



An Empirical Approach of Regulation on China's Pension Investment

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An Empirical Approach of Regulation on China's Pension Investment

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Abstract

A prerequisite for preserving or increasing the value of pension funds is to make an appropriate investment of them; for this purpose most countries have issued regulation to guide the pension investment. After conducting an empirical analysis of different investment portfolios, e.g. bank deposit, Treasury bond, and public equity, using the capital asset pricing model (CAPM), we have reached the following conclusions. Observing the strict limitation on quantity, the public equity ratio in portfolio of pension funds should be controlled below 20%. To avoid the systematic risks intrinsic to the investment within a single country as China that has a newly emerging and still immature stock market, some part of pension funds investment should be allowed to flow to foreign markets. The constraints on public equity investment may be liberalized and the prudential person rule of pension investment in Common Law could be imported into pension legislation amendments when the Chinese stock market and legal system is more developed and mature.

Keywords: Pension; Investment Portfolio; Regulation; Home Bias

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Pension investment is becoming increasingly important because of the population aging trend in both developed and developing countries. How to regulate pension investment is becoming one of the hottest topics in present's stock market in China. In 2006, the Shanghai Social Security Fund embezzlement scandal was disclosed to the public^①, just because the Shanghai's pension fund had been invested in companies owned by some senior official's cronies instead of investing into stock market. A retrospective review of the cases of social security fund maladministration investigated during the past decade finds that, a large amount of pension administrators ran into difficulties for generating either too low returns from the investment of pension funds, or from misguided attempts to increase those returns by the use of unauthorized investment channels or intermediaries. These problems have emphasized the urgent problem of implementing regulatory legislation on investment of pension funds after the *Social Insurance Law* comes into force in July 2011.

In China, the stock-dominated capital market only has a history of 21 years, and the time spent on the building of social security system is even shorter. How, where, and in what channels the pension invested is a huge challenge for economists, lawyers, and policy makers all over the world. Except for some ministry level rules and governmental documents, no laws and regulations are available for regulating investment of pension funds in China. Given such a circumstance, it is hard to find a pertinent reference for discussing and probing into the issue of investment portfolio of pension funds in the capital market. This paper provides some empirical benchmarks to guide the pension investment.

The first part of this paper gives an introduction to overseas pension markets and a review of literature. The second part demonstrates the issue of China's investment of pension funds using capital asset pricing model (CAPM). Empirical analysis is made in the third part on the investment

^① Chen Liangyu, the then chief secretary of the Shanghai Municipal Committee of Communist Party of China, was sacked for his involvement in a social security fund scandal. Zhu Junyi, director of the Shanghai Municipal Bureau of Labour and Social Security, was stripped of his post. They were suspected of misconduct involving a 3.2 billion yuan (US\$410 million) loan of social security funds to a private toll road operator. On 11 April 2008, Chen Liangyu sentenced to 18 years for corruption and crime of abusing authority, and 300,000 RMB of his personal property confiscated. Thus it resulted in the sentence on the highest official involved in Shanghai social security fund case, which is called the "No. 1 Corruption Case of China", for it concerns high value of money and a large amount of officers and businessmen. It was a typical "group crime".

instruments of China's capital market to calculate earning-risk details of different investment portfolios of pension funds, which provides a benchmark for policy-making of pension investment in capital market. In the fourth part, with the inclusion of overseas investment in the CAPM, the risks of pension investment limited to the domestic capital market are shown to be largely removed. The conclusion in the fifth part, sets out where proposals are delivered for regulatory legislation on pension based on the previous empirical analysis.

1. Introduction

The US's Old Age, Survivors and Disabled Trust Funds (OASDI) are typical pay-as-you-go (PAYG) scheme regulated by the *Social Security Act*. OASDI's annual report of 2011 reveals that, prior to 2018 the fund will increase its surplus; by the end of 2010, the total balance accumulated in the past years reached US\$ 2.6 trillion. However, as the baby boomers after World-War II are now moving rapidly into their retirement, the fund will be exhausted in 2036 if no change is made to the settlement program used today.^① The second pillar of the US pension is private pension, due in part to the *Employee Retirement Income Security Act (ERISA)* passed by the US Congress in 1974, which requires the private pension administrators to observe the prudential person rule. In effect, ERISA sought to redefine the financial discretion available to plan sponsors and to set stricter parameters for pension funding. According to ERISA, fiduciaries must act prudently and must diversify the plan's investments in order to minimize the risk of large losses. In addition, they must follow the terms of plan documents to the extent that the plan terms are consistent with ERISA. This means that, the law orders an investment administrator to control risks by diversified investment and different investment portfolios regarding the high risks intrinsic to capital market.

The UK's pension system also face a seriously challenge these years. 2010 is the first time in the past 15 years that the state-provided National Insurance Fund suffered a shortfall of income over expenditure. So from the fiscal year 2011-2012, the two ratios of pension contribution, of employees and employers respectively, are expected to increase 1% by both, resulting in a total contribution ratio of 25.8%. Meanwhile, the Pensions Act 2008 establishes new duties for employers that they will have

^① 2011 OASDI Annual Report, Washington, D.C., May 13, 2011.

to enroll their employees over the age of 22 into an occupational pension scheme. From 2012, the “automatically enrolled” minimum employer contribution will improve the occupational pension scheme, employer contribute of 3% on employees’ annual salary between £5,035 to £33,540, plus 4% from employees themselves and 1% from governmental tax relief.^① The totally 8% of contributions will construct the UK’s new occupational pension system, which could be invested into capital market. Regulations on pension investment are contained in the Pension Act 1995 and 2005, the obligation for trustees and fund managers to exercise their powers of investment or dispositions must be in a manner calculated to ensure the “security, quality, liquidity and profitability” of the portfolio; another requirement is that assets must be invested predominantly in regulated markets.

Population aging is a serious problem in Japan as the richest country in Asia and a country with life expectancy longest in the world. In the year 2000, Japan has 86.40-million of age 15-64 labors, occupying 68.1% of the total population. But in 2015, the ratio of labors will fall to 61.2% of the total population rapidly. Moreover, within such a ratio half is women, who in Japan cannot enter the labor market completely.^② In dealing with the crisis of aging, the pension administrator of Japan makes all efforts. On the one hand, market-oriented policy is adopted to liberalize investment; on another hand, regulation is enhanced to preserve or increase the massive asset of pension. Japan has the *Life Improvement Pension Insurance Law* and *National Pension Law* to stipulate that the “pension accumulation fund” of Japan contributes to a part of the premium collected from pension beneficiaries, which is an important source of future pension payment. The purpose of “pension accumulation fund” is to sustain long-term and efficient operation on the behalf of the beneficiaries, and thus to help the stable running of future pension fund.

In line with the global trend of pension reform, in 1997 the State Council of China issued No.26 Document named *Decision of the State Council on Establishing a Unified Basic Old Age Insurance System*, officially stipulating that the pension insurance system shall transit from its original state- or entity-secured, pay-as-you-go system to the new system of “combined social pooling and personal account” wherein employees pay 8% of their salary into their personal account and employers

^① The UK’s National Insurance Fund Account 2010-11, LONDON: The Stationery Office.

^② Data Source: Global Pensions, Visited by Apr. 15 2012.

<http://www.globalpensions.com/global-pensions/news/1723285/japans-pensions-mandates-202-despite-dire-demographics>

contribute 20% into social pooling account. The social pooling account is similar to OASDI of the US and national insurance of the UK, while the personal account shall have the appropriate investment channels to preserve and increase its value. Article 69 of the *Social Insurance Law* to be officially implemented on July 1 2011 stipulates that “the social insurance fund shall, preconditioned by secured safety, preserve and increase its value by investment and operation regulated by the State Council.” Here the “investment and operation” includes investment in the capital market. However, it’s not mentioned in the *Social Insurance Law* how to invest and what the investment ratio would be; which will be prescribed clearly in the forthcoming *Regulations of Supervision and Administration on Social Insurance Fund*.

There are two forms in the government policies relating to pension fund investment: one involves strict quantitative asset restrictions (QAR), where the government makes specific regulations, typically on the limits of holding a particular class of assets; the other approach is termed as prudential person rule (PPR), in which pension funds are invested prudently as someone would do in the conduct of his or her own affairs, i.e. there is generally no any strict restriction on particular assets. (Davis 2002; Hu et al, 2007). La Porta et al (1998, 2008) find that legal rules protecting investors vary systematically among legal origins, with the laws of common law countries (originating in English law) being more protective of outside investors than the laws of civil law (originating in Roman law) and particularly French and German civil law countries. Their research result showed that legal investor protection is a strong predictor of financial development. The two types pension regulation rule distinguishes the Anglo-American economies (PPR) from continental economies (QAR), especially Germany. As western advanced economies are not equal partners in pension fund capitalism, pension funds are more important financial institutions in Anglo-American economies, or common law countries; the burgeoning growth of Anglo-American pension assets has had, and will have in the future, significant implications for the global economy. (Clark 1998)

We can see that PPR is corresponding to the common law system, whereas QAR is corresponding to the civil law system. Because Germany was a rising power in the late 19th century and its legal system was well organized, when many Asian nations were developing, the German Civil Code became the basis for the legal systems of Japan, Korea and China. The German Civil Code was introduced in the later years of the Qing Dynasty and formed the basis of the law of the Republic of

China, which remains in force in today's China. The current *Interim Provisions on the Administration of Investment by the National Social Security Fund* Article 28 stipulates: The investment in securities investment funds and stocks shall not be higher than 40% of the total assets of social insurance fund. From this we could conclude that China involves strict QAR, where the government makes specific regulations, typically on the limits of holding a particular class of assets. Hu et al (2007) conducted an empirical study investigating quantitatively the extent to which potential benefits could be achieved if the current QAR approach in China is shifted towards a more liberalized regulatory approach of PPR. The questions are: Is there any logic of economics behind the prescribed 40% ratio? Could the investment of personal account be made by consulting these stipulations? What rules should be made in the *Regulations of Supervision and Administration on Social Insurance Fund* on controlling pension investment? And, what the future amendment shall be after certain regulatory legislation has been established? We may use basic economic analysis as a starting point to answer these questions.

2. Foundation of Economics for Pension Investment Regulation: Capital Asset Pricing Model (CAPM)

In a growing economy with an unchanging age structure, an unfunded PAYG social security retirement system that is financed by a constant payroll tax rate provides each cohort of participants with an implicit real rate of return on their tax contributions equal to the aggregate rate of growth of the economy (Samuelson 1958). Almost all developed countries are now challenged by both the population aging trend and fiscal austerity following the current international financial crisis wherein the PAYG system suffers shortfalls of income over expenditure, and they are actively seeking solutions. Although different countries adopted somewhat varying methods in reforming their pension systems, one point of similarity in virtually all the reforms has been the use of a personal account mechanism, where funds can be invested into the capital market to get sustainable pension treatment and mitigate payroll tax incidence. The key assumption underpinning this reform is that the fund accumulated in the personal account may enjoy an investment return higher than the PAYG program. A consequence is that the retired may enjoy higher pension in their old age. Feldstein et al. (2001) calculated that individuals depositing a fraction of wages to a personal retirement account (PRA), and

investing these funds in a 60:40 equity-debt portfolio, would have enjoyed an average return of 5.5 percent per annum with a standard deviation of 12.5 percent. The 5.5 percent log return would permit the benchmark benefits to be purchased with PRA deposits of 3.1 percent of payroll, only one-sixth of the PAYG tax (12.4 percent) needed for the benchmark benefits. The investment risk can be reduced by intergenerational transfers conditional on the performance of stock and bond prices.

Chile is the country that introduced the most radical version of the personal account in its pension reform. In summarizing the experiences of Chile, Edwards (1998) held the view that the running of fully-funded personal account operated by private fund administrators was a successful revolution of pension mechanism. Similar to Chile, Hong Kong Special Administrative Region of China implemented the *Mandatory Provident Fund Schemes* in 2000, providing an official mechanism to secure the old age of employees. Except for some people exempted from the Schemes, all the employees within age 18 to 65 of Hong Kong shall be registered in the provident fund scheme, and 10% of an employee's monthly income contributed 5% by the employer (capped at a certain level) and the employee, respectively. The mandatory provident fund must be invested in the capital market, with its portfolio to be determined by an investment manager appointed by the fiduciary observing the principle that long-term investment plan shall be made for the benefit of accrued interest of the fund and its members and retirement guarantee furnished to such members.

Since 1990s, developed countries of Europe and America and some developing countries have been on the way of developing market-oriented legal regulation on social insurance fund; in these countries multi-tier social insurance mechanism is constructed, the development of supplementary pension insurance programs encouraged, partially-funded mode implemented, personal account introduced, and some programs of social insurance are of proprietorship reformed (Clark et al 2001, 2002). In fund regulation they gradually loosened governmental control and returned to market, carrying out market-oriented adjustment and reform. Constrained by particular conditions, different countries had presented different adjustment steps on their market-oriented development. It is evident that, most countries that are now undertaking social insurance system reform will continue their market-oriented development of their social insurance funds. It shall be a global hot issue how to consummate the legal system for social insurance fund regulation.

In a funded personal retirement account system, the most important issue is how to invest

appropriately. As all the investments shall observe the three principles of profitability, safety, and liquidity in a compatible way; however, these three principles lead to different priorities due to different investment requirements. The social security function of pension determines the sequence of its investment principles to be: safety, profitability, and liquidity. The reputational consequences from a significant real reduction in the value of social security funds mean that minimization of risk ranks higher than investment return. At the same time the general ability of most governments to borrow from the market means that liquidity is probably the least important consideration although this may be revised in the light of the recent bailouts of several European states where the availability of liquid pension funds enabled the governments in question to avoid or at least defer large fiscal corrections.^①

According to the theory of portfolio, the expected yield of an asset will be related to risk in a market. Generally an asset with higher risk shall have benefit higher than the assets of lower risks in order to compensate such asset's potential risks. Based on the consideration of risk avoidance, a rational investor will be only stimulated to hold an asset with higher risk when such asset's expected yield is higher. Given a normal environment, fund administrators will balance in a subjective way different risks and expected yields with a purpose to maximize yield for a certain risk tolerance, or to minimize risk for any given targeted yield. (Markowitz 1952; Sharp 1964; Lintner 1965)

To meet the principle of safety, in the actual portfolio of pension investment, a large part flows to "risk-free" assets while some to risk assets as specified by governmental regulation and principle. One of the most popular models used to determine the optimal securities portfolio is the capital asset pricing model (in brief CAPM), which is a particular utility function that the utility of randomly distributed return depends only upon the expected yield and the variance (standard deviation). Risk avoidance means that the increase of expected utility is good while the increase of variance (risk) is bad. The final value of an asset depends on its co-variance with other assets. Assume the total expected yield of the securities market is $E(R_m)$, standard deviation as risk measurement

^① For example the use of Ireland's National Pension Reserve to inject funds into its ailing banking sector in 2008 and 2009 gave Ireland some leeway although in the end the extent of the banking sector's losses required both severe fiscal austerity measures and an EU led international bailout. Argentina nationalized its second pillar pension system in November 2008 to take advantage of its surpluses in order to manage the Government's overall debt problem.

criterion σ_m , R_0 the risk-free yield, $[E(R_m) - R_0]$ the risk reward that's the potential benefit a consumer gets in delayed consumption according to the general hypotheses of micro-economics. Then we can express the mathematical relationship between expected yield and risk of stock i as following:

$$E(R_i) = R_0 + \frac{[E(R_m) - R_0]}{\sigma_m^2} \sigma_i \quad (1)$$

Formula (1) represents a straight line with intercept R_0 and slope $\frac{[E(R_m) - R_0]}{\sigma_m^2}$, which means

relationship between the expected yield $E(R_i)$ and the standard deviation σ_i a linear one. This linear efficient set of CAPM is called capital market line (CML). As the risk reward $[E(R_m) - R_0]$ of the investment portfolio is always positive, i.e., CML is always upward, so the pricing of the stock with higher σ_i shall have higher expected yield. Therefore, the slope and intercept of CML represent price of risk and price of time respectively, which reveals the essential features of an equilibrated securities market. So the funds administrators may find their securities portfolios constituted of securities of variable degrees of risk securities at the CML.

As it is an objective fact that no systematic risk can be eliminated completely, investment portfolios will suffer heavy losses when the securities market shall undergo material adjustment caused by a change of the domestic and international economic and political environment. As the losses induced by stock price fall will increase due to a heightening systematic risk of investment portfolio, the pension administrators shall mitigate the systematic risk of the securities portfolio through some approaches such as diversification into non-correlated assets or short selling. Generally the systematic risks vary due to different investment purpose and portfolio strategies of funds administrators. The systematic risk is higher when the fund's investment target is relatively aggressive. The funds may use systematic analysis of investment portfolio to find a balance between the two dialectic factors-tolerable risks and expected yield, modifying their securities portfolios to attain the expected average systematic risk level.

The CAPM is an important reference index for China's pension investment in capital market. China opened its stock market in December 1990 and instability and irregularity have dominated this

initial stage of its development. However the Chinese capital market has huge growth potential given the rate of growth of GDP and its very low level of capitalization compared to GDP. Since in 2000 the Shenzhen Exchange stopped issuing main IPOs, we have used the Shanghai Composite Index (SCI) of Shanghai Exchange as our securities index data. The SCI covers all the tradable stocks of A shares and B shares, representing basically the whole Chinese Stock market. SCI publicized by Shanghai Exchange is used as stocks' representative, while the three-year Treasury bond and one-year bank term deposit are representatives of fixed income instruments. An empirical study is made on particular data with the expected yield as benefit index and yield's standard deviation as risk measurement index in different portfolios.

We could assume that at the end of 1990 when Shanghai Exchange was opened the "SCI Fund" was established simultaneously, which fits perfectly all the stocks traded at Shanghai Exchange. From 1991 to the end of 2010, although there are yields over 100% during 1991 to 1992 the earliest time of stock market, over 50% in 1996 and 2000, and 130% in 2006, there are 15%-20% loss during 1993-1994, and 2001-2002, or even the disastrous fall of 65% in 2008. Arithmetical mean of these twenty years' yield is 30.22%, a high return from investment; however, the yields have huge fluctuations. The standard deviation of expected yield calculated out here is 62.23%, showing an emerging market's sharp fluctuations. The three-year treasury bond and one-year term bank deposit of the same period have much smaller yield and standard deviations for risk measurement, as shown in the table below.

Table 1 Yield -Risk of SCI Fund (Equity), Treasury bond, and Bank Deposit 1991-2011

Year	Shanghai Composite Index (Equity) Year on Year change	Average Bond (3 years)	Average Deposit(1 year)
1991	129.41%	10.00%	10.08%
1992	166.57%	9.50%	8.82%
1993	6.84%	13.96%	12.24%
1994	-22.30%	13.96%	12.24%
1995	-14.29%	14.00%	10.98%
1996	65.14%	13.06%	7.47%
1997	30.22%	9.18%	5.67%

1998	-3.97%	7.11%	3.78%
1999	19.18%	3.51%	2.25%
2000	51.73%	2.89%	2.25%
2001	-20.62%	2.89%	2.25%
2002	-17.52%	2.21%	1.98%
2003	10.27%	2.32%	1.98%
2004	-15.40%	2.74%	2.07%
2005	-8.33%	3.33%	2.25%
2006	130.43%	3.20%	2.52%
2007	96.66%	4.40%	4.14%
2008	-65.39%	5.61%	2.25%
2009	79.98%	3.17%	2.25%
2010	-14.31%	3.68%	2.75%
2011	-32.89%	3.87%	3.50%
AVERAGE	27.21%	6.41%	4.94%
STDEV	62.20%	4.34%	3.71%
CORREL-E/D			19.58%
CORREL-D/B		94.60%	
CORREL-E/B	9.64%		

Notes: SCI are the annual close values publicized by Shanghai Exchange every year, the average is heavily influenced by the first 2 years when the pricing of initial offers may be expected to be low to encourage investment. the arithmetic mean and standard deviation are calculated here according to their mathematical definitions. Interest rate of Treasury bond: from the weighted average calculation of 10-year and 7-year treasury bonds issued by Ministry of Finance during each year; the interest rate of 1-year term deposit in bank: the value at year-end from the past data publicized by the People's Bank of China. The annual average yield and standard deviations are calculated out here using pertinent mathematic definitions. Here the inflation rate was not added as all the three instruments will have the same real value proposition. The last three rows are the correlation between two of three investment instruments (Equity, Bond, and Deposit).

From data of Table 1 we know that the equities represented by SCI Fund have the highest yield among those three investment instruments. Meanwhile it also has the highest risk (measured by standard deviation of yield), far higher than that of Treasury bond and bank deposit. On the one hand, the equity itself indicates intrinsic risk; on another hand, as a new stock market, China has fluctuations much acute than those of mature markets by a standard deviation of yield over 40%. In America, in the past two decades the standard deviation of the Dow Jones index yield scarcely exceeded 20%; in

fact since 1990 this standard deviation was often kept down 10%. Although NASDAQ 100 index established on Feb.1 1985 is widely acknowledged as a market index of the highest fluctuation in the US, its standard deviation has been never higher than 28% since its first trade. Investors in Chinese stock market with too sharp falls and rises are as “birds set dumb by thunders,” that often they are poor losers from their investment. Investment in an SCI index tracker fund would have suffered a loss over 14% in 1995, over 20% in 2001, over 17% in 2002, and 65.39% in 2008. Such huge losses do not meet the first principle “safety” of pension funds; that is why pension funds cannot be all invested in equity.

From Table 1 we can also see that, the Treasury bond has its yield and risk between equity and bank deposit, but more approximate to bank deposit. As both treasury bond and bank deposit are investment instruments of fixed yield, and since 1996 the continued decrease of interest rate by 8 times in a row caused simultaneously the lowering of treasury bond’s interest rate at issue and actual interest rate in trade, they two have the same declining trend: During 1991-2010, the relevancy factor of their yield changes attains 94.63%, which explains that the trends of their yield are closely related, namely in a portfolio the different ratios of these two instruments cannot acquire higher yield nor avoid risk efficiently. Therefore, bank deposit is mainly used as a tool of liquidity in the portfolio. In the social insurance case revealed in 2006 an objective reason that plays the most important role is that the sole investment in treasury bond and bank deposit can only harvest a rather low yield, and then the pension administrators ventured to invest in real estate development and trust investment etc.; their objective target is to get investment returns higher than treasury bond and bank deposit.

We can now capture the future view of Chinese economic development: capital as an important production factor is gradually moving from the original shortfall position to come into a balance or surplus situation, which has been the recent emerging trend. On the one hand massive foreign capital flows into China; as stated in the *World Investment Report 2010* of the UN, China in 2009 had become the world’s second largest foreign investment absorber, only after America. (UNCTAD 2010) On the other hand, in China private asset accumulation is booming. At the end of 2009 Chinese residents’ bank savings were over 26-trillion-yuan. As the price of capital, the actual interest rate is difficult to increase in circumstances of rapid capital accumulation. The bond interest rate is also constrained for it relates closely to the bank deposit’s interest rate. At the same time, due to the deepening of Chinese

economy's interaction with world economy, it is impossible for the domestic interest rate to be much different from foreign interest rates without attracting large speculative inflows particularly in the light of the RMB's steady appreciation. Following the global financial crisis and the adoption of quantitative easing by the US Treasury, international interest rates will continue to be kept at a relatively low level. Given such a situation, investing pension funds into equity is a reasonable behavior which is necessary for the principle of profitability but which means having to face certain risks. The key problem is how to invest the pension funds in stock market given the experiences and data of China's past 20 years' capital market development.

3. Earning-Risk Empirical Analysis of Pension Investment Portfolio

The portfolio theory of Markowitz (1952) described that the investment risks can be reduced when different varieties of investment instruments are pooled together. However, as price changes of Chinese stocks have high volatility, that often individual stocks rise or fall following the whole market, so it is less important to "select equities", for it is difficult to scatter risks only to pool together different stocks.^① But from Table 1 we see that SCI index has little correlation with Treasury bond and bank deposit, and the three instruments can be considered relatively independent. For this we pooled SCI investment together with national bond and bank deposit at a ratio from 0-100%, and calculated out the expected yield and standard deviation of each portfolio for the period 1990 – 2011,

^① The phenomenon that individual stocks rise and fall simultaneously with the whole market index can be analyzed by the relevancy of stock price changes, Fox example, by random sampling the author collected the close prices of 120 months in 10 years from Jan. 1993 to Dec. 2002, of 2 stocks – Fangzheng Technology (Yanzhong Industry) and Shenhua Holdings (Shenhua Industry) traded at Shanghai Exchange, and ex-right price backward adjustment of right-sending issues was made for them. As calculated the relevancy of these two stocks' close values is 0.920. Meanwhile, when compared to the 120 months' close values of SCI, Fangzheng Technology has a relevancy 0.916, while Shenhua Holdings has a relevancy 0.938. Generally the mathematic relevancy is very high when its value goes above 0.9. In 120 months' close values, the relativities between these two values and between each value and SCI are so high, which explains that the rise or fall of individual stocks, and of stocks and composite index is closely related. The assumption of economics of independent changes of individual stocks fits not Chinese market.

judging the earning-risk of these portfolios from a quantitative view. These investment portfolios can now basically cover the different combinations of the pension funds' investment instruments, and thus to assess the earning-risk of the pension funds. The following table shows data of the portfolios:

Table 2 Earning-Risk Data of Different Portfolios

Shanghai Composite Index Proportion	3 Years Treasury Bond Proportion	1 Year Bank Deposit Proportion	Portfolio Expected Earning Rate	Portfolio Standard Deviation
0%	0%	100%	4.94%	3.71%
0%	100%	0%	6.41%	4.34%
5%	90%	5%	7.38%	8.44%
10%	85%	5%	8.42%	10.72%
15%	80%	5%	9.46%	13.63%
20%	75%	5%	10.50%	16.74%
25%	70%	5%	11.54%	19.86%
30%	65%	5%	12.58%	22.92%
35%	60%	5%	13.62%	25.90%
40%	55%	5%	14.66%	28.80%
45%	50%	5%	15.70%	31.61%
50%	45%	5%	16.74%	34.35%
60%	30%	5%	18.50%	39.08%
70%	20%	5%	20.58%	44.47%
80%	10%	5%	22.66%	50.05%
90%	5%	5%	25.06%	56.08%
100%	0%	0%	27.21%	62.20%

Note: SCI ratio under 30% has more data of samples than those above 40%, mainly for the consideration of pension safety. The first, second lines and the last line of the table mean the investment in a single variety. Bank deposit occupies a ratio of 5% in all the multi-variety portfolios. The portfolios' differences are mainly manifested in the fall or rise of the ratio of SCI fund and Treasury bond in portfolios. The expected yield and standard deviation of the investment portfolios are squared according to their definitions.

To generate a bi-dimensional chart (chart 1) from the expected yields and standard deviations of the right two groups of years in Table 2, we can see that the points of each portfolio of these two

groups pf data are almost connected by one straight line, which is CML:

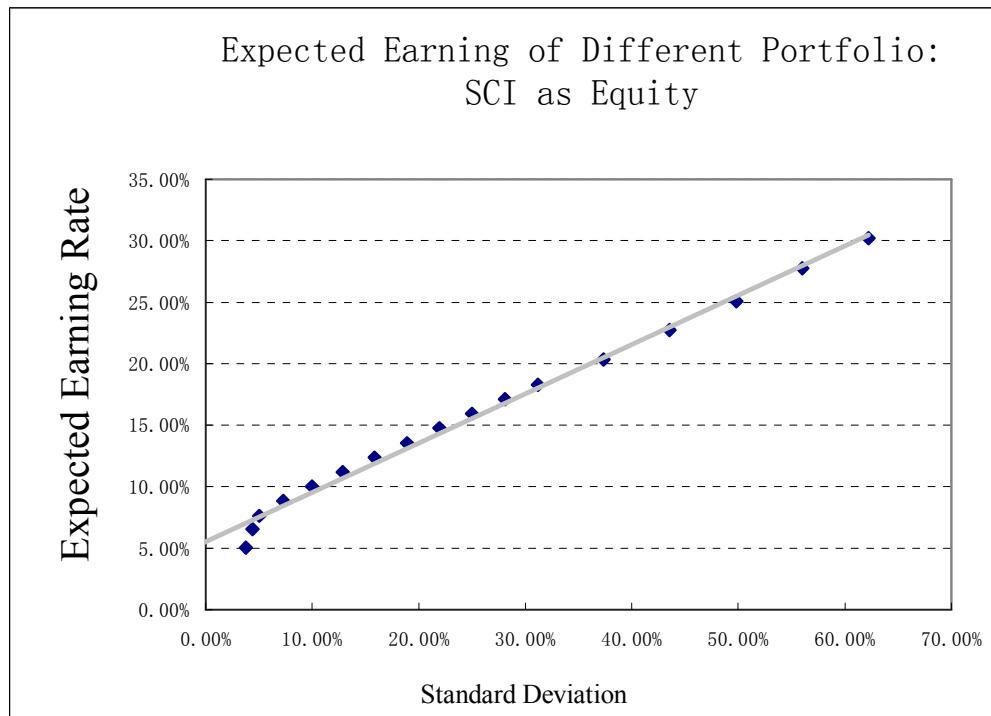


Chart 1. Data Groups and CML of Investment Portfolios 1991-2011. Source: Table 2

Mathematic regression can be made using the least squares method on the two groups of data of expected yield and standard deviation in Table 2, calculating out the slope and intercept of CML, which values got, Chart 4 is used to depict the equation. For data from 1991 to 2011, we have CML equation from mathematic regression as:

$$E(R_{1991-2010}) = R_0 + \frac{[E(R_m) - R_0]}{\sigma_m^2} \sigma_i = 5.52\% + 0.4004 \sigma_i \quad (2)$$

This is the CML equation of portfolios constituted of SCI fund, 3-year Treasury bond, and 1-year bank deposit 1991-2011. Chart 1 has captured the straight line expressed by this equation, which shows: during this period, the “risk-free investment” has an interest rate of 5.52% (intercept of CML in the chart), a relatively high general interest rate from 1991 to 2011, mainly because before the continuous decrease of interest rate in 1997, the bank deposit and treasury bond have high interest

rates. The slope of CML is $\frac{E(R_m) - R_0}{\sigma_m^2} = 0.4004$, which is the growth rate of market price of

efficient portfolios' risk. This rate gives an approximate judgment of earning-risk 1991-2010, namely a 0.4004% increase of expected yield will be acquired when the standard deviation as risk measurement increases by 1%. On the contrary, to increase 1% yield based on the "risk-free investment" increase of 2.5% (i.e. 1/0.4004) is to be faced. Thus we have now an important index of earning-risk to be consulted when we invest pension funds in portfolios of capital market.

To check the fitness of the related expected yield and standard deviation, we calculated the relevancy factor (r^2) of these two groups of data to be 0.9963, which shows that the investment combinations of the three investment instruments, equity, treasury bond, and bank deposit in Chinese capital market, almost fit completely the CAPM, which is caught in a vivid way that CML covers most data points.

The above portfolio equation can be used to assess decisions on how to determine the equity ratio in pension investment. Data of Table 2 tell us that, the expected yield and standard deviation (risk) of a portfolio rise correspondingly when the SCI fund (equity investment) increases in this portfolio. Meanwhile these data show the feature of a portfolio in diversifying risks. A relatively low ratio (below 10%) of equity investment with a standard deviation of expected yield below 10% can be held as of low risk and durable by the pension funds, violating not the principle of safe investment for pension funds. To increase the equity pension investment gradually: when the equity ratio in a portfolio is 20%, the standard deviation is 12.88%. When the equity ratio in a portfolio is 40%, the standard deviation is 25.01%.

Is such a risk acceptable? We use the US with the most developed capital market as a reference. From 1945 to 1995, the Standard & Poor's 500 index had a mean yearly return of 11.95%, with a standard deviation of 16.5%. Of the same period Salomon Brothers Class-AAA Bond had a yield of 3.3% and a standard deviation of 10.4%. (Bordo Wheelock, 2007; Moore, 2006) A portfolio with 60% equity and 40% bond shows a yield of 5.9% and a standard deviation 12.5%. Such yield and risk represent the long-term investment in the US.

With the yield's standard deviation 10.4% of Salomon Brothers Class-AAA Bond of the above-mentioned 50 years as a reference, we can conclude that in Chinese pension funds' investment

in the domestic capital market, an equity ratio below 10% in a portfolio is relatively safe. Taking into consideration of the step-by-step entrance of Chinese pension funds into equity market, that the equity ratio increases from a relatively low ratio gradually, we can think: The risk level is durable when the equity ratio of a portfolio at the stock market rises gradually to 20% to have a standard deviation same as that of 60% equity and 40% bond combination in America. Meanwhile in a predictable future Chinese pension funds' investment of equity ratio shall be below 40% with a standard deviation 25% higher than the standard deviation (19%) of America S&P500 Index of the same period, approaching the NASDAQ 100 index notable for acute fluctuations. The upper limit 40% set on equity ratio is mainly to prevent potential risks arising from an instable new market, with the final target to secure pension funds.

Statistics of China Securities Regulatory Commission (CSRC) show that, as of the end of 2011, China had 2,342 public-listed companies with a total value of RMB 21.48 trillion, equaling to over 45.5 % of GDP.^① Currently China's funded pension funds exist in two forms, i.e. Pillar 1B (personal account) and Pillar 2 (enterprise annuity account). The current pension fund investment legislation specifies that all assets in Pillar 1B are invested in government bonds and bank deposits, while those in Pillar 2 are also subject to the QAR approach. (Hu et al 2007) By the year 2030 or so, Chinese population of elders aged over 60 will have increased to 400-million, a population equivalent to today's 15 EU countries as a whole. At that time the accumulated balances of pension funds will also amount to trillions of RMB. It is unimaginable for the pension funds or the equity if such massive assets of pension are not invested in the capital market. So we must speed up the legislation procedure governing the pension investment in the capital market. Only by investing in public-listed companies which are the representatives of outstanding Chinese enterprises can share the fruits yielded in economic development, increase the yield of pension funds, and bring high returns to pension beneficiaries.

4. Empirical Analysis on Overseas Investment of Pension Funds: How to Eliminate “Home Bias”?

^① Statistics of China Securities Regulatory Commission, Data could be shown at:

http://www.csirc.gov.cn/pub/zjhpublic/G00306204/zqscyb/201201/t20120116_204813.htm

The above analysis based on the investment on China's domestic stock market may be recognized as having some degree of so called "Home Bias". Tesar and Werner (1995) find that portfolios turnover rates are higher on foreign than on domestic ones. Despite the general relaxation of controls on foreign portfolio investments by developed countries that took place in the early 1980s, French and Poterba (1991), Cooper and Kaplanis (1994) and Tesar and Werner (1995) show that there continues to exist a strong "Home Bias" in national equity portfolios. Explanations that have been offered for this bias include both barriers to capital flows created by higher costs of transacting in foreign securities, withholding taxes, and political risk, as well as other factors such as the failure of purchasing power parity, information asymmetries, and different regulations. But if the asymmetric information between domestic and foreign markets is not a so serious problem, Brennan and Cao (1997) find that when domestic investors possess a cumulative information advantage over foreign investors about their domestic market, investors tend to purchase foreign assets in periods when the return on foreign assets is high and to sell when the return is low, so the "Home Bias" could be eliminated at some degree.

As a emerging market economy, China at the beginning of its reform and opening to the world couldn't invest its limited domestic capital into foreign market. Speedy development has made China an economy with world's largest foreign currency reserve, and an investor with increasing ability to invest overseas. In 2009, China ranked as the world's second largest direct absorber of foreign capital, and the fifth capital output country after the US, France, Japan, and Germany. (UNCTAD 2010) Therefore, although now no program of overseas investment is available for pension funds (except the NSSF), such issue of overseas investment shall be probed into to eliminate "Home Bias" and to diversify the risks intrinsic to investment confined in domestic capital market. Free flows of capital across borders promote a more efficient allocation of world resources by allowing savings to find their most productive use beyond their national borders. China's currency, Renminbi, is also facing a heavy pressure of appreciation in the international financial market, Significant outward investment of pension and other exchange funds will help offset surpluses on the trade account, although investment returns will need to take account of the negative impact of likely currency appreciation.

Today the Council of National Social Security Fund has the governmental permission to invest in

foreign market. Article 14 of the *Interim Provisions on the Administration of Overseas Investment by the National Social Security Fund* stipulates that the fund's overseas investment shall have a ratio calculated by cost no more than 20% of its total assets. Assuming the pension fund's overseas investment selects the relatively mature S&P500 of the US, HANG SENG of HK, and FTSE 100 of the UK as the target indices for comparison in Table 3:

**Table 3 Annual Yields, Standard Deviations and the relevancy of
SCI S&P500, HK's HANG SENG, FTSE100**

Year	SCI CLOSE	SCI GAIN	S&P500 CLOSE	S&P500 GAIN	HKHS CLOSE	HKHS GAIN	FT100 CLOSE	FT100 GAIN
1990	127.61	-	330.22	-	3024.00	-	2143.50	-
1991	292.75	129.41%	417.09	26.31%	4297.30	42.11%	2493.10	16.31%
1992	780.39	166.57%	435.71	4.46%	5512.40	28.28%	2846.50	14.18%
1993	833.80	6.84%	466.45	7.06%	11888.40	115.67%	3418.40	20.09%
1994	647.87	-22.30%	459.27	-1.54%	8191.00	-31.10%	3065.50	-10.32%
1995	555.29	-14.29%	615.93	34.11%	10073.40	22.98%	3689.30	20.35%
1996	917.02	65.14%	740.74	20.26%	13451.50	33.53%	4118.50	11.63%
1997	1194.10	30.22%	970.43	31.01%	10722.80	-20.29%	5135.50	24.69%
1998	1146.70	-3.97%	1229.23	26.67%	10048.58	-6.29%	5882.60	14.55%
1999	1366.58	19.18%	1469.25	19.53%	16962.10	68.80%	6930.20	17.81%
2000	2073.48	51.73%	1320.28	-10.14%	15095.53	-11.00%	6222.50	-10.21%
2001	1645.97	-20.62%	1148.08	-13.04%	11397.21	-24.50%	5217.40	-16.15%
2002	1357.65	-17.52%	879.82	-23.37%	9321.29	-18.21%	3940.40	-24.48%
2003	1497.04	10.27%	1111.92	26.38%	12575.94	34.92%	4476.90	13.62%
2004	1266.50	-15.40%	1211.92	8.99%	14230.14	13.15%	4814.30	7.54%
2005	1161.06	-8.33%	1248.29	3.00%	14876.43	4.54%	5618.80	16.71%
2006	2675.47	130.43%	1418.30	13.62%	19964.72	34.20%	6220.80	10.71%
2007	5261.56	96.66%	1468.36	3.53%	27812.65	39.31%	6456.90	3.80%
2008	1820.81	-65.39%	903.25	-38.49%	14387.48	-48.27%	4434.20	-31.33%
2009	3277.14	79.98%	1115.10	23.45%	21872.50	52.02%	5411.19	22.03%
2010	2808.08	-14.31%	1257.64	12.78%	23,035.45	5.32%	5957.16	10.09%
2011	2199.42	-32.89%	1257.60	0.00%	18,434.39	-19.97%	5572.30	-6.46%
AVER.		27.21%		8.31%		15.01%		5.96%

STDEV		62.20%		18.63%		38.52%		16.04%
CORREL		SCI-FT	SCI-S&P	SCI-HKHS	HKHS-S&P	HKHS-FT	S&P-FT	
		43.57%	34.99%	46.31%	49.82%	67.23%	90.63%	

Data source: annual yields calculated out from that year's close price publicized at official websites of these four indices; average yield, standard deviation and the correlation calculated out by mathematic definitions.

From Table 3 it is evident that among these four indices, S&P500 and FT100 are highly correlated because their correlation coefficient is 90.63%. S&P500 as one of the several indices most used by the world's fund administrators has only a relevancy factor 34.99% with SCI, the lowest correlation among the four indices. So we can use S&P500 as a reference index for overseas investment which will minimize the risks intrinsic to investment constrained in Chinese domestic stock market, and the best choice for eliminating "Home Bias".

Considering liquidity of pension funds and convenience to compare with the third part's conclusion, a portfolio containing international investment chooses still 3-year Treasury bond and 1-year bank deposit as components of combination. Equity investment is constituted of 60% SCI and 40% S&P500, resulting in the following portfolio of Table 4:

Table 4 Earning-risk of Different Portfolios containing International Equity

Shanghai Composite Index	3 Years Treasury	1 Year Bank	Portfolio Expected Earning Rate	Portfolio Standard Deviation
Proportion	S&P 500 Index	Bond Proportion	Deposit Proportion	
0%	0%	0%	100%	4.94% 4.34%
0%	0%	100%	0%	6.41% 4.42%
3%	2%	90%	5%	7.00% 5.53%
6%	4%	85%	5%	7.66% 7.08%
9%	6%	80%	5%	8.32% 8.85%
12%	8%	75%	5%	8.98% 10.72%
15%	10%	70%	5%	9.65% 12.65%

18%	12%	65%	5%	10.31%	14.63%
21%	14%	60%	5%	10.97%	16.62%
24%	16%	55%	5%	11.63%	18.63%
27%	18%	50%	5%	12.29%	20.65%
30%	20%	45%	5%	12.96%	24.71%
36%	24%	30%	5%	13.96%	28.80%
42%	28%	20%	5%	15.28%	32.90%
48%	32%	10%	5%	16.61%	37.01%
54%	36%	5%	5%	18.25%	41.12%
60%	40%	0%	0%	19.65%	41.21%

Notes: SCI fund of 60% in equity pool, S&P500 of 40%; other calculations all are same as in Table 2.

We could find that the expected yield and standard deviation of the portfolio have decreased greatly after allocating part of the portfolio to a notional S&P500 index tracker fund. The major cause of expected yield's decrease lies in the history that during 1991-2011 S&P500 had a yield lower than that of SCI, while the decrease of standard deviation means the mitigation of risk, which indicates that, if Chinese pension funds go to purchase international equities represented by S&P500, the investment risk will decrease significantly compared to investment completely confined in domestic stock market.

Similarly, using the two groups of data for expected yield and standard deviation shown in Table 4, by the least squares method, we could make mathematic regression and calculate out the slope and intercept of CML after introducing overseas market as follow.

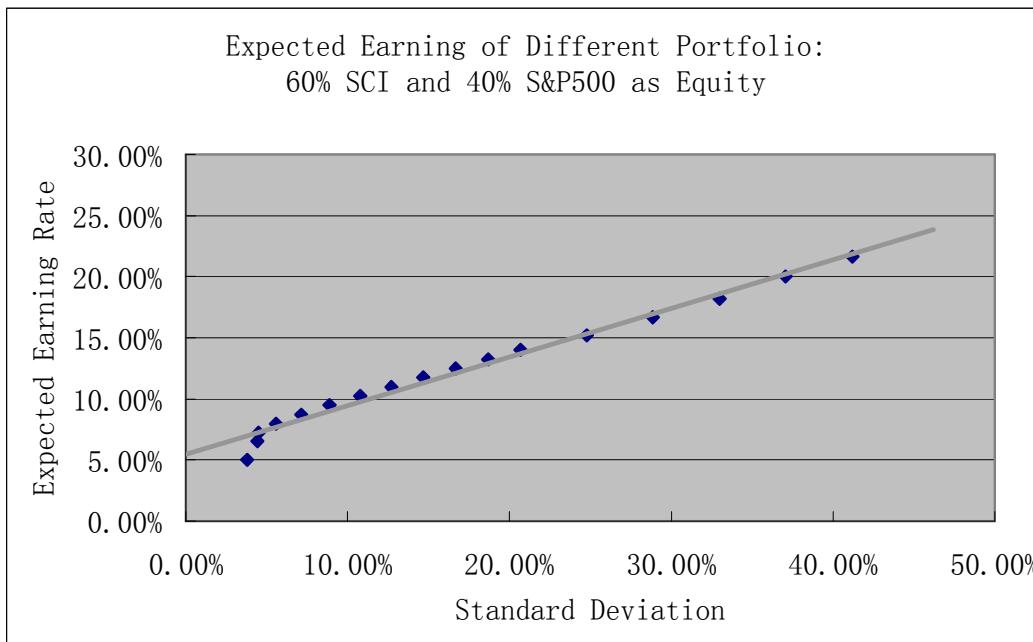


Chart 2. Data Groups and CML of international Investment Portfolios 1991-2011. Source: Table 4

Chart 2 describes the particular values and the equation. CML (1991-2010) of international investment equation from mathematic regression is as following:

$$E(R_{1991-2010}) = R_0 + \frac{[E(R_m) - R_0]}{\sigma_m^2} \sigma_i = 5.46\% + 0.3976 \sigma_i \quad (3)$$

The result of this equation is similar to that of Equation (2) of investment confined in domestic market, i.e., an increase of 1% by the risk-measuring standard deviation will obtain an increase of 0.3976 in the expected yield. Similarly to increase the yield by 1% on the basis of “risk-free investment” interest rate 5.46%, the increase of standard deviation by approximately 2.5% (namely $1/0.3976$) is to be anticipated.

By the same way the relevancy factor of the expected yield and standard deviation can be calculated out to be 0.9917, which means that a portfolio pooling three investment instruments as equity, Treasury bond, and bank deposit will still fit perfectly CAPM even when the international market is introduced. This is vividly reflected by the fact that the derived CML captures most data points.

From the empirical analysis taking S&P500 as a reference target we could conclude the relevant proportions between yield and risk have no major change when pension fund is partially invested in a

foreign market; however, what distinguishes advantages of overseas investment is that the portfolio's expected yield and risk-measuring standard deviation are decreasing almost at the same proportion. This represents the value of a more 'liberal' investment approach. From this point of view, international investment can be an option when in the future Chinese pension funds are allowed to invest in the capital market to reduce the risks arising from investment limited to domestic market. Some degree of removal of "Home Bias" means a reduction of risks.

5. Conclusion

The principles of safety, profitability, and liquidity shall be always observed closely during the process of pension investment because of the collective social nature of pension fund ownership. As demonstrated by the evidence from applying the CAPM to historic investment data over the past two decades, a significant part of the personal pension account can and must be invested in equities in the capital market. This paper has shown that based on past performance, a pension fund portfolio will still achieve a satisfactory risk-return yield even if such portfolio contains a significant investment in quoted Chinese equities despite the market's historic volatility. A choice of different time periods would have given different values of parameters as risk-free interest rate and CML slope; but the linearity of earning-risk is the same, which provides an important reference point for the investment of future portfolios.

A review of the general trend and historical experiences of the long developed capital market around the world finds that, the stock market despite its volatility, has an upward trend in a long run in parallel with that of economic development. Thus the yield of Chinese stock market will have a further significant margin over that of Treasury bond or bank deposit. If only Treasury bonds and bank deposit are the target investment of pension funds, the yield particularly in comparison to price inflation and even more wage growth) is evident.. Certain participation in the stock market by pension funds will allow the funds to enjoy a greater share of the fruits of economic development and avoid the dual-risk of too low yield and inflation.

Following the deepening of China's reform and opening, the pension funds should pursue the option of overseas investment when a large number of Chinese enterprises are themselves investing

overseas. The empirical analysis taking S&P500 as an example has proved that, not only “Home Bias” can be eliminated by pension funds’ overseas investment, but also the risks intrinsic to a single market can be reduced greatly making use of various relativities of different markets. As there is a much higher degree of correlation because of the increasing importance of mainland shares quoted on the HK market, at an early stage the relatively familiar HK market can be the investment target, while in the future more extensive coverage shall be targeted to scatter risks further.

According to Article 69 of the *Social Insurance Law* in China, it is necessary to invest in the capital market. Based on China’s long-term tradition of continental/civil law system, and considering the newly rising capital market in China, the *Rules of Supervision and Administration on Social Insurance Fund* should set strict rules on the quantity of equities in pension portfolio to secure the safety of pension funds because of the lack of expertise in both investment management and fund oversight by plan sponsors. At the beginning the equity ratio can be confined below 20%; this limit may be relaxed gradually by legislative amendments when the capital market develops and related laws and regulations become mature, for example the equity ratio in pension portfolio may increase to 40-50%, or higher.

A further thought will cause us to consult the prudent person rule (PPR) for pension regulation as in the Common Law system of the UK and the US, and to borrow excellent from a number of the UK pension acts, and the *Employee Retirement Income Security Act* of the US. The *Old Age Insurance Law* would be issued by China’s top legislature to relax most of the limits on equity investment in pension portfolio, turning pension funds into the most important institutional investor in Chinese capital market. One benefit would be to promote the healthy development of Chinese capital market, and another benefit would be that the accumulated pension can secure better the future of Chinese citizens.

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