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Empirical Study on Chinese Funds' A-Share Investment and Asset Volatility

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Using data of 15 consecutive quarters, from the first quarter of 2008 to the third of 2011, I employed multivariate regression as well as graphical analysis of the asset allocation results to study funds' investment behavior in the A-share market. Evidences are presented that: funds' shareholding proportions in listed companies are positively correlated to stock volatility, but this relationship is not constant among quarters; funds preferred volatile stocks in bull markets and showed aversion to individual stock volatility in bear markets; and funds generally constructed A-share portfolios with large volatility.

Key Words: Chinese fund industry, A-share market, volatility, portfolio
JEL Codes: G11, G23

I. Introduction

Securities investment funds had appeared in Chinese stock market in October 1991, and China's domestic stocks denominated in RMB—A-shares—have been their primary assets. Since the promulgation of "Securities Investment Fund Regulation Interim Measures" in October 1997, thanks to the huge market demand and strong policy support, Chinese fund industry experienced a period of rapid development. Up to the end of 2007, there are 346 domestic funds in China, and their total net value reached 3275.59 billion RMB (approximately US$500 billion) and created the highest record until now.

However, Chinese fund industry's business environment changed significantly after the 2008 financial crisis and the bear market that followed it. During 2008 and subsequent years, fund industry was in a "structural transition phase" named by professionals. The change is characterized by different developmental features, business structures and investment philosophies. Funds began to focus on not only investment return but also sustainable cash flows, and clients are more and more discriminating about asset allocation philosophies.

Table 1 Changes in Funds' Sizes, Semiannually from 2008 to 2011

	Mid-2008	End-2008	Mid-2009	End-2009	Mid-2010	End-2010	Mid-2011	End-2011
Number of domestic funds	388	439	492	557	618	704	810	914
Proportion of total A-share market value held by funds	21.56%	19.95%	17.91%	12.53%	10.87%	8.83%	7.92%	7.90%

The number of China's domestic funds has been rapidly increasing since 2008, but the A-share market proportion held by them gradually shrinks[1]. This phenomenon is linked to more accessible investment channels and the trend of diversification in asset allocation, as well as the extremely fierce competition within that industry.

Funds are usually considered to be more professional and rational than individuals, and their attitude towards risk exhibited in investment behaviors has attracted wide attention. Some scholars even argued that government should continue to vigorously encourage and provide policy support to institutional investors, including securities investment funds, for that they are mature and prudent investors that contribute to the stability of stock market. Such assertions play a part in motivations for this study.

The word "fund" in this paper means any Chinese fund that participate in China's A-share market investment. Other institutional investors such as QFII (Qualified Foreign Institutional Investors) or pension funds are not included.

The purpose of this paper is to examine Chinese funds' investment behavior in A-share market, and provides a better knowledge about the attitude of funds as a whole to A-share assets' volatility, and thus help to understand the role played by fund industry in A-share market.

The rest of the paper is organized as follows: SectionⅡreviews and summarizes extant literatures. Section Ⅲ and SectionⅣ describe used and research designs in detail. SectionⅤreports empirical results. Finally, conclusions will be drawn and factors that may undermine the accuracy of conclusion will be discussed in Section Ⅵ.

II. Literature Review

Questions about securities investment funds' (or institutional investors') attitude to asset volatility have incited widespread attention among academics and many of them have conducted detailed research.

As one of pioneers in this field, Eric G. Falkenstein (1996) investigated cross-sectional mutual fund equity holdings for year 1991 and 1992 in US market. One of his findings is that mutual funds are averse to stocks with low idiosyncratic volatility. Almost concurrently, Richard W. Sias（1996）made use of NYSE listed companies' institutional shareholding data from 1977 to 1991 to study the relationship between the level of institutional shareholding and security return volatility, and found that the two variables are significantly and positively associated after

[1] The total net value of funds was stable since 2008

accounted for capitalization.

Such researches had not been conducted to investigate China market until recent years. Based on 6 funds' public notices at the end of year 2000, HAN Qi-heng, TANG Wan-sheng and LI Guang-quan (2002) constructed cross-sector variance-covariance matrices and presented efficient frontier, feasible set and the locations of these funds' portfolios. Because of the relative proximity to the least variance point of the funds' portfolio locations, they concluded that that funds prefer lower volatility when allocating assets among shares from different sectors.

HU Qian (2005) coped with the problem from a different perspective and argued that from year 2000 to mid-2004, funds prefer volatile stocks in bull markets and turn to be averse to individual stock's volatility in bear markets after applying multiple cross-sectional regressions. Even when data from similar time period is used, divergence in results exists: based on the methodology of Sias(1996), Faugure and Shawky(2003), QI Bin, HUANG Ming and CHEN Zhuo-si(2006) examined institutional investor holdings and stock volatilities in Chinese capital market, and found the significant negative relationship between them when controlling the sizes of listed companies. However, just like Sias(1996), this study might be vulnerable to the accusation of omitting important variables that should also be controlled for. Another endeavor made by HU Da-chun and JIN Sai-nan(2007) revealed that funds prefer volatile stocks but higher fund shareholding has some stabilizing effects on stocks, and such a relationships varies across sectors. They applied dynamic panel data models to 1999~2004 Chinese A-share market quarterly data and precluded the discovery of possible variations of funds preferences for different level of volatilities among quarters.

Authors of most literatures concerned about Chinese funds' investment behavior so far used data prior to 2007. As stated above, significant changes occurred to Chinese fund industry, and the market environment faced by them also altered. These facts brought new challenges to market participants and regulators. Under such a background, this study that explores domestic funds' attitude towards asset volatility when they are investing in A-shares can be adequately meaningful.

III. Data

Data of A-shares used in my study corresponds to 15 consecutive quarters, from the first quarter of 2008 to the third of 2011[2]. Stocks are categorized into 9 sectors according to Global Industry Classification Standard(GICS). They are consumer staples, energy, financials, information technology, industrials, health care, consumer discretionary, utilities and materials[3]. Shanghai and Shenzhen 300 Index(CSI300) and CSI300 sector indices are also collected to represent the general performance of Chinese stock market and stocks from each sector. All data came from Wind Financial Terminal.

Data about funds' shareholding as a fraction of each stock encompasses all public

[2] Until the research began, many companies' 2011 annual reports had not been disclosed;

[3] There are only 4 companies are classified to telecommunication services sector, and also due to the incompleteness of their data, this sector is excluded from the date base.

information available (mainly came from listed companies' and funds' periodic disclosures). Compared with using merely data from heavily held stocks disclosed by institutional investors, there should be no doubt that information of funds' more diversified portfolios can be better captured. This completeness contributes to the reliability of the study.

The database is formed after such a screening process: removing stocks in a certain quarter that (a) are not revealed to be held by funds, or (b) suffer severe incompleteness in financial data, or (c) daily return volatility within the quarter is zero[4] (long-term trading suspension).

IV. Methodology

I study the attitude of funds towards their assets' volatility in two levels: first, the volatility of individual stock; and then the volatility of A-share portfolios. Detailed methodologies are described as follows:

1. Volatility of Individual Stock

In order to find evidence about funds' attitude towards stock volatility in A-share market, multivariate linear regression is applied. The levels of fund shareholding of individual stocks at the end of a certain quarter are used as dependent variables and stock return volatility is one of independent variables. Besides, several control variables must be set so that the influence of other stock features can be removed.

First of all, company sizes are tightly associated with the levels of fund shareholding. A fund has to pay more to purchase stocks, of a large company than a small company, to gain or be able to exert significant influence on the company's decisions. And many empirical results show that stocks with larger capitalization has significantly smaller volatilities of their returns. So market capitalization at the end of each quarter in logarithmic form is set as a control variable in the regression. Second, some scholars pointed out stocks with lower prices have larger bid-ask spread relative to their average price, so the transaction costs of such stocks are bigger (Blume and Stambaugh 1983). For similar reason, calculated variances of low price stocks are significantly higher than their real variances (Falkenstein 1996). Consequently, average stock price within each quarter is added into the regression equation to remove its interference to funds' stock holding decisions. Price-to-book value ratio is a measurement of A-share's valuation level. Gompers and Metrick (1998) found that institutional investors prefer stocks that have higher book to market ratio (lower price/book ratio). Besides, liquidity of stocks is obviously one of the most important factors that institutional investors seeking profits such as funds should consider when making investment decisions. Liquidity reflects the difficulty or transaction costs of buying or selling stocks, and researchers discovered that mutual funds prefer more liquid stocks(Falkenstein 1996); and it is usually used (with stock prices) by investors as the basis for

[4] Because of the existence of volatility spillover effect, short-term trading suspension does not significantly influence the quality of data, so only stocks experienced long-term trading suspensions in a certain quarter was removed.

analyzing price manipulators' behavior, especially in Chinese A-share market. For reasons above, price-to-book value ratio at the end of each quarter and average daily turnover rate within each quarter are also controlled for.

In addition, due to the heterogeneous business cycles and operations of companies classified into different sectors, funds have to consider not only fundamentals or technical indicators of a company but also the sector it is classified into. Funds' preference varies across sectors, and it is argued that such variation is related to funds' different expectations about the future of these sectors(HU Da-chun and JIN Sai-nan,2007). In Chinese capital market, investment accessibility varies greatly across sectors. And this fact leads to funds' limited freedom when investing in some specific companies. In order to remove the influence of different sectors to the results, using industrials as a benchmark, I set dummy variables for stocks from other 8 sectors.
Variables in regression analysis are defined and listed below in Table 2.

Table 2 Variables

type	Symbol	Meaning	Notes
Explained Variable	FSH_i	Fraction held by funds at the end of each quarter	Calculations refer to (1)~(6)
Explanatory Variable	$Volatility_i$	Daily return volatility within each quarter	
Control Variable	MC_i	Market capitalization at the end of each quarter	
	P_i	Average stock price within each quarter	
	PB_i	Price/book value ratio at the end of each quarter	
	$Liquidity_i$	Daily average turnover rate within each quarter	
	Ind_Staple	Dummy for consumer staples companies	Equals 1 only when the company is classified into consumer staple sector and 0 otherwise
	Ind_Energy	Dummy for energy companies	Equals 1 only when the company is classified into energy sector and 0 otherwise
	Ind_Fin	Dummy for financials	Equals 1 only when the company is classified into financial sector and 0 otherwise
	Ind_Info	Dummy for information services companies	Equals 1 only when the company is classified into information service sector and 0 otherwise
	Ind_Health	Dummy for health care companies	Equals 1 only when the company is classified into health care sector and 0 otherwise
	Ind_Discre	Dummy for consumer discretionary companies	Equals 1 only when the company is classified into consumer discretionary sector and 0 otherwise
	Ind_Utilities	Dummy for utilities companies	Equals 1 only when the company is classified into utilities sector and 0 otherwise
	Ind_Materials	Dummy for materials companies	Equals 1 only when the company is classified into materials sector and 0 otherwise

The fraction of i company's shares held by funds at the end of quarter k is calculated as:

$$FSH_{ik} = NFS_{ik}/NS_{ik} \quad (1)$$

Where NFS_{ik} is the number of company i's A shares held by all funds at the end of quarter k;
and NS_{ik} is the number of i company's A shares outstanding at the end of quarter k;
The daily return volatility of stock i at the end of quarter k is given by:

$$\text{Volatility}_{ik} = \sqrt{\frac{1}{N_k - 1}\left[\ln\left(P_{i,k,j}/P_{i,k,j-1}\right) - \frac{1}{N_k}\ln\left(P_{i,k,N_k}/P_{i,k-1,N_k}\right)\right]^2} \quad (2)$$

where $P_{i,k,j}$ is the closing price of stock i at the j_{th} trading day of quarter k; and N_k equals to the number of trading days in quarter k;

And the total value of company i's A-shares outstanding at the end of quarter k:

$$MC_{ik} = P_{i,k,N_t} \times NS_{ik} \quad (3)$$

The average price of stock i during quarter k is:

$$P_{ik} = \frac{1}{N_k} \times \sum_{j=1}^{N_k} P_{i,k,j} \quad (4)$$

Price-to-book ratio of stock i at the end of quarter k can also be easily found:

$$PB_{ik} = TMC_{ik}/TNS_{ik} \quad (5)$$

Where TMC_{ik} is the total market capitalization of company i, including A-shares, B-shares (domestic stocks traded in foreign currencies), H-shares (listed in HK) and N-shares (listed in New York), at the end of quarter k; TNS_{ik} is the total number shares outstanding of company i at the end of quarter k.

Last, the average daily turnover rate of stock i during quarter k is given by:

$$\text{Liquidity}_{ik} = \frac{1}{N_k} \times \sum_{j=1}^{N_k} (\text{Volume}_{i,k,j}/NS_{ik}) \quad (6)$$

Where $\text{Volume}_{i,k,j}$ is the trading volume of stock i on the j_{th} trading day of quarter k.

When companies' sizes, share prices, valuation levels, share liquidities and sector features are accounted for, multivariate regression analysis can be effectively employed to investigate the influence exerted by stock volatility on funds' investing decisions.

2. Volatility of A-Share portfolios

Funds' preferences for different levels of stock return volatility can be explored based on the methodology described above. Nevertheless, individual stock volatility is only one part of the whole story.

The process of asset allocation starts with observation and experience and ends with beliefs about the future performances of available securities (Markowitz 1952).Total risk of a portfolio can be split into two parts: systematic risk and unsystematic or idiosyncratic risk. Following the spirit of diversified investment strategy, unsystematic risk can be reduced or even eliminated. When securities are not perfectly correlated with each other, opportunity to "improve" by constructing portfolios exists. The total volatility depends on each security's volatility and also the variance-covariance matrix and the weights of these securities. Unsystematic risk can be optimally diversified when different and specific weights are assigned to securities. This is the case of approaching the efficient frontier (Markowitz 1959). As professional and institutional investors, risk diversification is a basic tool funds widely adopt. Therefore, the whole Chinese

fund industry's attitude towards volatility can be observed when the results of asset allocation, which was made based on good knowledge of "return- risk" trade-off relationship, are depicted.

Directly studying funds' A-share portfolio construction results is impractical, especially with limited time and under modest technological conditions: all A-shares should be used to form a feasible set and the corresponding efficient frontier[5]. Chinese A-share market is characterized by the tendency of stock prices to move up and down altogether. It has been criticized to be a "policy market", since the government's decisions have tremendous impact on the total stock market's performance. For the fact that stocks from different sectors generally have much smaller degree of correlation, funds' diversification strategies can be effectively reflected by their allocation results among sectors.

The depiction of efficient frontier and allocation results among sectors involves calculating the proportion of money invested in stocks from each sector. The weight of funds' investment into stocks from sector i at the end of quarter k can be calculated as follows:

$$\mathrm{IND}_{ik} = \sum_{j=1}^{S_{ik}} (\mathrm{FSH}_{i,k,j} \times \mathrm{MC}_{jk}) / \sum_{m=1}^{S_k} (\mathrm{FSH}_{mk} \times \mathrm{MC}_{mk}) \quad (7)$$

where $\mathrm{FSH}_{i,k,j}$ is the fraction of a company held by funds at the end of quarter k, and the company is the j_{th} one from sector i . MC_{jk} and MC_{mk} denote A-share capitalizations of company j and company m at the end of quarter k, respectively. FSH_{mk} is the fraction of a stock, which is the m_{th} one in A-share market then, that is held by funds at the end of quarter k. And S_{ik} is the number of A-share market listed companies at the end of quarter k;

The weight vectors $W_1, W_2, \ldots, W_{15}$ corresponding to ends of 15 quarters can be obtained after such calculations. With daily closing price of CSI300 Sector Indices, 15 return matrices[6] $R_1, R_2, \ldots, R_{15}$ and further the variance-covariance matrices $V_1, V_2, \ldots, V_{15}$ can be created. After optimization, we can depict the efficient frontiers under the no-short-selling condition[7]. Meanwhile, expected daily returns $E(r)$ and volatility σ_k can be found:

$$E(r)_k = \varphi_k \cdot R_k \cdot W_k^T \quad (8)$$

where φ_k is a $1 \times N_k$ row vector that every element of whom is $1/N_k$, k=1,2,…,15; and the superscript "T" represents the transposition of a vector.

And

$$\sigma_k = \sqrt{W_k \cdot V_k \cdot W_k^T}, \text{ and } k=1,2,\ldots,15 \quad (9)$$

Following this method, we can pinpoint the cross-sector allocation results of each quarter in the "risk-return" plane. Then analyzing such points' relative positions to their corresponding efficient frontiers allows us to achieve the goal of this part of study.

It is worth noting that funds' asset allocation results observed may not always be ideal. One of the reasons is that the construction of efficient frontiers is based on the assumption that funds can always "actively make choices". However, for a certain portfolio, individual security's

[5] There are around 1000 stocks in the market held by funds, and when their data are used simultaneously, the solving process is very demanding technologically

6 For additivity across portfolios, simple returns are employed.

[7] Market participants had not been officially allowed to conduct short selling in China until Nov 25, 2011

volatility is not constant across different periods of time. What makes it worse is that relative changes in market value of securities also alter their weights in the portfolio (Fabozzi and Francis 1979). In terms of the whole fund industry, even if no change occurred to the number of each stock held, allocation varies as stocks' relative prices move up or down. Therefore, portfolio variation is a dynamic process where active choosing and passive accepting happens simultaneously. On the other hand, for regulatory and governmental reasons, all funds face limitations when trying to invest in some specific companies or sectors. All these facts indicate that it is reasonable and acceptable if the allocation results are not always perfectly close to efficient frontiers.

V. Empirical Results

1. Pool regression

As the first step, I pool subsamples to explore the relationship between fund shareholding and stock volatility during the 15 quarters. Remove all the subscript "k" from each variable and the regression equation is:

$$FSH_i = \alpha + \beta_1 Volatility_i + \beta_2 \ln(MC_i) + \beta_3 P_i + \beta_4 PB_i + \beta_5 Liquidity_i + \sum \gamma_? Ind_? + u_i$$

Where Ind_? represent dummy variables for the 9 sectors. The Table below shows the correlation coefficient matrix of main variables:

Table 3 Correlation Coefficient Matrix of Main Variables with Pool Data

	FSH	Volatility	Ln(MC)	P	PB	Liquidity
FSH	1					
Volatility	.0791	1				
Ln(MC)	.2405	-.2400	1			
P	.3501	-.0313	.2457	1		
PB	.0968	.0252	.0369	.2146	1	
Liquidity	-.0930	.2975	-.1869	.1043	.0252	1

The absolute value of the coefficient between any two regressors is no bigger than 0.3 and the possibility of collinearity between two regressors can be ruled out. After 5 multivariate linear regressions—— each regressor acted as dependent variable and other 4 as independent variables——are run, the largest R^2 is 0.104[8]. So no evidence of multicollinearity is found.

[8] Details of these auxiliary regressions are not reported

Table 4 Regression Result of Pool Data

	coefficient	S.E.
Intercept	-55.2382**	2.159
Volatility	.1443**	.007
Ln（MC）	2.4377**	.0921
P	.2608**	.0131
PB	.0269	.0162
Liquidity	-.0530**	.0327
Ind_Staple	1.9630**	.3903
Ind_Energy	-1.4490**	.5111
Ind_Fin	-1.1276**	.3063
Ind_Info	.6132*	.2925
Ind_Health	4.6741**	.3982
Ind_Discre	3.8904**	.2837
Ind_Utilities	-2.9213**	.3023
Ind_Materials	-.4258	.2307
Adj. R^2	.2113	
F-Statistic	355.1973	

NOTE. –Estimation is based on White's Heteroskedasticity-Consistent Standard Errors & Covariance Estimation (White 1980); due to the large sample size (17191), lower size of the test (1% and 5%) are used.

*p<.05

**p<.01

The sign on the estimated coefficient of volatility is positive and the null hypothesis that it equals zero is significantly rejected, which indicates when the stock volatility increase by 1%, the fund shareholding level increase by 0.1443%. Estimated coefficients on variable ln(MC) and P are also positive and significant, so larger company size and higher stock price are associated with higher level of fund shareholding. Null hypothesis that the coefficient on price-to-book ratio is zero cannot be rejected. F-statistic tells that the model as a whole is statistically significant. The relationship between dependent variable FSH and independent variables are evident, albeit the relatively modest adjusted R^2 may suggest that explanatory power of the multivariate model is not quite strong.

From this pool data regression we get the message that funds' shareholding is positively correlated to stock volatility after removing the effects of company size, stock price, valuation level and liquidity, and also the sector companies are classified into. That is to say, funds prefer to hold larger fractions of more volatile stocks during the 15 quarters. In addition, the fund industry exhibited preference for larger size, higher price and lower liquidity. No evidence was found to show funds really care how stocks are valuated by the market, which may be explained

by that different investment styles of funds cancelled out each other. Last but should not be neglected, compared with industrials sector, funds hold significantly larger fraction of companies' shares in consumer staples, health care and consumer discretionary sectors, but for financials and utilities companies it is just the other way around.

2. Separate Cross-sectional Regressions

To capture the possible time-varying characteristic of funds' attitude to stock volatility, I proceed the study by applying the same regression to each subsample respectively. Estimate for some control variables is inconsequential for this study, so results are selectively reported.

Table 5 Estimates of the Variable Volatility

Sub-sample	Coefficient	S.E.	Size of subsample	CSI300 Index quarterly return
2008-1st	.0160	.0391	863	-35.11%
2008-2nd	-.1659***	.0621	901	-24.95%
2008-3rd	-.1200**	.0529	823	-18.45%
2008-4th	-.1099*	.0615	916	-15.79%
2009-1st	-.0549*	.0325	910	28.66%
2009-2nd	.1069***	.0384	1001	21.72%
2009-3rd	-.0690**	.0317	954	-7.47%
2009-4th	.0412	.0388	1238	12.24%
2010-1st	.0443	.0263	1229	-5.51%
2010-2nd	.0070	.0170	1415	-28.02%
2010-3rd	.0118	.0259	1287	15.02%
2010-4th	.1393***	.0269	1503	2.72%
2011-1st	.1318***	.0229	1283	1.05%
2011-2nd	-.0791***	.0207	1549	-7.24%
2011-3rd	-.0370	.0263	1319	-16.67%

NOTE.-No autocorrelation detected, but the problem of heteroskedasticity is evident, so all results are also based on Heteroskedasticity-Consistent Standard Errors & Covariance Estimation (White 1980); adjusted R^2 varies from 0.17~0.42

*p<.1

**p<.05

***p<.01

After correlation coefficient matrices are examined, suspicion of multicollinearity for several subsamples exists. Estimated standard errors might be larger than they should be for those subsamples, so judgments about significance tend to be "conservative". Though there may be coefficients unfairly regarded as no different from zero, we focus on only significant ones. Obviously, the relationship between fund shareholding level and stock volatility varies with time,

since there are both positive and negative signs on statistically significant coefficients. It is not difficult to notice that, when CSI300 quarterly returns are taken into account, significant coefficients are always positive when the market is going up and negative when it is moving downwards, with minimal number of exception[9]. We can conclude that funds exhibited preference for volatile stocks in bull markets[10] and showed aversion to individual stock's risk in bear markets. This might be linked to fund managers' focus on avoiding big losses when the market was going down and their progressive strategies for higher returns when the market was climbing up.

Table 6 Estimated Coefficients of Dummy Variables for Different Sectors

Sub-sample	Ind_Staple	Ind_ Energy	Ind_Fin	Ind_Info	Ind_ Health	Ind_ Discre	Ind_ Utilities	Ind_ Materials
2008-1st	3.85***	4.01**	-.53	.97	5.79***	3.39***	-4.61***	2.51**
2008-2nd	6.39***	5.31*	-2.32	1.44	9.37***	5.77***	-5.16***	4.06***
2008-3rd	2.60*	3.75	-.76	1.37	3.96***	3.29***	-4.57***	-.38
2008-4th	3.37	3.78	-2.89	-1.43	5.45***	6.08**	-5.12**	.13
2009-1st	-.12	-.13	.09	-.37	.73	2.94***	-2.46**	-.08
2009-2nd	1.14	.28	2.97*	-1.00	3.54**	5.09***	-4.99***	1.78*
2009-3rd	1.24	-1.26	.96	.396	3.40***	2.71***	-2.69***	1.79**
2009-4th	2.11	-3.02*	.06	1.25	5.79***	4.57***	-4.08***	1.98**
2010-1st	1.35	-3.44***	.77	.82	3.40***	3.61***	-1.99***	.16
2010-2nd	3.29	-6.13***	-3.65***	.39	5.98***	5.04***	-3.12***	-1.97***
2010-3rd	2.17**	-3.13***	-1.86***	.99	2.19**	3.25***	-2.07***	-.97
2010-4th	1.42	-4.61***	-1.59*	1.82*	4.10***	4.36***	-2.85***	-1.70**
2011-1st	.05	-1.48	-.02	1.75**	2.00**	2.93***	-.87	-.35
2011-2nd	.36	-2.10	-.47	1.10	3.31***	3.77***	-.66	-.31
2011-3rd	-.75	-1.79**	-.75	.74	1.85*	2.57***	-1.01	-1.48***

NOTE. -As mentioned before, estimate is based on Heteroskedasticity-Consistent Standard Errors & Covariance Estimation (White 1980).

*p<.1

**p<.05

***p<.01

Both regularity and time-varying feature can be observed from regression results above. For instance, compared with industrials companies, funds always hold larger fractions of consumer discretionary companies and smaller fractions of utilities companies; energy and materials companies were once preferred by funds, but gradually they turned to be disinclined to hold larger fraction of these stocks, all compared with industrials. As the proportions of each sector stocks in A-share market are generally stable, coefficients on the dummy variables for the same sector are comparable among subsamples. So, significant estimated coefficients can serve as additional evidences for the time-varying feature of funds allocation results among sectors.

[9] China's A stock market began to rebound in the first quarter of 2009. Funds' preference for less volatile stock in this period is possibly caused by managers' psychological inertia after a big bear market.

[10] Simple definitions for bull and bear market similar to what used by Fabbozi and Francis (1979) are adopted here. Positive quarterly return indicates a bull market and vice versa.

3. Volatility of portfolios

I carry out the scheme described in detail in Section IV and get the average daily returns (used as expected return), standard deviations, and then plot efficient frontiers and also funds' allocation results. Thus looking into funds' portfolio volatility can be achieved with some insights.

Figure 1 Efficient Frontier, the First Quarter of Year 2008

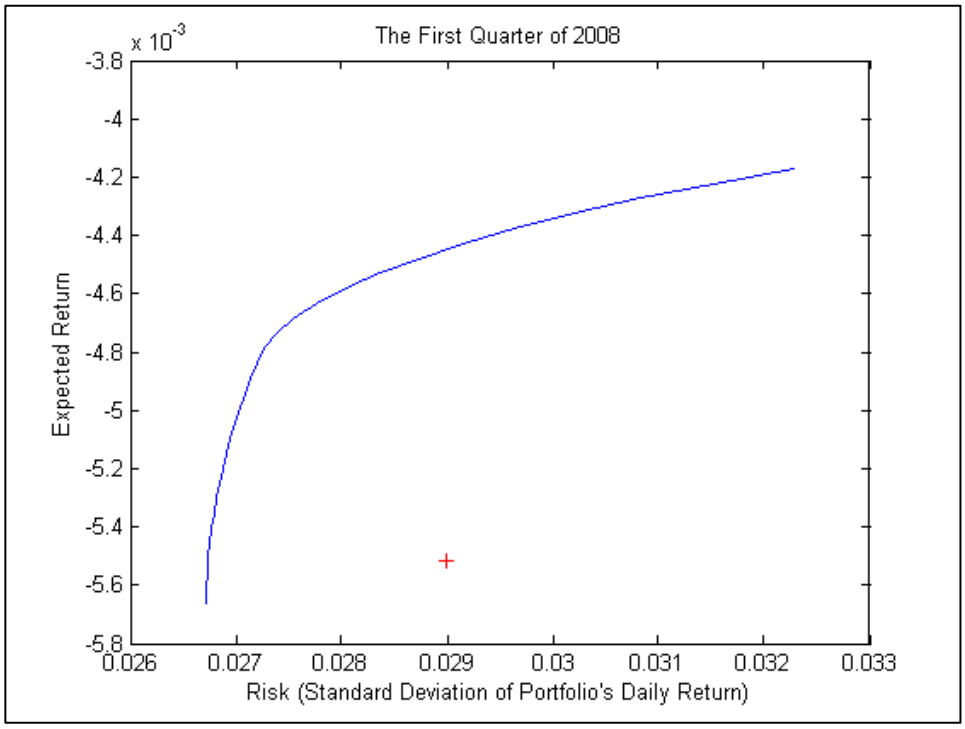
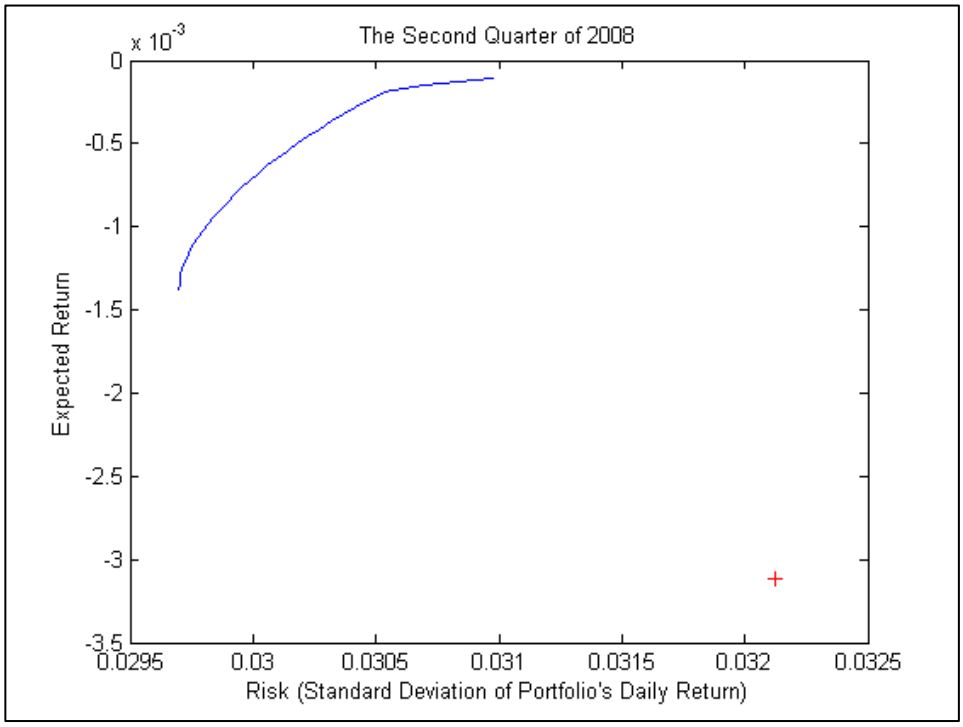


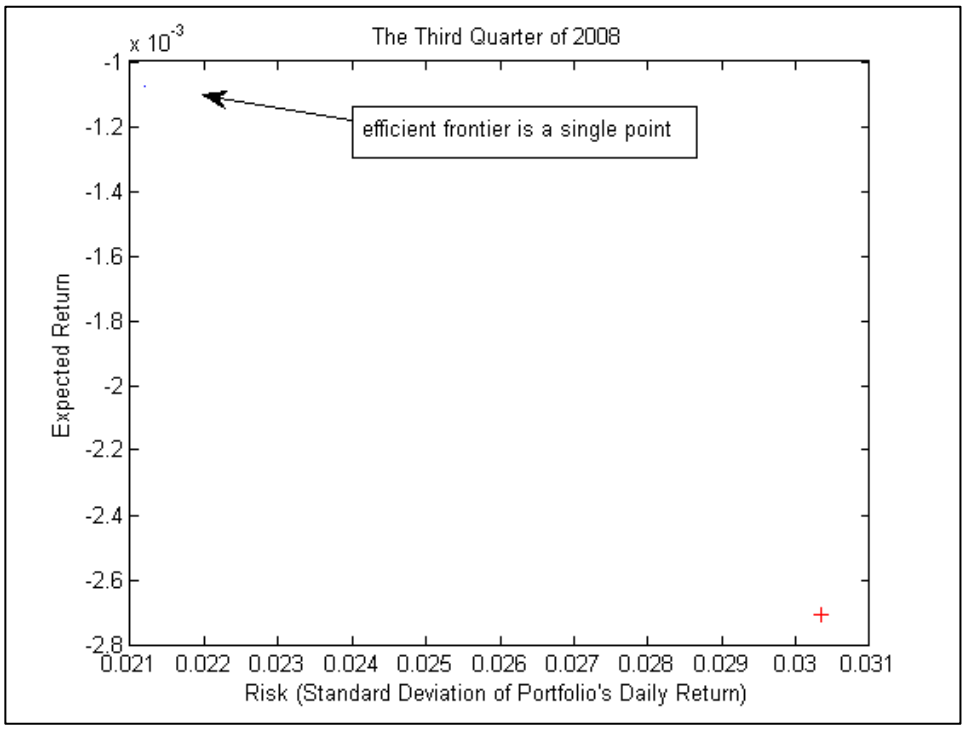
Figure 1 presents the efficient frontier of the first quarter of 2008, constructed with 9 CSI300 Sector Indices, and the red cross "+" represents funds' allocation result. A-share market was in a bear market then, and any point on the efficient frontier has a negative expected return. But potential losses can still be minimized if good allocation strategies were taken. In this quarter, the funds "chose" an allocation strategy with lower return and larger volatility, as the red cross is not close to efficient frontier and lies in a "bad" position in the plane. Compared with the least-standard-deviation portfolio, which is on the down side end of the blue curve, funds' portfolio is far from optimally diversified and thus has a relatively large volatility.

Figure 2 Efficient Frontier, the Second Quarter of Year 2008



Similarly, efficient frontier of the second quarter of 2008 and fund industry's portfolio was presented in Figure 2. The red cross is more distant to any point on the blue curve. In this quarter, funds' portfolio had much lower expected return and much larger volatility than they could have.

Figure 3 Efficient Frontier, the Third Quarter of Year 2008



There is a special case for the third quarter of 2008: efficient frontier is a single point on the return-risk plane[11]. In this quarter, the larger the weight of utilities sector stocks in the portfolio, the closer the portfolio is to the "efficient frontier". However, it is evident that this goal was not fulfilled by the fund industry in the third quarter of year 2008.

Figures depict situations of the rest of the 15 quarters are given below.

Figure 4

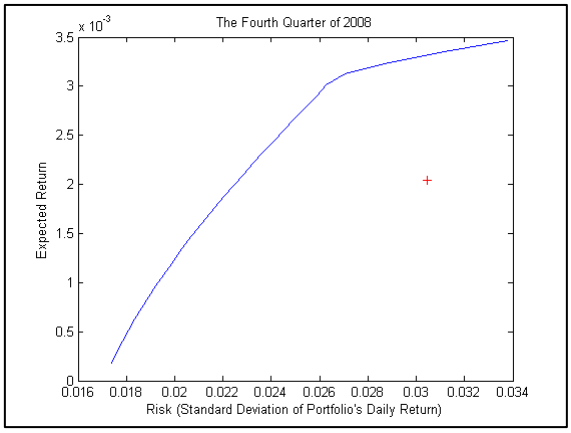
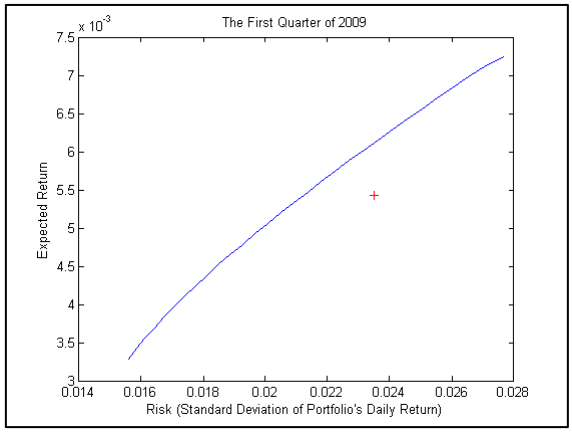


Figure 5



[11] This may be implausible at the first glimpse, but is actually possible under no-short-selling conditions, especially in short terms. Conditions for the existence of this phenomenon are briefly explained as follows. First, if there are only 2 risky assets in the market, $Asset_1$ and $Asset_2$.It is easy to see the necessary condition for 100% investment in $Asset_1$ are $-\infty < R_2 < R_1 < +\infty$ and $0 < \sigma_1 < \sigma_2 < +\infty$, but this is not a sufficient condition. Denote the weights of these two assets as w_1, w_2, and the variance of the portfolio can be calculated:${\sigma_p}^2 = {w_1}^2\sigma_1^2 + {w_2}^2\sigma_2^2 + 2w_1w_2\sigma_1\sigma_2\rho$. After optimization for the minimal variance, we can get $w_1 = \frac{\sigma_2^2 - \sigma_1\sigma_2\rho}{\sigma_1^2+\sigma_2^2-2\sigma_1\sigma_2\rho}$, $w_2 = 1 - w_1$. It is sure that $\sigma_1^2 + \sigma_2^2 - 2\sigma_1\sigma_2\rho = (\sigma_1 - \sigma_2)^2 + 2\sigma_1\sigma_2(1-\rho) > 0$, so when $\rho \geq \sigma_1/\sigma_2$ holds, the optimal portfolio has weights$w_1 = 1, w_2 = 0$. Now, assume there are N different risky assets $Asset_1 \sim Asset_N$ and $-\infty < R_i < R_1 < +\infty$, $0 < \sigma_1 < \sigma_i < +\infty$, i = 2,3, … , N, If the correlation coefficient between $Asset_1$and any $Asset_i$'s return $\rho_{1,i}$satisfy $\rho_{1,i} \geq \sigma_1/\sigma_i$, no smaller variance than ${\sigma_1}^2$ can be created without short selling. When this is the case, adding any other assets into the portfolio cannot "improve" the risk level, so the efficient frontier turns out to be a single point.

Figure 6

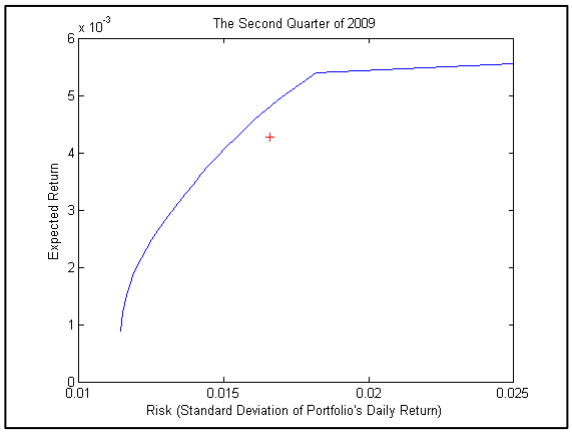


Figure 7

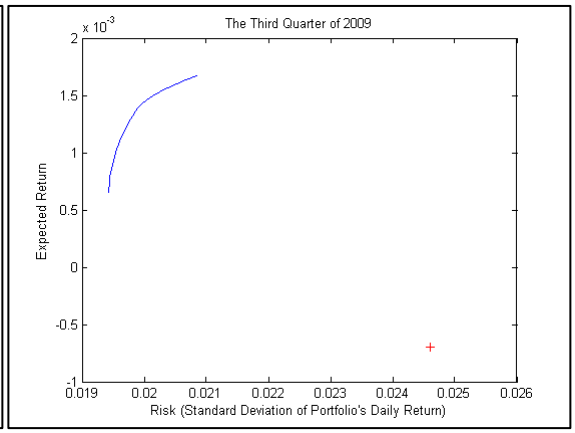


Figure 8

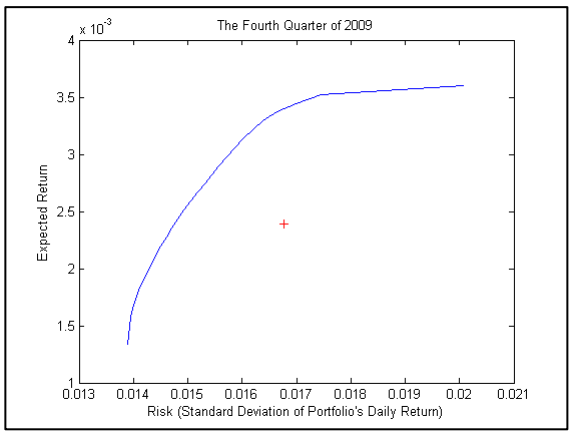


Figure 9

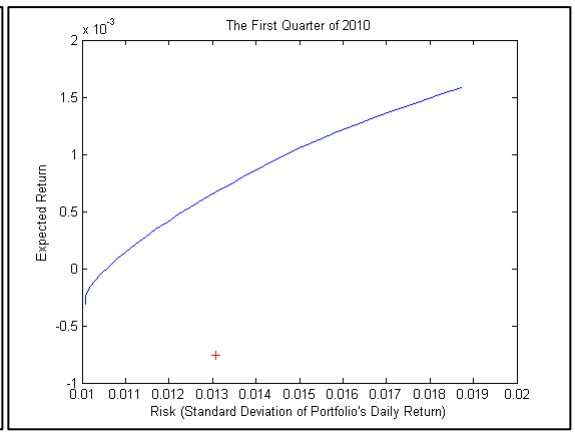


Figure 10

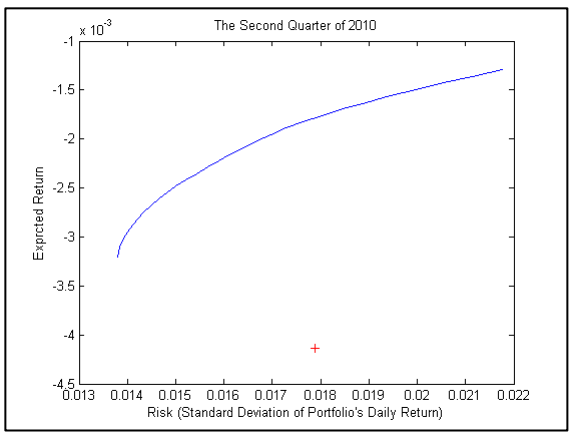


Figure 11

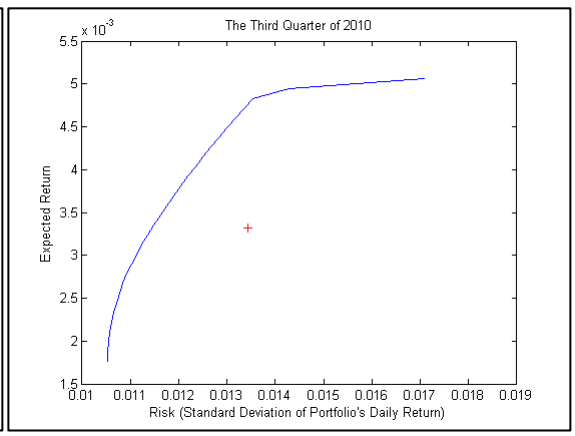


Figure 12

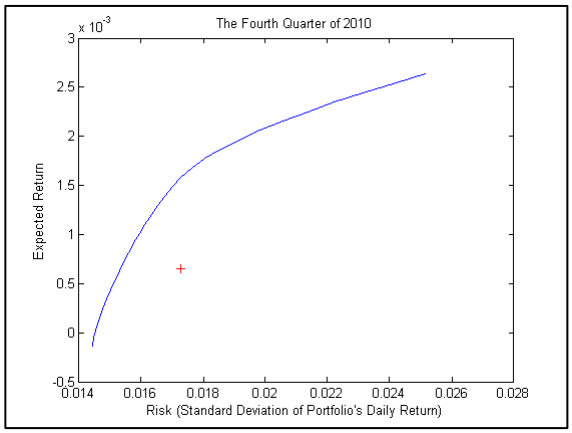


Figure 13

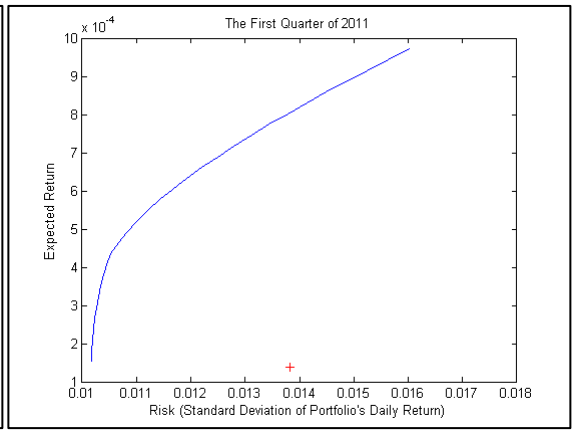


Figure 14

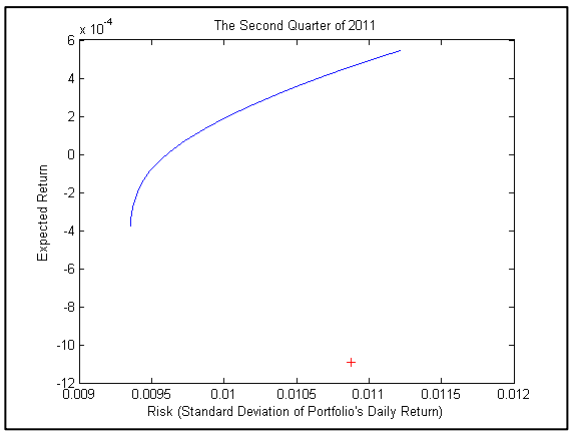
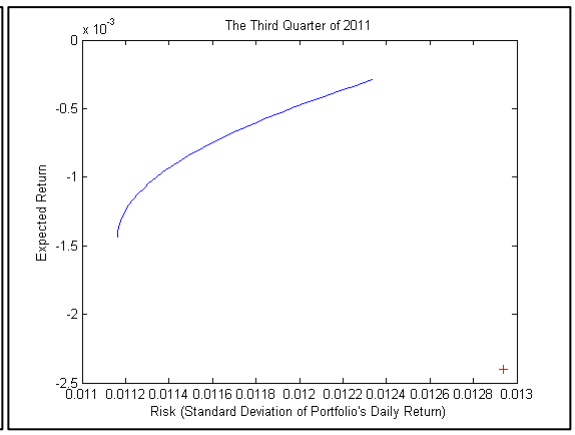


Figure 15



Though not very precisely, we can get the visual message from figures above that the fund industry's allocation positions are not always close to efficient frontiers. In terms of the proximity to the blue curve, there are "beautiful" results, but "ugly" ones seem to dominate. This fact does not imply that funds are market losers, because aside from A-shares, they can also invest in fixed income, futures, warrants, and money markets etc. to achieve their goals in asset allocation. A-share portfolio is only one sub-portfolio of their "real" portfolio. But as we care about how funds behaved in A-share market, what we can learn from these figures is that funds always constructed portfolios whose locations correspond to relatively large daily return standard deviations. Therefore, we have reason to believe that in most cases, fund industry's cross-sector A-share portfolios have large volatilities, and overall, fund industry did not exhibit strongly risk-averse attitude when investing in A-share market.

VI. Conclusions

I used A-share data of 15 consecutive quarters, form the first quarter of year 2008 to the third of 2011, and studied the China's fund industry's attitude towards asset volatility when investing in A-share market. After multivariate regression and graphical analyses, following

conclusions are reached:

First, when company size, stock price, valuation level and liquidity, and also the sector a company is classified into are accounted for, the level of fund shareholding is positively and significantly correlated with stock volatility. But this relationship is not stable.

Second, funds overall preferred volatile stocks in bull markets and showed aversion to individual stock's risk in bear markets.

Finally, in terms of portfolios constructed with A-shares from different GICS sectors, China's fund industry as a whole has various locations on the return-risk plane, but the volatility of these portfolios are generally large. For the reason that, to a large extent, cross-sector allocation results can reflect funds' investment behavior in A-share market, it is not groundless to say funds constructed volatile A-share portfolios.

To sum up, as one of the major players in A-share market, fund industry of China had time-varying preference about stock volatility, and the preference is closely related the market; funds nearly always create A-share portfolios with large volatilities.

Admittedly, this study has some limitations that can undermine the accuracy of conclusions above:

Though all available fund shareholding data was collected, omitting is inevitable. For some companies whose equities highly concentrated in only one or several shareholders, relatively smaller shareholding fraction of funds might not be disclosed. Besides, CSI300 Sector Indices were used as proxies for stock returns of different sectors and might involve some bias. Endogeneity is another potential problem in multivariate linear regression analysis. Further tests, introductions of instrumental variables and correction methods such as GMM may be needed.

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