國立臺灣師範大學管理學院管理研究所

碩士論文

Graduate Institute of Management

College of Management

National Taiwan Normal University

Master Thesis

基金經理人對總經因素變化之反應—以中國基金為例

The Responses of Fund Managers to Macroeconomics Factors – Evidence from China Funds

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中華民國 108年 8月

August, 2019

誌謝

本論文之完成，首要感謝指導老師賴慧文教授，在撰寫論文時不厭其煩悉心教導，給予工作機會的幫助，以及研究方法的學習。也感謝何宗武教授在R語言程式的指導，另外也非常感謝口試評委蔡蒔銓教授和張森林教授提供寶貴的建議與指正。

感謝瑄在我寫論文寫不出來的時候給予我鼓勵與鞭打，恐嚇我論文沒有進度，就去路邊敲碗，同時陪我聊天聊到天亮，撫平我脆弱的心靈，解決我所有的煩惱，成為我最強的後盾。也感謝遠在澳門的肥丁在我趕論文進度感到厭煩時，不停的發訊息騷擾我，讓我分心回覆訊息忘掉當下的論文，拖累我的進度。

感謝管研所的同學與朋友，陪我渡過整個碩班生涯，尤其是常常一起吃飯一起玩樂的那幾位，雖然你們都選很貴的餐廳，導致我們在下課時間越來越邊緣，還讓我變得越來越窮，但認識你們我真的非常開心。

最後，感謝我的家人多年來悉心栽培，沒有你們的包容與支持，我無法完成自己的目標，謝謝你們。

李詩薇　謹誌

2019 年 8 月

摘要

本文以中國基金為研究對象，以探討基金經理對總經因素的反應。本研究選擇基金經理人的特徵、總經因素和系統風險資金變化作為迴歸分析的變量。

在測試迴歸模型前，我們將六個總經因素進行主成分分析（Principal Component Analysis），以避免自由度的損失。因此，我們將通貨膨漲率，生產者價格指數和重貼現率作為主成分 1，將存款準備金率，外匯儲備和美元兌換人民幣匯率作為主成分 2。

迴歸結果的結論對應於整個假設。當總經因素處於不利狀態時，與男性基金經理人相比，女性基金經理人不願意承擔更多風險，與具有本科學位的基金經理人相比，具有研究生學位的基金經理人傾向於承擔更少的風險。在子樣本中，我們只測試了股票型基金的系統性風險變化，結果是當總經不利因素增加時，與國外畢業的基金經理人相比，在國內畢業的基金經理人願意承擔更多的風險。

關鍵詞：系統性風險的改變、基金、基金經理人的特徵、宏觀經濟因素、主成分分析、多元迴歸分析

Abstract

This study apply China funds for the research object to discuss the responses of fund managers to the macroeconomic factors. This study selected characteristics of fund managers, macroeconomic factors and systematic risk changes of funds as variables for the regression analysis.

Before we test the regression analysis, we divided six of the macroeconomic factors into two principal components to avoid the loss of degrees of freedom. Therefore, we classify inflation rate, producer price index and re-discount rate as principal component one and deposit reserve rate, foreign exchange reserve and U.S dollar against RMB exchange as principal component two.

The conclusions of the regression results are corresponding to the entire hypothesis. When macroeconomic factors are in unfavorable situation, female fund managers are not willing to take more risk compared to male fund managers. In addition, when macroeconomic factors are in unfavorable situation, fund managers with postgraduate degrees are tend to take less risk compared to fund managers with undergraduate degrees. In the sub sample, we have tested systematic risk changes of equity funds only, when macroeconomic factors are in unfavorable situation, we found that fund managers who graduate in domestic are willing to take more risk compare to fund managers who graduate in abroad.

Keywords: Systematic risk of changes, funds, characteristics of fund manager, macroeconomic factors, principal components analysis, multiple regression analysis

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1. Introduction

1.1 Research motivation

In November 1997, the State Council approved the issuance of the Interim Measures for the Administration of Securities Investment Funds, marking the birth of the fund industry. In 1998, the first two closed-end funds, the fund Jintai and the fund Kaiyuan were issued online through the exchange system, which opened the prelude to the China fund market.

The lack of new fund issuance prompted the SFC to promulgate the Pilot Measures for Open-end Securities Investment Funds in October 2000. One year later (September 2001), China's first open-end fund "Hua'an Innovation" was established, marking the official entry of China's fund industry into the era of open-end funds. In 2004, the regulatory authorities issued laws and regulations such as the Securities Investment Fund Law (the Fund Law) and the Securities Investment Fund Operation Management Measures, which provided legal protection for the standard operation of the fund industry.

Affected by the financial crisis, the fund share grew slowly during 2008-2011, and the fund market was in a "stagnation period". Although the stock market has risen and the overall fund issuance has not decreased, the fund market has been weak, and the net asset value has not broken through the peak of 2007.

Since 2012, the introduction of new policies, especially the implementation of the newly Fund Law and the Administrative Measures for Securities Investment Fund Management Companies, has led to a round of regulatory relaxation in the asset management industry. A good policy has enhanced to the rapid development of the second round of the fund industry. The wave of business innovation has spawned a boom in the fund market.

With the rapid development of the China fund market, investors generally obtain fund information such as fund size, performance ranking, fund risk, expense ratio, turnover, fund flow, fund age and fund style from the fund investment companies. In addition, companies will also provide the fund manager attributes such as gender, age, nationality, education background and fund tenure because it related to the future development of each type of funds. In short, investors will make the transaction through the reliable information and fund investment companies will acquire asset to make further investment and capital allocation.

The way in which companies raise capitals from the investors are widely used, it is one of the fastest and direct ways for companies to obtain capitals and it also makes funds become one of the most important assets in the financial markets. Overall, the development of funds market enhance the national economic development and the promotion of commercial activities. However, if there are fluctuation or adverse effect on fund market, it will not enhance the national economic development. The two main factors affect the fund markets are systematic and non-systematic risk, non-systematic risks are the risks unique to individual companies and systemic risks are caused by environmental

factors such as overall political, macroeconomic, and social factors. Among the factors, macroeconomic factor is the only one, which has relatively complete and objective data for research and analysis and it is an important factor affect fund markets. Hence, we research the change of beta in China funds through the response of fund managers to the macroeconomic factors. In this research, we mainly investigate the relationship between systematic risk changes of China funds, characteristics of fund managers and macroeconomic factors. After that, we use empirical results to analysis conclusion for providing a suggestion for the future works.

1.2 Research purpose

How fund managers with different attributes such as gender, education background and graduation background respond to the change in macroeconomic factors.

1.3 The structure of dissertation

The structure of this paper is classified into five different sections. The contents of each section are as follows:

1. Introduction

   Illustration for research motivation, research purpose and the structure of this paper.

2. Literature review

Sort out dissertations, local and foreign journals related to characteristics of fund managers, different investment decisions between fund managers and the correlation between macroeconomic factors and financial commodities.

3. Research methods

Introduction of research object, characteristics of fund managers, macroeconomic factors, research hypothesis and regression model.

4. Empirical results

Mainly for the empirical results and statistical analysis, and explain the significance of statistical research results.

5. Conclusion

Conclusion for empirical results and suggestion for further research.

2. Literature Review

The fund markets can be affected by economic and non-economic factors. Economic factors are the macroeconomic factors, such as money supply and interest rates, inflation, national income, gross domestic product, exchange rate and foreign exchange deposits, and the booming cycle. Non-economic factors refer to various factors other than the economy, including politics, culture, education, science and technology, health, military, and diplomacy. Among the various factors mentioned above, macroeconomic factors are more important consideration factors. Because the overall economic factors have relatively complete data, and the previous literature also has research on the relationship between the overall economy and the fund.

In addition to the economic and non-economic factors, the fund manager is also an important key to the future development of the fund, because the style portfolio and the asset allocation that the fund manager chooses to invest will affect the investor's investment decision. Therefore, we will select some important macroeconomic factors and we will discuss the response of fund managers on macroeconomic factors. For example, male fund managers will take more risk rather than female fund managers when macroeconomic factors in unfavorable situation. This paper takes the characteristics of fund managers and the macroeconomic factors as the main literature reference.

2.1 The characteristics of fund managers

Kumar, Niessen-Rueniz, and Spalt (2015) has mentioned that managers with foreign-sounding names have lower annual funds flow even they have the similar performance with other managers who have typical American names. Moreover, manager with foreign-sounding names with good performance in funds have lower appreciation and greater punished with bad performance compare to the managers without foreign-sounding names. The reasons are due to the social bias such as name-induced stereotypes and taste-based discrimination. In short, local investors prefer to invest mutual funds managed by managers with typical American names. The evidence is more obvious due to the exogenous events like 9/11 terrorist attacks and Boston marathon bombings, investors avoid to investing the mutual funds managed by the managers with the Middle East or South-Asia names. There have the similar empirical results through statistical data and online experiment. However, investors lived in the regions with highly concentrated foreign-born person more willing to invest mutual funds managed by foreign-sounding names managers. Overall, these results suggest that the mutual fund investments of local investors are affected by social biases such as in-group bias, stereotyping and discrimination.

徐明東與黎捷 (2005) has presented the characteristics of fund managers like academic background, age, periods engaged in financial industry, tenures and fund style would affect the excess return of funds in China. For example: fund managers with MBA or PHD degrees would have more advantage than fund managers who only have Bachelor degree. However, the empirical results

illustrate that fund managers with MBA or PHD degrees have lower investment performance compared to whose with Bachelor degrees. It seems nonsense in logical reasoning but the authors explain the reasonable reasons like the types and quantity of China funds are less, inadequate management regulations, information asymmetry and secret deal. In addition, fund managers with short periods engaged in financial and tenures have better performance. The reason is fund managers with bad performance will be dismissal and replaced by new fund managers, so most of them focus on short-term investment with higher risks.

Chevalier and Ellison (1999) has presented fund managers with master degrees have good performance compared to whose without master degrees. The reason is they achieve better education and have better networks for gathering information. In addition, young managers achieved higher return than older managers due to lower expenses and survivorship bias. For instances, investment companies will be more sensitive to young managers, so young managers will work harder for the future career and avoid to dismissal through bad performance. The last point is fund managers with higher SAT scores will have better performance because of higher inherent abilities and indirect benefits such as better information sources and improved access to IPOs.

Beyer and Bowden (1997) indicated that people with masculine domain would be more confidence than people who did not have it. Prince (1993) mentioned that men feel more confidence than women in financial matter because they think that they are more reasoning and logic. Barber and Odean (2001) presented overconfidence investors tend to make more transaction and lower returns.

Although men and women also exhibit overconfidence, men are more confident than women are, the evidence is men tend to spend more time for analyzing financial commodities and make more transactions. In addition, they overestimate their abilities; believe that returns are highly foreseeable and hold riskier portfolios. As the result, men trade more but women perform better than men did.

Oakley (2000) contended that stereotype leads investor may prefer to invest in funds that managed by male rather than female-managed funds, the reason is they think female fund managers underperform than male fund managers. On the other hand, stereotype leads investors think that fund managed by female are less competent and effective in investment. However, Atkinson, Baird and Frye (2003) proved that there are no difference between male and female fund managers in performance, risk and other fund characteristics and they have similar academic background. The difference of gender attributed related to wealth constraints and investment knowledge. In addition, female fund managers have low net asset flows compared to male fund managers. The possibility is investors prefer male fund managers to manage mutual funds, this leads to mutual fund companies prefer to hire male fund managers rather than female fund managers.

Kumar (2010) analyzed that female analysts has stronger market react and provide estimates accurately than male analysts. However, Green, Jegadeesh and Tang (2009) mentioned that female analysts lower than male analysts in forecast precision. On the other hand, Niessen-Ruenzi and Ruenzi (2013) analyzed that female fund managers who managed mutual funds would have lower fund inflow compared to male fund managers. It would have similar result if male fund managers

who managed fund replaced by female fund managers. The reason is investors would prefer to invest in the mutual funds that are managed by male fund managers even female fund managers are more reliable and stable on investment styles and even have the identical performance on female and male fund managers. The empirical, experiment and IAT result indicated customer-driven discrimination is the main reason to explain why female fund managers in mutual funds industry are low proportion.

曾德明、查琦、龔紅 (2006) indicated the excess return, devaluation rate and unit net asset has positively effect on the fund performance, it means the higher of the indicators, the higher of the fund performance. However, fund managers' working experience and P/B ratio has negative effect on the fund performance, so investors should select the funds with lower P/B ratio and working experience of fund managers.

2.2 The different investment decision between fund managers

Bams and Otten (2007) has mentioned that fund managers prefer domestic investments rather than foreign investments because they are 'home bias.' These include information asymmetry and institutional constraints. In addition, Bams and Otten expected foreign fund managers prefer to invest well-known large foreign company stocks instead of small foreign companies, which might reduce informational disadvantages. However, their results indicate that foreign fund managers invest more in smaller companies compared to local fund managers.

Van Inwegen and Shukla (1995) mentioned that international asset pricing models encourage investors to allocate their investment portfolio diversification. However, lack of information leads to poor performance and returns for investors in foreign fund markets and increase to home bias (included currency risk, transaction costs and information costs). It is usual that investors prefer to invest in the fund markets that they familiar with, so authors want to analyze whether informational advantage to domestic investors will lead to better performance. The empirical result indicated that UK mutual fund managers (foreign) have poor performance compared to US mutual fund managers (local) in the US fund market. However, information disadvantages become less in late 1980s to early 1990s, the reasons could be possible for UK managers increase their experience in US fund markets or improved information technology.

Covrig, Lau and Ng (2006) analyzed the similar and differences of local and foreign managers on stock preference in 11 different countries. Empirical results indicated that both lcoal and foreign managers prefer stocks with low return variability, high return on equity and large turnover. However, they are different in investment decision. Domestic managers concentrate firms with low financial distress, high potential growth and low financial distress and large dividend yields, whereas foreign managers prefer to invest in global corporations that have greater investor recognition and worldwide visibility. International studies provide evidence that demand of foreigners are strong when they invest in different regions diversely; the reason is they do not have equal information compared with domestic managers, so they prefer to invest the stocks that they know about. Covrig, Lau and Ng

suggested that the different stock preference of local and foreign managers are not related to geographic location of managers, are their fund investment in geographic allocations.

French and Poterba (1991) presented that US equity traders have strong preference for the investment in domestic equity markets (94%) even though US equity market is only 48% in the proportion of global equity market. Coval and Moskowitz (1999) also documented that US equity managers have strong preference in domestic market even this behavior is inefficient from diversification. The reasons for the US equity managers resist making investment in foreign market are due to national boundaries, which would possible lead to exchange rate fluctuation, taxation and variation in regulation. The second reasons are geographic proximity, which might lead to informational differences between local and foreign investors. The empirical results proved that US investors have a strong favor investment in local firms with small size, high levered and produce nontraded goods and they prefer investment with the factors of geographic proximity.

2.3 The correlation between macroeconomic factors and financial commodities

Mittal and Pal (2011) analyzed the correlation between macroeconomic indicators and Indian capital markets. They have made the hypothesis like exchange rates, savings, inflation and interest rates have no significant influence on BSE Sensex and S&P CNX Nifty. The empirical result indicates inflation has influence on BSE Sensex and S&P CNX Nifty significantly, interest rate has influence on S&P

CNX Nifty significantly, foreign exchange rate has influence on BSE Sensex significantly and saving has no significant influence on BSE Sensex and S&P CNX Nifty.

張容嘉 (2011) presented the relationship between macroeconomic factors and the performance of China Open-end Funds with the application of APT (Arbitrage Pricing Theory). The dependent variable is the return of China Open-end Funds. Independent variables are unexpected inflation, unexpected growth rate of value-added of industry, unexpected growth rate of M1 supply, unexpected growth in total retail sales of consumer goods, unexpected change rate of oil price, unexpected growth rate of trade volume, risk premium, interest rate term structure and the component of return of Shanghai and Shenzen 300 Index return. The empirical results show that in the first sub- period (2006/01-2008/3) , only the component of return of Shanghai and Shenzen 300 Index return has significant impact on the return of China Open-end Funds. For the second sub-period (2008/04-2010/12), unexpected growth rate of value-added of industry, unexpected growth rate of M1 supply, unexpected change rate of oil price, unexpected growth rate of trade volume have excess return of China Open-end Funds. In the whole sample period, only unexpected change rate of oil price and the component of return of Shanghai and Shenzen 300 Index return have significant impact on the performance of China Open-end Funds. The reason of this phenomenon could be immature of China capital market and leads to the unstable change of the application of APT in China fund market.

王怡文 (2010) adopted multiple regression model to analyze the impact of macroeconomic indicators (exchange rate, money supply, CPI, oil price, BDI, foreign exchange deposit and industrial

production index) on stocks market and mutual funds in Taiwan. The empirical results approved that there are positive correlation between money supply, BDI and industrial production index with stocks market and mutual funds, negative correlation between exchange rate with stocks market and mutual funds.

3 Data and Research Method

3.1 Research object and data processing

Our data are collected from TEJ (Taiwan Economic Journal) and the research object is China funds. Our research used quarterly systematic risk data during the period from 2008 to 2018, 43 research periods are selected, and 1530 of funds are selected. In addition, we have removed the outliers and the criteria of our samples are included in $\pm 2.689\sigma$. The systematic risk changes of funds are defined as below:

The systematic risk changes of funds:

$$\Delta BETAR_t = \frac{(BETA_t - BETA_{t-1})}{BETA_{t-1}} \quad (3\text{-}1)$$

where BETA = weighted of investment rate * Beta; $BETA_t$: systematic risk changes of funds in the t period.

The systematic risk changes of funds could be affected by the change in company's risk, not by fund manager's risk selection. Therefore, one may argue that Beta would vary in a period even fund managers did not change the allocation of weight in the investment portfolio. As a result, the systematic risk changes may not link to manager's characteristics. However, one way to deal with this issue is to normalize it, as defined in Equation 3-1. Because of normalization, the effect of the Beta will become less relevant.

3.2 Characteristics of fund managers selection and data processing

Our data are collected from TEJ (Taiwan Economic Journal). There are 1039 out of 3275 fund managers which are correspond to our research and we distinguished the characteristics of fund managers such as gender (male or female), education background (undergraduate or postgraduate) and graduation background (domestic or foreign) to test the different response of the fund managers when macroeconomic factors are in unfavorable situation.

We will use dummy variables to differentiate their gender, education background and graduation background. The variable definition of fund managers' characteristics:

1. Gender (FMG): if a fund manager is female: 1, male: 0.
2. Education background (FMEB): if a fund manager is postgraduate (Master or PHD degree): 1, undergraduate: 0.
3. Graduation background (FMGB): if a fund manager graduates at domestic (China): 1, abroad: 0.

3.3 Macroeconomic factors selection and data processing

1. Macroeconomic factors selection

   Our thesis selects variables based on the following two considerations:

   (1) According to the Mittal and Pal (2011), 張容嘉 (2011) and 王怡文 (2010), our thesis selected macroeconomic factors which could affect the change of systematic risk, macroeconomic factors divided to three types are shown as follows:

Table 1 Macroeconomic factors

Types	Names
A. Price level	Inflation rate
	Producer price index
B. Interest rate level	Re-discount rate
	Deposit reserve rate
C. Exchange rate level	Foreign exchange reserve
	US dollar against RMB exchange rate

(2) The available of macroeconomic factors

Since China's statistics on macroeconomic factors started late, the statistical standards are not consistent, and the data of many economic indicators are not complete, such as consumer confidence index and unemployment rate.

According to the points above, we selected six macroeconomic factors such as inflation rate, producer price index, re-discount rate, deposit reserve rate, foreign exchange reserve and US dollar against RMB exchange rate as our variables in the model. The macroeconomic factors are collected from TEJ (Taiwan Economic Journal).

2. Data processing of macroeconomic factors

(1) Variables definition

We will define six of the macroeconomic factors through the formulas below:

A) Inflation rate (INR)

Inflation rate measures the average price of goods and services increase in a period, resulting the fall in the purchasing value of money.

When inflation rate increases, The People's Bank of China may terminate lowering interest rate and quantitative easing monetary policy, it means that economy may slow down. In contrast, when inflation rate decreases, The People's Bank of China may start lowering interest rate and quantitative easing monetary policy, economy may growth. The definition of variables is as below:

$$\Delta INR_t = INR_t - INR_{t-1} \quad (3\text{-}2)$$

B) Producer price index (PPI)

Producer price index is changing in manufacturing or wholesale costs; usually the retail price of a commodity is determined by the manufacturer's production cost.

The data of producer price index represent the change of producer price. When producer price index increases, The People's Bank of China may increase interest rate and economy may slow down. In contrast, when producer price index decreases, The People's Bank of China may reduce interest rate and economy may growth. Thus, we assume the definition of variables is as below:

$$\Delta PPI_t = PPI_t - PPI_{t-1} \quad (3\text{-}3)$$

C) Re-discount rate (RDR)

Re-discount rate is when the commercial bank's funds are insufficient, except from inter-bank lending, they will borrow from the central bank and it is one way for The People's Bank of China to control currency policy.

When there is excess assets in the market, The People's Bank of China can raise re-discount rate to stimulate the interest rate increase in the market and the economy development may slow down. Conversely, lowering the re-discount rate leads to the interest rate fall and the economy development may boost up. The definition of variables is as below:

$$\Delta RDRt = RDRt - RDRt - 1 \quad (3\text{-}4)$$

D) Deposit reserve rate (DRR)

Deposit reserve rate refers to financial institutions make deposits and ensure customers can withdraw the deposits and the liquidation needs.

The history of China's deposit reserve rate, it can be found that the sharp rise in foreign exchange reserves is the main reason for the increase in deposit reserve rate. In figure 1, foreign exchange reserve and deposit reserve rate have same trend from 2010 to 2011. (The People's Bank of China's foreign currency assets surged between 2009 and 2011, and the corresponding RMB supply increased passively, so it adjusts deposit reserve

rate to control the money supply). However, The People's Bank of China reduce the deposit reserve rate significantly since 2015. If interest rates continue to rise and the real economy is difficult to obtain funds, The People's Bank of China will adjust again and decrease deposit reserve rate.

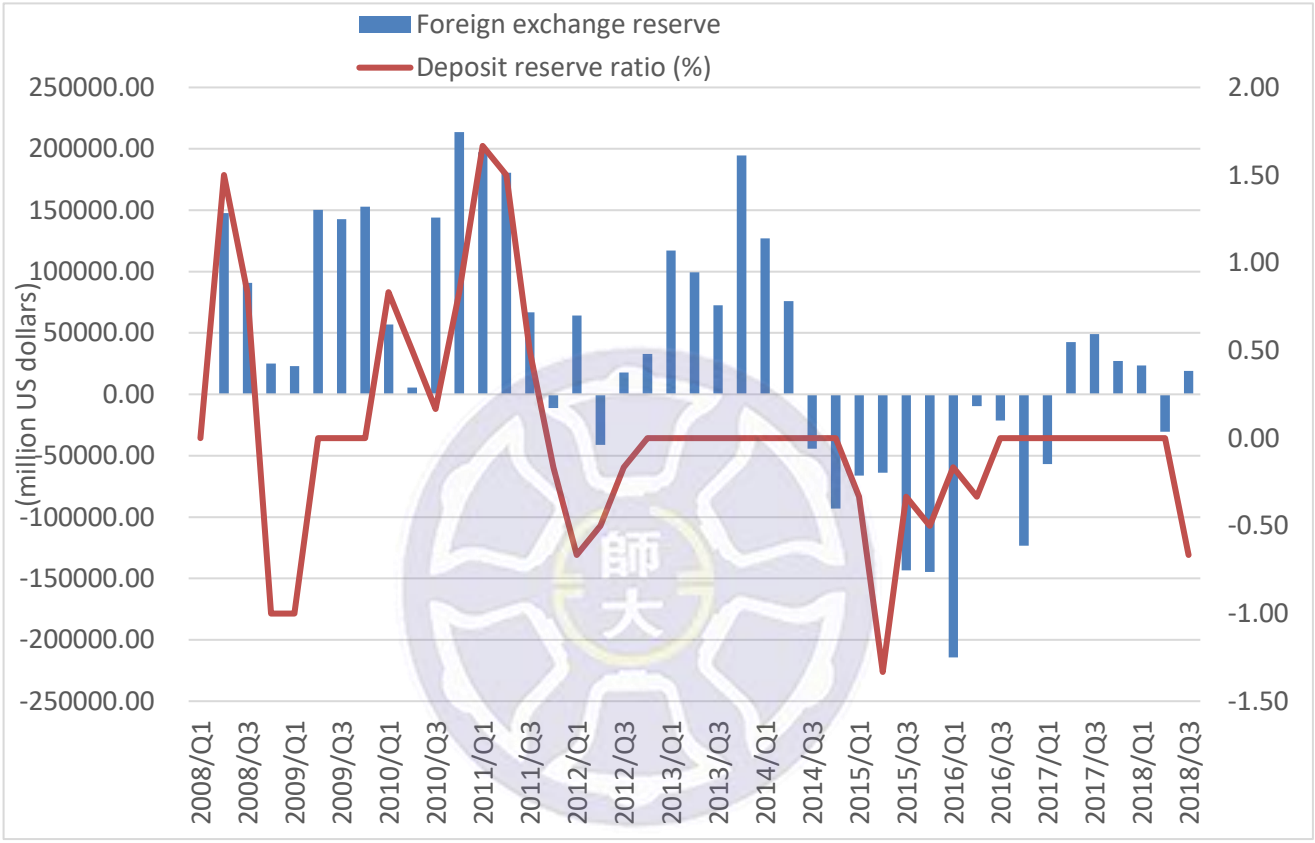

Figure 1 The trend of deposit reserve rate foreign exchange reserve

When deposit reserve rate increases, The People's Bank of China may terminate quantitative easing monetary policy and economy may slow down. When deposit reserve rate decreases, The People's Bank of China may start quantitative easing monetary policy and economy may rise. The definition of variables is as below:

$$\Delta DRRt = DRRt - DRRt - 1 \quad (3\text{-}5)$$

E) Foreign exchange reserve (FRR)

Foreign exchange reserve is one of the assets in national monetary authority and it can be exchanged for foreign currency at any time. In addition, foreign exchange reserve is important because it is international liquidity in a country and it can stabilize the exchange rate and balance the payments.

When foreign exchange reserve increases, The People's Bank of China may terminate quantitative easing monetary policy and economy may slow down. When foreign exchange reserve decreases, The People's Bank of China may start quantitative easing monetary policy and economy may rise. The definition of variables is as below:

$$\Delta FRR_t = \frac{(FRR_t - FRR_{t-1})}{FRR_{t-1}} * 100 \quad (3\text{-}6)$$

F) U.S dollar against RMB exchange rate (USRMBR)

The variation of U.S dollar against RMB exchange rate may have a considerable influence on the economy and the stock price. Due to the impact of the trade war, The People's Bank of China depreciate RMB to offset the drag from trade war, but it's not a long term appropriate approach because the sharply depreciated of RMB may impact domestic market confidence.

In addition, the depreciation of RMB may also affect the stock market. When the goods import from China, the price of the goods are cheaper than other countries and be

more competitive due to the depreciation of RMB. Hence, the corporation profit and the stock price increase. On the contrary, when the goods export to China, the price of goods are more expensive than other countries, so the corporation profit and the stock price decrease. The definition of variables is as below:

$$\Delta USRMBR_t = \frac{(USRMBR_t - USRMBR_{t-1})}{USRMBR_{t-1}} * 100 \quad (3\text{-}7)$$

(2) Principal component analysis

When there are many independent variables in the regression model, the more parameters must be estimated and more the loss of degrees of freedom. Therefore, we have used principal component analysis to solve this issue. The following process will explain the steps of how to divide six of macroeconomic factors into two principal component:

As we can see that KMO test is 0.64 and it is significant in table 3, which means the data is suitable for principal component analysis.

Table 2 KMO and Bartlett Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.640
Bartlett's Test of Sphericity	Approx. Chi-Square	94.133
	df	15
	Sig.	0.000

We will only select the principal components with the total larger than 1, so we take principal component 1 and 2, the cumulative explanation is 73.418%.

Table 3 Total Variance Explained

Principal Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of	Cumulative	Total	% of	Cumulative
1	2.725	45.422	45.422	2.725	45.422	45.422
2	1.680	27.996	73.418	1.680	27.996	73.418
3	0.603	10.043	83.461			
4	0.416	6.941	90.402			
5	0.383	6.382	96.784			
6	0.193	3.216	100.000			

There are inflation rate, production price index and re-discount rate in principal component 1, which means price and interest rate level are included. On the other hand, there are deposit reserve rate, foreign exchange reserve and US dollar against RMB exchange rate in principal component 2, which means interest rate and exchange rate level are included. The data represent the correlation between macroeconomic factors and principal components and we will define principal component 1 and 2 as FAC1 and FAC2.

Table 4 Rotating element matrix

	Principal Component	
	1	2
ΔINR	0.882	
ΔPPI	0.883	
ΔRDR	0.832	
ΔDRR		0.701
ΔFRR		0.854
ΔUSRMBR		-0.800

3.4 Research hypothesis

According to Barber and Odean (2001) presented men are more willing to accept risk because of overconfidence and Chevalier and Ellison (1999) indicated fund managers with master degree or above are risk avoidance. Van Inwegen and Shukla (1995) mentioned local fund managers have better performance rather than foreign fund managers in the local investment market. Although we do not have any foreign fund managers in our sample, we still want to assume that fund managers graduate in domestic are more willing to accept risk than fund managers graduate in abroad when they invest in local market. In the light of the journals above, we have make some hypothesis as below:

H1: When macroeconomic factors are in unfavorable situation, female fund managers are less inclined to take risk than male fund managers do.

H2 : When macroeconomic factors are in unfavorable situation, fund managers with postgraduate degree tend to take less risk than fund managers with undergraduate degree.

H3 : When macroeconomic factors are in unfavorable situation, fund managers graduate in domestic are willing to take risk compared to fund managers graduate in abroad.

3.5 Regression model

Our research apply panel data for the multiple regression analysis, China fund's beta is the dependent variable, the characteristics of fund managers and principal components are the independent variables. We adopt SPSS software for analyzing the sample data. The regression model is shown as follows:

$$\begin{aligned}\Delta BETAR_{it} = {} & \alpha + \beta_1 FMG_{it} + \beta_2 FMN_{it} + \beta_3 FMAB_{it} + \beta_4 \Delta FAC1_{it} + \\ & \beta_5 \Delta FAC2_{it} + \beta_6 FMG_{it} \text{ X } \Delta FAC1_{it} + \beta_7 FMN_{it} \text{ X } \Delta FAC1_{it} + \\ & \beta_8 FMAB_{it} \text{ X } \Delta FAC1_{it} + \beta_9 FMG_{it} \text{ X } \Delta FAC2_{it} + \\ & \beta_{10} FMN_{it} \text{ X } \Delta FAC2_{it} + \beta_{11} FMAB_{it} \text{ X } \Delta FAC2_{it} + \varepsilon_{it} \end{aligned} \quad (3\text{-}8)$$

Table 5 Variables code definition

Variable Code		Variable Name	
ΔBETAR		China funds' Beta	
FMG		Fund managers' gender	
FMEB		Fund managers' education background	
FMGB		Fund managers' graduation background	
ΔFAC1	ΔINR	Principal Component 1	Inflation rate
	ΔPPI		Producer price index
	ΔRDR		Re-discount rate
ΔFAC2	ΔDRR	Principal Component 2	Deposit reserve rate
	ΔFRR		Foreign exchange reserve
	ΔUSRMBR		U.S dollar against RMB exchange rate

4 Empirical Analysis

4.1 Descriptive statistics

The research object is 1530 systematic risk change of funds, from 2008 to 2018 (43 quarters). Independent variables are from 2008 to 2018 (43 quarters), which included characteristics of fund managers (gender, education background and graduation background), factor1 (inflation rate, production price index and re-discount rate) and factor2 (deposit reserve rate, foreign exchange reserve and US dollar against RMB exchange rate).

Table 6 The statistics result of variables

	Min	Max	Mean	SD	N
ΔBETAR	-1.0000	3.0733	0.2023	0.8725	15976
Gender	0.0000	1.0000	0.1759	0.3807	15976
Education	0.0000	1.0000	0.9652	0.1833	15690
Graduation	0.0000	1.0000	0.9286	0.2575	15690
ΔFAC1	-9.1725	5.8964	1.0200	1.9611	14609
ΔFAC2	-3.9244	8.6314	-0.5677	1.1623	14609

4.2 Correlation analysis

If the correlation between the variables are high, there will be collinearity problem. Therefore, we have calculated the correlation coefficient between the variables; the result is shown as below:

As we can see that, the correlation coefficient between five of the variables are not high, it means highly or completely correlated are not existed between the variables. Each of the variables can be existed in the regression model.

Table 7 The correlation coefficient matrix of variables

	Gender	Education	Graduation	ΔFAC1	ΔFAC2
Gender	1				
Education	-0.155**	1			
Graduation	-0.022**	-0.032**	1		
ΔFAC1	0.001	-0.002	-0.006	1	
ΔFAC2	0.014*	-0.027**	0.031**	0.075**	1

**. Significant at the 1% level; *. Significant at the 5% level.

4.3 Multiple regression analysis

The result of table 8 indicates F values are significant in 1% level except column (3) and (4). When we input principal component2 and interaction terms (principal component2 X characteristics of fund managers) into the regression analysis, none of the variables is significant; it means principal component2 in regression model is not appropriate to explain systematic risk changes of funds.

In column (1), we can find that ΔFAC1 is significant at 1% level, which means when principal component 1 increases, systematic risk changes of funds will decrease 0.046%.

In column (2), the result indicates education background is significant at 10% level, which means when fund managers possess postgraduate degree increase, systematic risk changes of funds

will increase 0.081%. In addition, gender*ΔFAC1 is significant at 1% level, when gender*ΔFAC1 increases, systematic risk changes of funds will decrease 0.031%. It means when macroeconomic factors increase, female fund managers will reduce the willingness to take risk compare to male fund managers.

In column (5), the result presents gender is significant at 1% level, which means when female fund managers increase, systematic risk changes of funds will increase 0.044%. For education background, it is significant at 5% level, which means when fund managers possess postgraduate degree increase, systematic risk changes of funds will increase 0.081%. Moreover, the result also presents gender*ΔFAC1 is significant at 1% level and education background*ΔFAC1 is significant at 5% level. When gender*ΔFAC1 increases, systematic risk changes of funds will decrease 0.034%. It means when macroeconomic factors increase, female fund managers will less inclined to take risk compare to male fund managers. When education background*ΔFAC1 increases, systematic risk changes of funds will decrease 0.026%. It means when macroeconomic factors increase, fund managers with postgraduate degree will not willing to take more risk compare to fund managers with undergraduate degree.

In column (6), the result shows us gender is significant at 10% level and gender*ΔFAC1 is significant at 1% level. When female fund managers increase, systematic risk changes of funds will increase 0.041%. When gender*ΔFAC1 increases, systematic risk changes of funds will decrease

0.033%. It means when macroeconomic factors increase, female fund managers will less inclined to take risk compare to male fund managers.

In column (7), we only select systematic risk changes of equity funds in our observations, the result presents education background*ΔFAC1 is significant at 1% level, it means when macroeconomic factors increase, fund managers with postgraduate degree are tend to reduce 0.104% risk. In addition, graduation background*ΔFAC1 is significant at 5% level, it means when macroeconomic factors increase, fund managers who graduate in domestic are tend to increase 0.085% risk.

According to the result in table 8, we can find that the result is consistent to the hypothesis 1,2 and 3. When macroeconomic factors are in unfavorable situation, female fund managers and fund managers with postgraduate degree tend to reduce risk, fund managers graduate in domestic are tend to rise risk.

Table 8 Systematic risk changes of funds regression estimates

	OLS	OLS	OLS	OLS	OLS	OLS	OLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	0.205***	0.176***	0.156***	0.176***	0.151***	0.204***	0.252
	(4.004)	(3.066)	3.030	(3.128)	(2.944)	(3.249)	(0.926)
Gender	-0.005	0.026	-0.006	0.002	0.044*	0.041*	0.046
	(-0.273)	(1.164)	(-0.278)	(0.071)	(1.780)	(1.648)	(0.442)
Education Background	0.065	0.081*	0.066	0.049	0.091**	0.059	0.089
	(1.551)	(1.711)	(1.568)	(1.102)	(2.025)	(1.185)	(0.332)

Graduation	0	0.009	0.002	-0.003	0.025	0.002	-0.107
	(0.009)	(0.270)	(0.078)	(-0.092)	(0.700)	(0.060)	(-1.086)
ΔFAC1	-0.046***	-0.020				-0.024	
	(-11.837)	(-0.786)				(-0.956)	
Gender*ΔFAC1		-0.031***			-0.034***	-0.033***	-0.048
		(-3.014)			(-3.385)	(-3.183)	(-1.196)
Education*ΔFAC1		-0.014			-0.026**	-0.01	-0.104***
		(-0.666)			(-2.219)	(-0.463)	(-2.742)
Graduation*ΔFAC1		-0.008			-0.015	-0.007	0.085**
		(-0.524)			(-1.268)	(-0.497)	(2.133)
ΔFAC2			0.000	0.047		0.054	
			(0.064)	(1.088)		(1.251)	
Gender*ΔFAC2				0.013	0.027	0.024	0.074
				(0.736)	(1.535)	(1.364)	(1.000)
Education*ΔFAC2				-0.043	-0.012	-0.046	0.054
				(-1.264)	(-0.571)	(-1.356)	(0.772)
Graduation*ΔFAC2				-0.008	0.013	-0.007	-0.088
				(-0.283)	(0.623)	(-0.265)	(-1.191)
Adjusted R^2	0.010	0.010	0.000	0.000	0.010	0.010	0.003
F value	35.72***	21.761***	0.685	0.730	17.243***	14.313***	1.701*
P value	0.000	0.000	0.602	0.646	0.000	0.000	0.084
Observations	14350	14350	14350	14350	14350	14350	1839

***. Significant at the 1% level; **. Significant at the 5% level; *. Significant at the 10% level.

5 Conclusion

In our research, we investigate whether the macroeconomic factors in unfavorable situation induced the different decision between the fund managers with different characteristics. The result shows us when principal component1 (inflation rate, production price index and re-discount rate) increases, female fund managers will tend to reduce risk compared to male fund managers. Our finding is consistent with the findings of Barber and Odean (2001), who present that men are more willing to accept risk because of overconfidence.

In addition, we prove that when principal component1 (inflation rate, production price index and re-discount rate) increases, fund managers who possess postgraduate degree will incline to reduce risk compared to fund managers who possess undergraduate degree. The result is consistent with Chevalier and Ellison (1999), who indicated fund managers with MBA degree or above are risk avoidance.

Furthermore, we also prove that when principal component1 (inflation rate, production price index and re-discount rate) increases, fund managers who graduate in domestic will incline to increase risk compared to fund managers who graduate in abroad. However, it is effective only with the sample of systematic risk changes of equity funds. It is a new finding because most of the journal investigated the different decision between domestic and foreign fund managers.

In future work, we suggest adding macroeconomic factors from different countries like US 10-year bond yield or Philadelphia Semiconductor Index. It might also affect the decision of fund

managers when macroeconomic factors are in adverse effect. We also suggest adding different characteristics of fund managers to explore the new findings.

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