Time-Varying Skill: An Investigation of UK Mutual Funds

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วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต
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วิทยานิพนธ์นี้ศึกษาทักษะที่แปรผันตามเวลาของกองทุนรวมตราสารทุนที่ลงทุนในประเทศของสหราชอาณาจักร ซึ่งได้แก่ ทักษะในการจับจังหวะตลาด และทักษะในการเลือกหุ้น โดยใช้ข้อมูลการถือครองหลักทรัพย์ของกองทุน จากปีพ.ศ. 2548 ถึง ปีพ.ศ. 2556 ซึ่งครอบคลุมช่วงเวลาที่เกิดภาวะเศรษฐกิจตกต่ำครั้งใหญ่ ระหว่างปีพ.ศ. 2551 ถึงปีพ.ศ. 2552 ด้วย จากการหาความสัมพันธ์ระหว่างวัฏจักรธุรกิจกับทักษะทั้ง 2 อย่างของกองทุน พบว่า กองทุนมีทักษะในการจับจังหวะตลาดและทักษะในการเลือกหุ้นในช่วงภาวะเศรษฐกิจขยายตัวมากกว่าในช่วงภาวะเศรษฐกิจถดถอย หรือกล่าวอีกนัยคือ ทักษะทั้ง 2 อย่างไม่ได้แปรผันตามช่วงเวลาของวัฏจักรธุรกิจ นอกจากนี้หากทำการเปรียบเทียบระหว่างกองทุนที่มีทักษะในการเลือกหุ้นดีเลิศในช่วงภาวะเศรษฐกิจขยายตัวกับกองทุนอื่นๆ พบว่า กองทุนที่มีทักษะในการเลือกหุ้นดีเลิศในช่วงภาวะเศรษฐกิจขยายตัว ยังมีทักษะในการเลือกหุ้นและทักษะในการจับจังหวะตลาดในช่วงภาวะเศรษฐกิจถดถอยมากกว่ากองทุนอื่นๆอีกด้วย อีกทั้ง กองทุนที่มีทักษะในการเลือกหุ้นดีเลิศในช่วงภาวะเศรษฐกิจขยายตัวมีผลการดำเนินงานที่มากกว่ากองทุนอื่นๆ โดยเฉพาะเมื่อวัดด้วยแบบจำลองกำหนดราคาสินทรัพย์ทุน นอกจากนี้ การศึกษาในช่วงภาวะเศรษฐกิจตกต่ำครั้งใหญ่ พบว่า กองทุนในสหราชอาณาจักรมีทักษะในการจับจังหวะตลาดในช่วงเวลาดังกล่าวมากกว่าในช่วงภาวะเศรษฐกิจถดถอยอื่นๆ แต่กองทุนมีทักษะในการเลือกหุ้นในช่วงภาวะเศรษฐกิจตกต่ำครั้งใหญ่น้อยกว่าในช่วงภาวะเศรษฐกิจถดถอยอื่นๆเพียงเล็กน้อย

ภาควิชา การธนาคารและการเงิน ลายมือชื่อนิสิต .....

สาขาวิชา การเงิน ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

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This thesis investigates time-varying skills of UK domestic open-end equity mutual funds, namely timing skill and picking skill by using holdings data from 2005 to 2013, including a great recession period during 2008 to 2009. From examining the relation between the business cycle and both skills, this thesis finds that funds have picking skill and timing skill in expansions more than in recessions. In other word, there is no variation of skills with the business cycle. Moreover, when comparing top picking skilled funds in expansions to other funds, the result shows that top picking skilled funds in expansions also have higher picking skill and timing skill in recessions. Besides, top picking skilled funds in expansions can outperform other funds only measured by CAPM model. In addition, the study in the great recession or the crisis period finds that UK mutual funds have timing skill in the crisis more than in regular recessions, but they have picking skill in the crisis a little bit less than in regular recessions.

Department:	Banking and Finance	Student's Signature	.....
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CHAPTER I

INTRODUCTION

1.1 Background and Motivation

An investigation of skills or the outperformance of active funds is important because they manage the largest portion of total net asset around the world and charge higher fee than passive funds[1](Cremers et al. (2014)). However, they ambiguously add higher values to investor than passive funds. The existence of skilled funds is necessary for both researchers and investors. For researchers, excess return in mutual fund performance will lead to the rejection of efficient market hypothesis (EMH) due to abnormal gains of informed traders. For investors, if the skill of active funds do not exist, investors should invest their money in passive funds and pay lower fees. Nowadays, researchers and investors still keep investigating on skills of active funds.

The recent evidence to support skilled funds in the U.S. is the study of Kacperczyk et al. (2014). They find the variation in skills over a business cycle by showing that fund managers have picking skill in expansions and have timing skill in recessions using portfolio holdings data. Additionally, Kacperczyk et al. (2014) state that timing skill can be found only in recession periods and this is the reason behind the failure to discover timing skill of many previous studies. However, time-varying skill in the U.S. may not hold for other countries and there is still no test for external validity.

The result of the variation in picking skill and timing skill over the business cycle of U.S. mutual funds cannot be used to make an inference about that in UK mutual funds. Even though, They have some similar characteristics e.g., high competition and low barrier to entry (Otten and Schweitzer (2002), Khorana et al. (2009)), they have two main different

[1]As of December 2010, 58% and 22% of open-ended equity mutual funds' total net asset around the world belong to truly active fund and explicating indexing fund respectively. Additionally, total shareholder cost, the annual expense ratio plus one-fifth of the front end load, around the world for truly active fund and explicit indexing are 1.66% and 0.35% consequently.

characteristics, namely tax treatment and investor protection (Cuthbertson et al. (2010)). U.S. mutual funds have different tax treatment of capital gain from UK mutual funds and U.S. investors have stronger protection than UK investors. These different characteristics can lead to different patterns or different levels in skills of funds. Regarding Ferreira et al. (2012), they conclude that funds will have high performance if they operate in the country that has a high level of financial development, high market liquidity and strong legal protection for investors.

This thesis uses portfolio holdings data to search for skilled funds of UK domestic open-ended equity mutual funds by looking at their sources of skills: timing skill and picking skill, and the pattern of exhibiting skills related to the business cycle, especially in the global financial crisis period. UK mutual funds should get more attention because in 2012, its market share, 35% of European asset under management (AUM), was the largest portion in Europe and its AuM/GDP ratio (282%) was the highest ratio in the world[2]. Moreover, according to Cremers et al. (2014), total shareholder cost of truly active fund in the UK, which is considered as upper bound expenses, is 1.82 times as expensive as that in the U.S. and total shareholder cost of explicit indexing fund in the UK, which is considered as lower bound expense, is 2.38 times as expensive as that in the U.S.[3]. Therefore, both the large market share and expensive charges show the importance of studying for the UK mutual fund industry. In addition, for the UK, testing time-varying skill in a crisis period can provide different results from testing time-varying skill in other periods. Xydias (2012), who studies the performance persistence of the UK funds pre and post-global financial crisis, shows that performance of UK funds are persistent in a period before 2008 and in a period after 2011 but in 2008-2011, the persistence disappears.

Furthermore, the study of Vidal et al. (2015) is the evidence of timing skill in recessions around the world by using return-based measure. Although their results include

[2] U.S. AuM/GDP ratio was 174%.EFAMA (2014). Asset Management in Europe (7th Annual Report).
[3] Total shareholder cost of explicit indexing fund and truly active fund in the UK are 0.62% and 2.38% respectively and in the U.S. are 0.26% and 1.31%.

2007-2008 crisis as one of their recession periods, this study will be further evidence emphasizing more on this crisis period for UK mutual funds. This thesis tests timing skill and picking skill using holding-based measure in crisis months separately from the other recession months to see how funds exhibit both skills in that particular period. Testing performance through severe recessions or crisis is the proper time to prove managerial skill of UK active funds.

1.2 Research Questions

Above all, this thesis aims to investigate whether timing skill and picking skill vary over the business cycle in UK mutual funds and whether the levels of using timing skill and picking skill in crisis differ from those in other regular recessions.

1.3 Objectives

The main objectives of this study are to investigate the variation in picking skill and timing skill over the business cycle of UK mutual funds by using holdings data and to test the impact of a great recession in the UK on the variation in picking skill and timing skill.

1.4 Contributions

This study is the evidence to support the existence of top skilled funds and the link between the sources of skills and the state of economy for the UK mutual fund industry by showing the behavior of exhibiting picking skill and timing skill in expansions, in recessions, and in crisis period. In addition, this thesis also helps prior literature to decrease a snooping bias by using non-U.S. data and testing in different the business cycle periods. Finding skills of active equity funds in the UK will help individual investors to have more confidence on their active funds charging expensive fee and to have more satisfaction to allocate more money into active equity funds than passive funds.

1.5 Research Hypotheses

Hypothesis 1: Timing skill has positive relation with recessions, while picking skill has negative relation with recessions.

Hypothesis 2: Top picking skilled funds in expansions, who have the highest 25th percentile of the fraction of observation months in expansions that have picking skill in the group of the highest 25th percentile of the overall picking skill return distribution, have better timing skill in recessions and have better performance than other funds.

Hypothesis 3: Funds have timing skill in the great recession period, the second quarter of 2008 to the third quarter of 2009, more than they have in other recession periods.

1.6 Organization of the Paper

The remaining chapters of this thesis are organized as follows. Chapter II reviews related literature. Chapter III describes hypothesis development, data, and methodology. Chapter IV presents empirical results. Conclusion is in Chapter V.

CHAPTER II

LITERATURE REVIEW

A large number of studies have been conducted to find skills of funds by determining whether risk-adjusted returns after fees of active funds outperform passive funds using various models with different techniques and different time periods. Most of them, especially in the last decade came to the conclusion that average or aggregate active funds cannot beat index funds: the studies in the U.S. including Pástor and Stambaugh (2002), Elton et al. (2003), Fama and French (2010) and the studies in the UK including Fletcher (1995) and Quigley and Sinquefield (2000). However, there is a small subset of active funds who can beat the market and can add value to investors: evidences of U.S. mutual funds including Chen et al. (2000), Wermers (2000), Busse and Irvine (2006), Kosowski et al. (2006), Barras et al. (2010), Fama and French (2010), Amihud and Goyenko (2013), Koijen (2014), and the evidence of UK mutual funds including Cuthbertson et al. (2008). Another aspect to find the evidence of managerial skill is to investigate on sources of skill which are picking skill and timing skill. Some papers find that picking skill exists in top performance funds but not for funds on average. While, there are little evidences to support positive timing skill. Furthermore, there are evidences of performance, picking skill, and timing skill relating to the business cycle. For example, in recessions, active funds will have better performance, use higher timing skill, and use lower picking skill than those in expansions.

2.1 Picking Skill

A lot of literatures can observe picking skill in the U.S. mutual fund industry. Wermers (2000) indicates that funds hold stocks having returns higher than market indices. Chen et al. (2000) investigate individual trade of funds and conclude that the stocks that they bought can outperform the stocks that they sold. The literature from Baker et al. (2010) also confirms picking skill by adding that funds can pick excellent stocks. Kacperczyk et al. (2005) find that active funds having more industry concentration can earn higher return and they tend to heavily

hold stocks in the industry that they have information advantages. Baker et al. (2010) show that skill of funds comes from the ability to forecast earnings of stocks' company from fundamental information and also point that we can use trading activity of funds to predict firms' earnings surprises for the next announcement date. Cohen et al. (2010) and Jiang et al. (2014) also suggest that overweighting on well performance of stocks leads to superior performance of mutual funds.

For the UK funds, Fletcher (1995) reveals selectivity skill of 101 equity unit trusts in year 1980 to 1989 using multifactor model. Additionally, Cuthbertson et al. (2008) find strong evidence of stock picking skill only for top ranked equity funds.

2.2 Timing Skill

Many studies in the U.S. support zero or significantly negative timing ability. The following literatures use return-based measure to explore market timing and find no evidence of market timing ability. Treynor and Mazuy (1966) (henceforth "TM") and Henriksson and Merton (1981) (henceforth "HM") run non-linear regressions of fund returns and market returns and conclude that funds cannot time the market. Ferson and Schadt (1996) create the conditional market timing model by conditioning on beta in order to distinguish related-return variables from the timing variable and find that funds do not have market timing skill. Becker et al. (1999) also use this conditional beta model and insist that market timing ability does not exist. Angelidis et al. (2013) suggest to use self-reported benchmark instead of passive benchmark that have similar risk characteristic in order to correct the skill measure and come to the conclusion that the timing skill insignificantly contributes return to fund performance. Nonetheless, some papers use TM and HM time series regression models with high frequency data such as daily returns and find timing skill (Bollen and Busse 2001)) and short term persistence of market timing (Bollen and Busse 2005)).

A measure of timing skill by using portfolio returns can lead to a dynamic effect and a downward bias. The dynamic effect explained by Jagannathan and Korajczyk (1986) is that

dynamic trading of mutual funds can cause the non-linear relation between fund returns and market returns. The downward bias occurs when the frequency of timing measure less than the frequency of funds' real timing strategy (Goetzmann et al. (2000)). The dynamic effect and the downward bias can be eliminated by using holdings data with high frequency to measure market timing skill.

The following literatures investigate timing skill in the U.S. by using holding-based measure. Daniel et al. (1997) create characteristics-timing measure (henceforth "CT") and find timing ability of funds. Sensoy and Kaplan (2007) also confirm positive market timing skill. Jiang et al. (2007) measure timing skill by using beta of portfolio calculated from holding data and find that U.S. domestic equity funds have market timing ability. Mamaysky et al. (2008) state that funds with high level of market timing skill can generate higher returns than funds with low level of market timing skill. Nevertheless, Elton et al. (2012) find no timing skill with concerning that not only market factor, but also other factors such as size can change portfolio's beta.

For the UK fund industry, the following studies support non-existent timing skill. Fletcher (1995) uses the test of Chen and Stockum (1986), which is similar to TM test, together with HM test for unit trust in 1980-1989 and finds significantly negative timing skill. Leger (1997) also shows the same result for 72 equity close-ended trusts in 1974-1993 by using single factor model. Byrne et al. (2006) apply regression (parametric) approach for both individual fund and aggregate funds and cannot discover the positive value for conditional market timing. Cuthbertson et al. (2010) provide the same evidence of no market timing for 675 equity funds in 1975-2002 even though they use both parametric and non-parametric approaches.

2.3 Performance and Sources of Skills Relating to the Business Cycle

There are literatures exploring the relation between the business cycle and performance of U.S. mutual funds, such as Ferson and Schadt (1996), Christopherson et al. (1998), and Kosowski (2011). Moskowitz (2000) finds that in recessions, active fund performance is better

than the performance in expansions. This finding is consistent with Glode (2011). Glode discovers superior performance of active funds in recessions and further gives an explanation that it is because the highest level of marginal utility of investor during that time. De Souza and Lynch (2012) apply style of mutual fund and GMM technique, Generalized Method of Moments, and explore cycle in performance.

For the relation between the business cycle and sources of skills, Kacperczyk et al. (2016) argue that skill originates from the ability of adjusting portfolio in consistence with micro and macro fundamental information and they explore time-varying skill in the business cycle. Additionally, in 2014, they investigate further on each source of skill and find that funds use timing skill in recessions and use picking skill in expansions and they also point that timing skill can be found only in recession periods (Kacperczyk et al. (2014)). Vidal et al. (2015) agree on that point by giving condition on state of the business cycle before finding timing ability and they find market timing in recessions for 35 countries around the world by using daily returns.

To summarize, the variation in using skills over the business cycle of U.S. mutual funds: picking skill in expansions and timing skill in recessions, is the recent finding about skill using holdings data in the U.S. In the UK, although there is the evidence of using timing skill in recessions by employing return-based measure, there is still a lack of the study using holding-based measure to find both stock picking skill and market timing skill and their variations over the business cycle for UK mutual funds. This thesis fills this gap and is also the stress test and external validity test for Kacperczyk et al. (2014) by testing time-varying skill through crisis using holdings data for the UK mutual funds.

CHAPTER III

DATA AND METHODOLOGY

This chapter starts with a discussion of hypothesis development. Then, it is followed by subchapter that provides the detail about data and sample selection. The third subchapter indicates definitions and measures of picking skill and timing skill. The Last subchapter is the detail about methodology that used to test hypotheses of this study.

3.1 Hypothesis Development

There is the evidence of the variation in using picking skill in expansions and market timing skill in recessions of U.S. mutual funds (Kacperczyk et al. (2014)). Additionally, there is the evidence of positive relation between timing skill and recessions of UK mutual funds (Vidal et al. (2015)). As a result, if this study test the variation of timing skill and picking skill over the business cycle for UK mutual funds, the results should be expected that timing skill has positive relation with recessions and picking skill has negative relation with recessions as the finding of previous studies. Funds should have picking skill in expansions more than in recessions because every stock seems to be excellent stocks in such a good period. So, funds necessarily select the truly excellent stocks which their excellences come from firm-specific factors and not come from market factors. In addition, funds should have timing skill in recessions more than in expansions because in recessions, market risk is high and macro factor affecting market return dominate micro factor affecting individual stock return. The contribution of this test is the knowledge about behavior of exhibiting both picking skill and timing skill with the business cycle of the UK mutual funds. Furthermore, this test also help prior literatures to decrease a snooping bias by using non-U.S. data and testing in different business cycle periods. The reason is that there is the evidence of lower co-movement between the UK and the U.S. economies after 1999 due to the introduction of Economic and Monetary Union (Komaki and Nobuo 2008)). Over all, the first hypothesis is as follow:

Hypothesis 1: Timing skill has positive relation with recessions, while picking skill has negative relation with recessions.

In the U.S., there is a small group of active funds who can beat passive funds measured by using returns data (Fama and French 2010)). In addition, there is the top group of active funds who have better picking skill in expansions and also have better timing skill in recessions measured by using holdings data (Kacperczyk et al. (2014)). This top skilled group uses switching strategy for varying both skills over the business cycle and earns higher returns than other funds. In the UK, a small group of active funds who outperform index funds also exists when testing on funds' returns (Cuthbertson et al. (2008)). Cuthbertson et al. (2008) also suggest that UK equity investors should invest in index funds because only 5% to 10% of top ranked UK equity mutual funds have stock picking skill. Therefore, it is important to further testing the variation in using skill over the business cycle for the top skilled group of UK funds. According to Kacperczyk et al. (2014), this top skilled group can be identified as top ranked picking skill of funds in expansions or top ranked timing skill of funds in recessions. If results of U.S. mutual funds hold for UK mutual funds, which is top skilled funds can provide more returns than other funds, UK investors should invest only in this top skilled funds. Thus, the second hypothesis can be defined as

Hypothesis 2: Top picking skilled funds in expansions, who have the highest 25^{th} percentile of the fraction of observation months in expansions that have picking skill in the group of the highest 25^{th} percentile of the overall picking skill return distribution, have better timing skill in recessions and have better performance than other funds.

The disappearance of persistent performance of UK funds from 2008 to 2011 (Xydias 2012)) indicates the impact of global financial crisis during 2007 to 2008 on the UK fund performance and skill. This study shows that performance persistence's result in a crisis period differs from results in pre and post-crisis periods. The difference in performance persistence leads this thesis to test the impact of severe recessions on skills of funds. According to the

finding of Vidal et al. (2015), which is timing skill has positive relation with recessions for UK mutual fund, this study examines whether funds on average use timing skill in the great recession period more than they use in general recession periods. There are two contributions of this test. First, we can observe funds' behavior during crisis by investigating their particular exercising of skill in this period. Second, we can use this information to make a decision of investing in active mutual funds for the next time when we face the great recessions again. Therefore, the third hypothesis to be tested is that:

Hypothesis 3: Funds have timing skill in the great recession period, the second quarter of 2008 to the third quarter of 2009, more than they have that skill in other recession periods.

3.2 Data and Sample Selection

This study investigates 295 domestic open-end equity mutual funds excluding index and sector funds in the UK. Monthly portfolio holdings data during January 2005 to December 2013 are available in Morningstar Direct Program database. The benefit of using Morningstar as a source of this data is that this program is free from survivorship bias because the program can show both dead and survivor funds. The criteria for mutual funds' samples are as follows. First, in the open-end fund universe, the UK is selected to be domicile and region of sale to eliminate the offshore funds. Next, the UK equities are chosen for global broad category group and for Morningstar category, respectively. After that, eliminate 117 index funds and sector funds[4]in order to get 1,820 active strategy funds including 1,552 Open-ended Investment companies and 268 Unit trusts. A next step is to pool fund families which have the same fund ID and remove merged funds and funds which were renamed in order to get only one observation fund for the same portfolio holdings data to avoid double counting. Furthermore, drop the funds lacking data and having equity proportion less than 80% in current quarter. To prevent incubation bias, the observation months that appear before reported starting year of the

[4] Fund name do not include "Sector", "Tracking", "Idx tracking", "Tracker", "100 index", "250 index", "All Share Index", "IdxTrke", "Vanguard Idx"

fund and funds that have number of stocks in their portfolio less than 10 stocks is eliminated. Finally, there are 295 funds as the sample of this study which can be separated into 11,743 observation months.

This thesis uses monthly interval for portfolio holdings data of domestic open-end equity mutual funds in the UK in order to reduce the problem of using quarterly data regarding the finding of Elton et al. (2010). They state that 18.5% of trade will disappear if we use quarterly frequency instead of monthly frequency. Historical monthly total returns of funds and other characteristics, namely total net asset, age, expense ratio, and turnover ratio are received from Morningstar program. Datastream program is the source of market returns, stock returns, book value, and market capitalization of stocks. Finally, OECD based recession Indicators[5] is used to identify recession and expansion months. Therefore, from the period of 2005 to 2013, there are 60 months for expansion periods and 48 months for recession periods including 18 months for great recession periods.

3.3 Definitions and Measures of Skills

Picking skill means the ability of fund to pick undervalued stocks. Fund with picking skill will overweight stocks of which future returns is about to increase and underweight stocks of which future returns is about to decrease. Timing skill means the ability of fund to time market movement. Fund with timing skill is going to overweight high beta stocks before a market return increases and underweight high beta stocks before the market return decreases. This thesis follows the skills' measure of Kacperczyk et al. (2014), which separate performance of business returns and performance of overall market returns. Therefore, picking skill return, *Picking*, is measured by calculating the product of portfolio weights deviating from market weights and unsystematic returns of stocks held in portfolio. Timing skill return, *Timing*, is measured by calculating the product of portfolio weights deviating from market weights and systematic returns of holdings stocks. In other words, hypothetical picking skill returns will be

[5] https://research.stlouisfed.org/fred2/series/GBRRECDM/

based on unsystematic returns portion,$(R_{t+1}^{i} - \beta_{i,t}R_{t+1}^{m})$ and hypothetical timing skill returns will be based on systematic returns portion of return on stock i, $(\beta_{i,t}R_{t+1}^{m})$

$$Picking_t^j = \sum_{i=1}^{N^j}(w_{i,t}^j - w_{i,t}^m)(R_{t+1}^i - \beta_{i,t}R_{t+1}^m) \quad (1)$$

$$Timing_t^j = \sum_{i=1}^{N^j}(w_{i,t}^j - w_{i,t}^m)(\beta_{i,t}R_{t+1}^m) \quad (2)$$

Where:

- $Picking_t^j$ is picking skill return of fund j at time t
- $Timing_t^j$ is timing skill return of fund j at time t
- $w_{i,t}^j$ is weight of stock i in fund j at time t
- $w_{i,t}^m$ is market weight of stock i in fund j at time t
- β_i is the sensitivity of the stock i's return to the market returns getting from running the rolling-window regression on single index model between month t and 12 months prior
- R_{t+1}^i is the stock i's returns from time t to time t+1
- R_{t+1}^m is the market return of the next period

To find skills' returns, $Picking_t^j$ and $Timing_t^j$, using holdings data, each stock's name in holdings data recorded by Morningstar program need to be matched to the stock's name recorded by Datastream program. The problem is that it is quite difficult to do so and require a lot of programing skill because the stock data from both sources are not perfect and not ready to be used. For example, the stocks' names in holding data from Morningstar is recorded in different characteristics even in the same stock, so the matching process faces with a ton of redundant holding stock and cannot be match to stocks' names in Datastream. Although ticker can be used to match, there is just some holding stocks having ticker. Besides, the matching process have to deal with stock that changes its name or changes its ticker several times in the past. There is no updated name for historical holdings data in Morningstar, whereas there

always be updated name with only one time tracking changed name in Datastream program. Moreover, the UK stock database from Datastream also need to be cleaned and require many processes in retrieving, filtering, checking and adjusting in order to get suitable historical UK stock database.

3.4 Methodology

3.4.1 Testing the Relation between the Business Cycle and Skills

The first hypothesis is that timing skill has positive relation with recessions, while picking skill has negative relation with recessions. To test this hypothesis, following regressions are calculated:

$$Picking_t^j = a_0 + a_1 Recession_t + a_2 Log(Age)_t^j + a_3 Log(TNA)_t^j + a_4 ExpRatio_t^j + a_5 TurnRatio_t^j + a_6 Flow_t^j + a_7 Size_t^j + a_8 Value_t^j + a_9 Momentum_t^j + \varepsilon_t^j \quad (3)$$

$$Timing_t^j = b_0 + b_1 Recession_t + b_2 \text{Log(Age)}_t^j + b_3 Log(TNA)_t^j + b_4 ExpRatio_t^j + b_5 TurnRatio_t^j + b_6 Flow_t^j + b_7 Size_t^j + b_8 Value_t^j + b_9 Momentum_t^j + \varepsilon_t^j \quad (4)$$

Where:

- $Picking_t^j$ and $Timing_t^j$ are picking skill return and timing skill return of fund j at time t calculated from equation (1) and (2), respectively.
- $Recession_t$ is explanatory variable, which equals to 1 for every month that specify in recession periods due to OECD indicator and 0 otherwise.
- $Log(Age)_t^j$ is the natural logarithm of fund j's age in year at time t.
- $Log(TNA)_t^j$ is the natural logarithm of total net asset of fund j at time t.
- $ExpRatio_t^j$ is expense ratio (% per year) of fund j at time t.
- $TurnRatio_t^j$ is turnover ratio (% per year) of fund j at time t.

- $Flow_t^j$ is percentage of growth in fund's new money.
- $Size_t^j$ is size style of fund which is value-weighted score of stock holdings' quintile score ranked by market capitalization of fund j (1 for smallest and 5 for largest).
- $Value_t^j$ is value style of fund which is value-weighted score of stock holdings' quintile score ranked by book-to-market ratio of fund j (1 for lowest and 5 for highest)
- $Momentum_t^j$ is momentum style of fund which is value-weighted score of stock holdings' quintile score ranked by stocks' past 12-month return of fund j (1 for lowest and 5 for highest)

Follow Kacperczyk et al. (2014), flow (*Flow)* and turnover ratio (*TurnRatio*) are winsorized at the 1% level to reduce the impact of outliers, all variables are demeaned and pooled regressions are run on equations (3) and (4) with clustering standard error by fund and time. All control variables are demeaned to interpret constant as the return of skill in expansions and slope as the difference in the return of skill in recessions. Pooled regression is used with clustering standard error by fund and time because the error term may have linear correlation within funds and time. As discussed in the study of Kacperczyk et al. (2014), the correlation can arise from the constant value of the recession variables of all fund observations in a given time as discussion in the.

Testing the Sensitivity of Skills to the Business Cycle

Testing the sensitivity of timing skill and picking skill in several levels to the business cycle is the further testing of the first hypothesis. Evidences of the outperformance of a small group of active funds (Cuthbertson et al. (2008)) and higher sensitivity to the business cycle of skills in higher level in the U.S. fund industry (Kacperczyk et al. (2014)) lead to examine whether in the UK fund industry, skills in higher level are more sensitive to recessions than skills in lower level. Quantile regressions are run on equation (3) and (4) at different quantile of skill distribution including 25th quantile, 50th quantile, 75th quantile, and 95th

quantile. Standard errors are calculated by using block bootstrapping with 1,000 repetitions to have independent error and differently distributed error.

3.4.2 Testing Skills and Performance of Top Picking Skilled Funds

3.4.2.1 Testing Timing Skill and Picking Skill of Top Picking Skilled Funds

There is the evidence in the U.S. showing that top picking skilled funds in expansions are the same funds having higher timing skill in recessions than other funds (Kacperczyk et al. (2014)). Thus, this thesis basically assumes the same result for the UK and has the second hypothesis stating that top picking skilled funds in expansions, who have the highest 25th percentile of the fraction of observation months in expansions that have picking skill in the group of the highest 25th percentile of the overall picking skill return distribution, have better timing skill in expansions than other funds. To test this prediction, pooled regressions are run with adding *Top* as a dummy variable for top picking skilled funds.

To form the group of top picking skill return, first, all funds' observation months are separated into recession months' subsample and expansion months' subsample. In expansion months' subsample, picking skill returns are ranked and top 25th percentile of the overall picking skill return distribution are chosen as the group of top picking skill return. To get top picking skilled funds, the number of observation months for each fund appearing in that group are counted and are calculated in the percentage of total observation months in expansions of each fund[6], which can be call fraction of top month. Then top picking skilled funds in expansions are assigned to funds which are in the top quantile of this fraction ranking.

Finally, flow (*Flow*) and turnover ratio (*TurnRatio)* are winsorized at the 1% level, all control variables are demeaned and pooled regressions are run on model (7) with

[6] The formula for the fraction calculation can be defined as:

$$\frac{Number\ of\ observation\ months\ of\ fund\ i\ that\ are\ in\ the\ highest\ 25th\ percentile\ of\ overall\ picking\ skill\ return\ distribution}{Total\ observation\ months\ in\ expansions\ of\ fund\ i}$$

clustering standard error by fund and time for each subsample months, recessions and expansions.

$$Ability_t^j = c_0 + c_1 Top_t^j + c_2 \text{Log(Age)}_t^j + c_3 Log(TNA)_t^j + c_4 ExRatio_t^j + c_5 TurnRatio_t^j + c_6 Flow_t^j + c_7 Size_t^j + c_8 Value_t^j + c_9 Momentum_t^j + \varepsilon_t^j \quad (5)$$

Where:

- Top_t^j equals to 1 if fund j is the top picking skilled fund and 0 otherwise.
- $Ability_t^j$ is the picking skill return or timing skill return.

3.4.2.2 Testing Performance of Top Picking Skilled Funds

This section investigates the last part of the second hypothesis stating that top picking skilled funds in expansions, who have the highest 25th percentile of the fraction of observation months in expansions that have picking skill in the group of the highest 25th percentile of the overall picking skill return distribution, have better performance than other funds. To test this assumption, the dependent variables are changed from picking skill or timing skill returns to excess returns of funds. Excess returns or alphas are calculated from 12-month rolling-window regression on various models, namely CAPM, three-factor, and four-factor models as shown in equation (6), (7), and (8), respectively. Alphas are calculated from various models to check whether top picking skilled funds can generate excess returns regardless of risk-adjusted model. Then, flow (*Flow*) and turnover ratio (*TurnRatio)* are winsorized at the 1% level, all control variables are demeaned and pooled regressions are run on model (9) with clustering standard error by fund and time.

$$R_{it} - R_{ft} = \alpha_i + b_i(R_{Mt} - R_{ft}) + e_{it} \quad (6)$$

$$R_{it} - R_{ft} = \alpha_i + b_i(R_{Mt} - R_{ft}) + s_i SMB_t + h_i HML_t + e_{it} \quad (7)$$

$$R_{it} - R_{ft} = \alpha_i + b_i(R_{Mt} - R_{ft}) + s_i SMB_t + h_i HML_t + m_i MOM_t + e_{it} \quad (8)$$

Where:

- R_{Mt} is market return at time t which is FT All Share TR Index.
- R_{ft} is risk free rate at time t which is 1- month UK T-bill rate.
- SMB_t is size factor calculated from the formula: $TRI^{HGSC}_{month\ t}$ - $TRI^{FT}_{month\ t}$
- HML_t is value factor calculated from the formula:

  $TRI^{MSCI\ UK\ Value}_{month\ t}$ -$TRI^{MSCI\ UK\ Growth}_{month\ t}$
- MOM_t is momentum factor.

$$\alpha_t^j = d_0 + d_1 Top_t^j + d_2 \text{Log(Age)}_t^j + d_3 Log(TNA)_t^j + d_4 ExpRatio_t^j + d_5 TurnRatio_t^j + d_6 Flow_t^j + d_7 Size_t^j + d_8 Value_t^j + d_9 Momentum_t^j + \varepsilon_t^j \quad (9)$$

Where: α_t^j is risk-adjusted excess return calculated from CAPM, three-factor, and four-factor models.

Testing Characteristics of Top Picking Skilled Funds in the UK

Testing the characteristics of top picking skilled funds is the further testing of the second hypothesis. This section investigates whether this top picking skilled funds express the unique characteristics regardless of different country characteristics between the U.S. and the UK. Fund-level data including, age, total net asset, expense ratio, turnover ratio, flow, portfolio dispersion, stock number, and industry dispersion are used in this investigation. The first five characteristics are the same data as the previous research questions use. *Portfolio dispersion* indicates the concentration of the portfolio of fund and is calculated by using Herfindahl index[7], which is the deviation of portfolio's weight from the market portfolio's weight. *Stock number* is the number of stocks that funds hold in their portfolios. *Industry dispersion* indicates the industry concentration of fund's portfolio and is measured by using Herfindahl index, which is the deviation of portfolio weights in a given industry from the market portfolio's weights. These characteristics are identified by using average, standard

[7]Herfindahl index = $\sum_{i=1}^{N}(w_p - w_m)^2$

deviation, and median value and are compared between top picking skilled funds and other funds

3.4.3 Testing the Relation between Skills and Crisis

This section tests the third hypothesis stating that funds have timing skill in the great recession period, the second quarter of 2008 to the third quarter of 2009, more than they have in other recession periods. To test this hypothesis, interaction term is added, *Recession*Crisis*, which equals to 1 if the observation months are in recessions and in the great recession and 0 otherwise. The great recession or crisis in the UK is in the period from the second quarter of 2008 to the third quarter of 2009[8]. Finally, flow (*Flow*) and turnover ratio (*TurnRatio)* are winsorized at the 1% level, all control variables are demeaned and pooled regressions are run on equation (10) and (11) with clustering standard error by fund and time.

$$Picking_t^j = h_0 + h_1 Recession_t + h_2 Recession_t * Crisis_t + h_3 \text{Log(Age)}_t^j + h_4 Log(TNA)_t^j + h_5 ExpRatio_t^j + h_6 TurnRatio_t^j + h_7 Flow_t^j + h_8 Size_t^j + h_9 Value_t^j + h_{10} Momentum_t^j + \varepsilon_t^j \quad (10)$$

$$Timing_t^j = k_0 + k_1 Recession_t + k_2 Recession_t * Crisis_t + k_3 \text{Log(Age)}_t^j + k_4 Log(TNA)_t^j + k_5 ExpRatio_t^j + k_6 TurnRatio_t^j + k_7 Flow_t^j + k_8 Size_t^j + k_9 Value_t^j + k_{10} Momentum_t^j + \varepsilon_t^j \quad (11)$$

Where: *Recession*Crisis* equals to 1 if the observation months are in recessions and in the great recession and 0 otherwise.

Testing the Sensitivity of Skills to Crisis

Testing the sensitivity of timing skill and picking skill in several levels to crisis is the further testing of the third hypothesis. To investigate whether skills in higher level are more sensitive to crisis than skills in lower level, equation (10) and (11) are used for quantile

[8] *Real GDP growth of the UK from Office for national statistics (ONS) (http://www.economicshelp.org/blog/7501/economics/the-great-recession/)

regressions at different quantile of skill distribution including 25th quantile, 50th quantile, 75th quantile, and 95th quantile, and block bootstrapping standard errors are calculated with 1,000 repetitions.

3.4.4 Robustness Test

Picking skill and timing skill, which are used as dependent variables, can be defined and measured in various ways. The finding of the relation between the business cycle and skills need to be the same no matter how skills are measured. The skill measures that are widely accepted are characteristic-timing (henceforth "CT") and characteristic-selectivity (henceforth "CS") of Daniel et al. (1997). Therefore, to test the robustness of the result, the dependent variables are changed to CT and CS. Moreover, according to testing performance of top picking skilled funds, the term of performance or excess return can be defined in various aspects such as performance from using public and private information, or performance from using only private information. To test the robustness of this result, performance are changed from unconditional alpha to conditional alpha and beta.

3.4.4.1 Using CT and CS as Alternative Measures of Skills

In order to test the robustness of main results, the dependent variables are changed from timing skill and picking skill measure of Kacperczyk et al. (2014) to characteristic-timing (CT) and characteristic-selectivity (CS) of Daniel et al. (1997). *Picking* and *CS* are picking skill of fund and *Timing* and *CT* are timing skill of funds which are based on different definitions. *Picking* means the ability to overweight (underweight) stock having higher (lower) business return, whereas *CS* means the ability to select stock that can outperform characteristic benchmark return. *Timing* means the ability to overweight (underweight) stock having higher return from market factor, whereas *CT* means the ability to generate higher performance by investing in stock that have higher characteristic benchmark return. Characteristic-timing (CT) and characteristic-selectivity (CS) are calculated by using equation (12) and (13). Then, flow (*Flow*) and turnover ratio (*TurnRatio)* are winsorized at the 1% level,

all control variables are demeaned. To test the relation between the business cycle and CT and CS, pooled regressions are run on equation (14) and (15) with clustering standard error by fund and time. To test the sensitivity of CT and CS to the business cycle, quantile regressions are run on equation (14) and (15) at different quantile including 25th quantile, 50th quantile, 75th quantile, and 95th quantile. Pooled regressions are run with clustering standard error by fund and time on equation (16) to find skill of top CS funds in expansions and on equation (17) to find performance of top CS, whose performance are calculated by alphas from CAPM, three-factor, and four-factor model. To test the relation between crisis and CT and CS, pooled regressions are run on equation (18) and (19) with clustering standard error by fund and time. To test the sensitivity of CT and CS to crisis, quantile regressions are run on equation (18) and (19) at different quantile including 25th quantile, 50th quantile, 75th quantile, and 95th quantile.

$$CS_t = \sum_{j=1}^{N} \widetilde{w}_{j,t-1}(\tilde{R}_{j,t} - \tilde{R}_t^{b_{j,t-1}}) \quad (12)$$

$$CT_t = \sum_{j=1}^{N} (\widetilde{w}_{j,t-1}\tilde{R}_t^{b_{j,t-1}} - \widetilde{w}_{j,t-k-1}\tilde{R}_t^{b_{j,t-k-1}}) \quad (13)$$

Where:

- $\tilde{R}_{j,t}$ is the return on stock j during period t.
- $\tilde{R}_t^{b_{j,t-k-1}}$ is the return on a benchmark portfolio during period t to which stock j was allocated during period t-k according to its size, value, and momentum characteristics.
- $\widetilde{w}_{j,t-k-1}$ is the relative weight of stock j at the end of period t-k in the fund.

$$CS_t^j = a_0 + a_1 Recession_t + a_2 X_t^j + \varepsilon_t^j \quad (14)$$

$$CT_t^j = b_0 + b_1 Recession_t + b_2 X_t^j + \varepsilon_t^j \quad (15)$$

$$Ability_t^j = c_0 + c_1 TopCS_t^j + c_2 X_t^j + \varepsilon_t^j \quad (16)$$

$$\alpha_t^j = d_0 + d_1 TopCS_t^j + d_2 X_t^j + \varepsilon_t^j \quad (17)$$

$$CS_t^j = c_0 + c_1 Recession_t + c_2 Recession_t * Crisis_t + c_3 X_t^j + \varepsilon_t^j \quad (18)$$

$$CT_t^j = d_0 + d_1 Recession_t + d_2 Recession_t * Crisis_t + d_3 X_t^j + \varepsilon_t^j \quad (19)$$

Where:

- X_t^j is a vector of fund-specific control variables including $Log(Age)$, $Log(TNA)$, $ExpRatio$, $TurnRatio$, $Flow$, $Size$, $Value$, and $Momentum$.
- α_t^j is risk-adjusted excess return calculated from CAPM, three-factor, and four-factor models.
- $TopCS_t^j$ equals to 1 if fund j is in the top skilled group and 0 otherwise.
- $Ability_t^j$ is the CS return or CT return.
- $Recession_t * Crisis_t$ equals to 1 if the observation months are in recessions and in the great recession and 0 otherwise.

3.4.4.2 Using Conditional Alpha and Beta as Alternative Performance

This section tests another measure of performance of funds which is based solely on using private information by ignoring any action on public information. Therefore, this thesis employs conditional alpha and beta models to test the robustness of the performance of top picking skilled funds in the UK. First of all, excess returns are calculated from conditional CAPM, conditional three-factor, and conditional four-factor models, which are equation (20), (21), and (22), respectively. Second, flow (*Flow*) and turnover ratio (*TurnRatio)* are winsorized at the 1% level, all control variables are demeaned and pooled regressions are run on equation (23) for top picking skilled funds and on equation (24) for top characteristic-selectivity funds.

Conditional CAPM:

$$\begin{aligned} R_{jt} - R_{ft} = {} & a_{j0} + a_{j1} z_{1,t-1} + a_{j2} z_{2,t-1} + a_{j3} z_{3,t-1} + b_{j0}(R_{mt} - R_{ft}) + \\ & b_{j1}[z_{1,t-1}(R_{mt} - R_{ft})] + b_{j2}[z_{2,t-1}(R_{mt} - R_{ft})] + \\ & b_{j3}[z_{3,t-1}(R_{mt} - R_{ft})] + e_{jt} \end{aligned} \quad (20)$$

Conditional three-factor model:

$$R_{jt} - R_{ft} = a_{j0} + a_{j1} z_{1,t-1} + a_{j2} z_{2,t-1} + a_{j3} z_{3,t-1} +$$

$$b_{j0}(R_{mt} - R_{ft}) + b_{j1}[z_{1,t-1}(R_{mt} - R_{ft})] +$$
$$b_{j2}[z_{2,t-1}(R_{mt} - R_{ft})] + b_{j3}[z_{3,t-1}(R_{mt} - R_{ft})] +$$
$$c_{j0}(R_{SMBt}) + c_{j1}[z_{1,t-1}(R_{SMBt})] + c_{j2}[z_{2,t-1}(R_{SMBt})] +$$
$$c_{j3}[z_{3,t-1}(R_{SMBt})] + d_{j0}(R_{HMLt}) + d_{j1}[z_{1,t-1}(R_{HMLt})] +$$
$$d_{j2}[z_{2,t-1}(R_{HMLt})] + d_{j3}[z_{3,t-1}(R_{HMLt})] + e_{jt} \quad (21)$$

Conditional four-factor model:

$$R_{jt} - R_{ft} = a_{j0} + a_{j1}z_{1,t-1} + a_{j2}z_{2,t-1} + a_{j3}z_{3,t-1} +$$
$$b_{j0}(R_{mt} - R_{ft}) + b_{j1}[z_{1,t-1}(R_{mt} - R_{ft})] +$$
$$b_{j2}[z_{2,t-1}(R_{mt} - R_{ft})] + b_{j3}[z_{3,t-1}(R_{mt} - R_{ft})] +$$
$$c_{j0}(R_{SMBt}) + c_{j1}[z_{1,t-1}(R_{SMBt})] + c_{j2}[z_{2,t-1}(R_{SMBt})] +$$
$$c_{j3}[z_{3,t-1}(R_{SMBt})] + d_{j0}(R_{HMLt}) + d_{j1}[z_{1,t-1}(R_{HMLt})] +$$
$$d_{j2}[z_{2,t-1}(R_{HMLt})] + d_{j3}[z_{3,t-1}(R_{HMLt})] + f_{j0}(R_{MOMt}) +$$
$$f_{j1}[z_{1,t-1}(R_{MOMt})] + f_{j2}[z_{2,t-1}(R_{MOMt})] + f_{j3}[z_{3,t-1}(R_{MOMt})] + e_{jt} \quad (22)$$

Where:

- $z_{t-1} = Z_{t-1} - \mathrm{E}[Z_{t-1}]$
- Z_1 is one-month T-bill yield at t-1
- Z_2 is dividend yield at t-1
- Z_3 is term spread at t-1 (yield on the UK 20 years – yield on the UK three-month T-bill)

$$\alpha_t^j = g_0 + g_1 Top_t^j + g_2 X_t^j + \varepsilon_t^j \quad (23)$$

$$\alpha_t^j = g_0 + g_1 TopCS_t^j + g_2 X_t^j + \varepsilon_t^j \quad (24)$$

The next chapter is chapter IV that present the empirical results and result discussions and also shows results from robustness test.

CHAPTER IV

EMPIRICAL RESULTS

This chapter starts with the summary of descriptive statistics. The second subchapter discusses results from testing the first hypothesis. The third and the fourth subchapter discuss results from testing the second hypothesis and the third hypothesis, respectively. Results from robustness test are discussed in the last subchapter.

4.1 Descriptive Statistics

Table 1 shows summary statistics of data by using the average value. It presents the characteristics of funds in year. The number of funds keeps increasing from 11 funds in 2005 to 180 funds in 2013. The range of number of observation months is from 128 to 2155 observation months. Each fund holds stock around 66 to 76 stocks. This table also presents the mean value of dependent variables, namely picking skill return (-0.44% per month in 2008 and 0.72% per month. in 2013) and timing skill return (-1.19% per month in 2008 and 1.40% per month in 2009). Besides, there are mean values of independent variables such as total net asset growing from 178.33 to 476.21 Million Pound, expense ratio ranking from 1.27% p.a. in 2005 to 1.44% p.a. in 2008, turnover ratio trading around 25.03% to 117.69%, growth rate of new money (flow) having the lowest value around -0.4% in 2007 and 2012. Characteristics of stock holding include large size style, low book to market value style, and average momentum style. Lastly, portfolio dispersion have Herfindahl Index around 1.1% and industry dispersion have Herfindahl Index from 4.1% in 2005 to 7.5% in 2006 and 2007.

Table 1: Descriptive Statistics

This table presents summary statistics of average values presented in year from 2005 to 2013 of the data including number of funds, number of observation months and number of stock holding in each fund. Picking skill return and timing skill return, which are dependent variables, are return per month. Independent variable including total net asset of fund presented in million pound, expense ratio and turnover ratio of funds presented in percentage per year and flow or the percentage growth of fund's new money. Size, value, and momentum are the proxy of funds' style: 1 for smallest or lowest and 5 for largest or highest. Portfolio dispersion and Industry dispersion indicate concentration of portfolio and industry, respectively and they are measured by using Herfindahl index.

Mean Value of	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Number of Funds	11	36	60	103	141	134	145	170	180
Number of Observation Months	128	431	722	1234	1693	1607	1738	2035	2155
Number of Stock Holding in Each Fund	76	66	68	71	74	74	74	74	72
Picking Skill Return (% per month)	-0.37	0.21	-0.30	-0.44	0.18	0.48	0.06	0.35	0.72
Timing Skill Return (% per month)	1.29	0.74	-0.18	-1.19	1.40	0.65	-0.09	0.67	0.52
Total Net Asset (Million Pound)	178.33	189.95	208.85	252.17	266.33	324.49	334.02	372.60	476.21
Expense Ratio (% per year)	1.27	1.36	1.35	1.44	1.42	1.38	1.37	1.33	1.29
Turnover Ratio (% per year)	117.69	18.88	35.29	32.93	25.16	46.63	25.03	30.24	44.14
Flow (%)	1.81	0.17	-0.41	0.19	-0.07	-0.10	-0.02	-0.42	0.69
Size Style	3.6	4.4	4.4	4.2	4.3	4.3	4.2	4.2	4.2
Value Style	1.2	1.4	1.5	1.5	1.5	1.4	1.5	1.5	1.6
Momentum Style	2.7	3.4	3.2	3.4	3.4	3.0	3.1	3.3	3.2
Portfolio Dispersion (%)	0.5	1.1	1.1	1.1	1.1	1.1	1.2	1.3	1.1
Industry Dispersion (%)	4.1	7.5	7.5	7.0	6.5	6.5	5.9	6.1	5.9

4.2 The Relation between the Business Cycle and Skills

Table 2 indicates that funds significantly have timing skill and picking skill in recessions less than in expansions by 0.41% and 0.55% per month, respectively. The strongly negative relations between both skills of funds and recessions fail to reject the null hypothesis of timing skill test, stating that timing skill has negative relation with recessions. However, they reject the null hypothesis of picking skill test, stating that picking skill has positive relation with recessions. These findings also mean that UK funds do not vary their uses of skills with the business cycle like the U.S. funds. Therefore, the previous study of Kacperczyk et al. (2014), showing the variation that funds have more timing skill in recessions and have more picking skill in expansions, does not exist in the UK and Skill Index that they create to identify skilled funds cannot be directly used in the UK. Besides, the result of negative relation between timing skill and recessions is inconsistent with the finding of Vidal et al. (2015) that they show positive relation between timing skill and recessions of UK mutual funds.

There are different results of timing skill. This thesis finds that UK funds have lower timing skill in recessions, whereas Kacperczyk et al. (2014) find that U.S. funds have higher timing skill in recessions than they have in expansions. Besides, timing skill in recessions of UK funds economically decrease. The possible explanation for the different result would be that not only skills are tested in different time period, but also skills of UK funds are testing through crisis.

Table 2: Timing and Picking Skills with the Business Cycle

This table presents the effects of the business cycle on timing and picking skill. *Picking* and *Timing* are explained variable calculated from equation (1) and (2) by using 12-month rolling window beta. *Recession* is dummy variables which equal to 1 for every month that specify in recession periods and 0 otherwise. *Log(Age)* is age in year of fund in term of natural logarithm. *Log(TNA)* is total net asset of fund in term of natural logarithm. *ExpRatio* is expense ratio (% per year) of fund. *TurnRatio* is turnover ratio (% per year) of fund. *Flow* is growth rate of fund's new money. *Size*, *Value*, and *Momentum* variables are the proxy of funds' style with the 3 dimensions depended on the average scores of holding stock in fund's portfolio in that month and sorted into quintile along each characteristics (1 for smallest or lowest and 5 for largest or highest). *Flow* and *Turnover* are winsorized at the 1% level, all control variables are demeaned and pooled regressions are run on equation (3) and (4) with clustering standard deviation by fund and time. The standard errors are given in parenthesis. ***, **, * indicate statistical significant at 1%, 5%, and 10%, respectively.

Independent Variables	Timing	Timing	Picking	Picking
Recession	-0.0041 ***	-0.0044 ***	-0.0055 ***	-0.0046 ***
	(0.0005)	(0.0004)	(0.0004)	(0.0003)
log(Age)	0.0003 *		0.0003 *	
	(0.0002)		(0.0002)	
log(TNA)	-0.0005 ***		0.0000	
	(0.0001)		(0.0001)	
ExpRatio	0.0201		0.0066	
	(0.0277)		(0.0515)	
TurnRatio	-0.0004 ***		-0.0003	
	(0.0001)		(0.0002)	
Flow	0.0066 **		0.0007	
	(0.0029)		(0.0019)	
Size	0.0039 ***		-0.0028 ***	
	(0.0010)		(0.0007)	
Value	0.0053 ***		-0.0003	
	(0.0007)		(0.0006)	
Momentum	-0.0017 *		0.0048 ***	
	(0.0009)		(0.0006)	
Constant	-0.0059	0.0053 ***	0.0005	0.0039
	(0.0056)	(0.0002)	(0.0033)	(0.0002)
Observations	11743	11743	11743	11743

Testing the Sensitivity of Skills to the Business Cycle

Panel A of Table 3 shows that timing skill returns in 95th percentile are more sensitive to recessions than timing skill return in 50th percentile by about 5 times. In Panel B of Table 3, picking skill returns in 95th percentile are a little bit lower sensitive to recessions than in 50th percentile. Therefore, only higher timing skill returns are more sensitive to recessions than lower timing skill returns. The finding of higher sensitivity of top timing skill return to the business cycle in the UK is consistent with the result in the U.S., which is the finding of Kacperczyk et al. (2014). However, the evidence of higher sensitivity of top picking skill return on the business cycle in the U.S. is not exist in the UK fund industry.

Moreover, the directions of the relation between the business cycle and skill returns in 95th percentile and in 50th percentile are different. Timing skill return in 95th percentile are significantly higher in recessions than in expansions, whereas timing skill return in 50th percentile are significantly lower in recessions than in expansions, 1.42% versus -0.07% return per month. Besides, picking skill return in 95th percentile are significantly higher in recessions than in expansions, whereas picking skill return in 50th percentile are significantly lower in recessions than in expansions, 0.28% versus -0.30% return per month. To summarize, in 95th percentile, timing and picking skill returns are significantly higher in recessions than in expansions, whereas in 50th percentile, timing and picking skill returns are significantly lower in recessions than in expansions.

Table 3: The Sensitivity of Timing Skill and Picking Skill to the Business Cycle

This table presents the effects of the business cycle on timing skill and picking skill in different level. *Picking* and *Timing* are explained variable calculated from equation (1) and (2) by using 12-month rolling window beta. *Recession* is dummy variables which equal to 1 for every month that specify in recession periods and 0 otherwise. *Log(Age)* is age in year of fund in term of natural logarithm. *Log(TNA)* is total net asset of fund in term of natural logarithm. *ExpRatio* is expense ratio (% per year) of fund. *TurnRatio* is turnover ratio (% per year) of fund. *Flow* is growth rate of fund's new money. *Size*, *Value*, and *Momentum* variables are the proxy of funds' style with the 3 dimensions depended on the average scores of holding stock in fund's portfolio in that month and sorted into quintile along each characteristics (1 for smallest or lowest and 5 for largest or highest). *Flow* and *Turnover* are winsorized at the 1% level. Quantile regressions estimated by using model (3) and (4) with block bootstrapping of standard error. The standard errors are given in parenthesis. ***, **, * indicate statistical significant at 1%, 5%, and 10%, respectively.

Panel A: Timing Skill				
	Q25	Q50	Q75	Q95
Recession	-0.0101 ***	-0.0027 ***	0.0055 ***	0.0142 ***
	(0.0009)	(0.0004)	(0.0006)	(0.0013)
log(Age)	0.0008	0.0007	-0.0006	-0.0036
	(0.0005)	(0.0004)	(0.0006)	(0.0013)
log(TNA)	-0.0004	-0.0010 ***	-0.0013 **	-0.0016
	(0.0002)	(0.0002)	(0.0003)	(0.0006)
ExpRatio	-0.0860	-0.0156	0.1639	0.4146 *
	(0.0333)	(0.0266)	(0.0432)	(0.1119)
TurnRatio	0.0000	-0.0004 ***	-0.0005	-0.0011
	(0.0002)	(0.0001)	(0.0003)	(0.0003)
Flow	0.0044	0.0030	0.0011	0.0097
	(0.0029)	(0.0024)	(0.0028)	(0.0051)
Size	0.0001	-0.0009	0.0041 ***	-0.0008
	(0.0005)	(0.0008)	(0.0007)	(0.0013)
Value	-0.0017 *	0.0028 ***	0.0127 ***	0.0294 ***
	(0.0006)	(0.0006)	(0.0008)	(0.0016)
Momentum	-0.0006	0.0027 ***	-0.0030 ***	-0.0008
	(0.0008)	(0.0009)	(0.0008)	(0.0015)
Constant	0.0032	0.0028	-0.0026	0.0110
	(0.0024)	(0.0029)	(0.0036)	(0.0073)
Observations	11743	11743	11743	11743

Table 3 (continued)

Panel B: Picking Skill				
	Q25	Q50	Q75	Q95
Recession	-0.0071 ***	-0.0030 ***	-0.0011 **	0.0028 **
	(0.0005)	(0.0003)	(0.0003)	(0.0008)
log(Age)	0.0011 *	0.0007 *	-0.0006	-0.0024 *
	(0.0004)	(0.0003)	(0.0005)	(0.0010)
log(TNA)	0.0004	0.0001	-0.0003	-0.0006
	(0.0002)	(0.0002)	(0.0002)	(0.0005)
ExpRatio	-0.0896	0.0066	0.1388 **	0.2882 ***
	(0.0592)	(0.0283)	(0.0403)	(0.0688)
TurnRatio	0.0000	0.0000	-0.0003	-0.0005
	(0.0003)	(0.0001)	(0.0002)	(0.0004)
Flow	-0.0011	-0.0009	-0.0004	-0.0017
	(0.0020)	(0.0016)	(0.0028)	(0.0036)
Size	-0.0004	-0.0028 ***	-0.0048 ***	-0.0081 ***
	(0.0009)	(0.0006)	(0.0006)	(0.0012)
Value	-0.0069 ***	0.0016 **	0.0091 ***	0.0199 ***
	(0.0008)	(0.0006)	(0.0006)	(0.0012)
Momentum	0.0045 ***	0.0047 ***	0.0040 ***	0.0029 **
	(0.0006)	(0.0005)	(0.0007)	(0.0011)
Constant	-0.0092 *	-0.0031	0.0063	0.0233 ***
	(0.0043)	(0.0029)	(0.0032)	(0.0062)
Observations	11743	11743	11743	11743

4.3 Skills and Performance of Top Picking Skilled Funds

4.3.1 Timing Skill and Picking Skill of Top Picking Skilled Funds

In this study, top picking skilled funds in expansions are funds that have the highest 25th percentile of the fraction of observation months in expansions that have picking skill in the group of the highest 25th percentile of the overall picking skill return distribution. Table 4 shows that top picking skilled funds significantly have higher picking return in expansions than other funds by 0.55% per month or 3.6% per year. This result confirm the definition and the construction of top picking skilled funds in expansions of this study. Moreover, they also significantly have higher picking skill in recessions than other funds by 0.32% per month. Besides, top picking skilled funds have higher timing skill in recessions but lower timing skill in expansions than other funds by 0.08% and 0.01% per month, respectively. These results can be inferred that top picking skilled funds significantly pick stock well not only in expansions but also in recessions and they can time the market well in recessions. Therefore, these findings confirm the first part of the second hypothesis stating that top picking skilled in expansions also have better timing skilled in recessions than other funds.

Moreover, according to the result from Table 2 concluding that the UK funds have timing skill and picking skill in expansions more than in recessions, the additional hypothesis to be tested is that top picking skilled funds in expansions also have higher timing skill in expansions than other funds. However, the result of a little lower timing skill in expansions than others by 0.01% per month from table 4 do not support this additional hypothesis.

Furthermore, the result showing that top picking skilled funds in expansions also has better picking skill and timing skill in recessions than other funds supports the study of Cuthbertson et al. (2008), stating that only 5% to 10% of top ranked UK equity mutual funds have stock picking skill. This thesis also adds more evidence of top skilled fund in the UK by discovering that they have better picking skill in both expansions and recessions and better timing skill in recessions than other funds.

Table 4: Top Picking Skilled Funds with the Business Cycle

This table presents the relation between the business cycle and skills of top picking skilled funds. *Top* is a dummy variable for a superior group of skilled funds whose picking skill in expansions is in the highest 25th percentile of the picking skill distribution. *Log(Age)* is age in year of fund in term of natural logarithm. *Log(TNA)* is total net asset of fund in term of natural logarithm. *ExpRatio* is expense ratio (% per year) of fund. *TurnRatio* is turnover ratio (% per year) of fund. *Flow* is growth rate of fund's new money. *Size*, *Value*, and *Momentum* variables are the proxy of funds' style with the 3 dimensions depended on the average scores of holding stock in fund's portfolio in that month and sorted into quintile along each characteristics (1 for smallest or lowest and 5 for largest or highest). *Flow* and *Turnover* are winsorized at the 1% level, all control variables are demeaned and pooled regressions are run on model (5) with standard error clustering by fund and time for each subsample months; expansion subsample and recession subsample. The standard errors are given in parenthesis. ***, **, * indicate statistical significant at 1%, 5%, and 10%, respectively.

	Timing		Picking	
	Expansion	Recession	Expansion	Recession
Top	-0.0001	0.0008	0.0055 ***	0.0032 ***
	(0.0008)	(0.0018)	(0.0009)	(0.0011)
log(Age)	0.0001	0.0008 *	0.0002	0.0006 **
	(0.0002)	(0.0005)	(0.0002)	(0.0003)
log(TNA)	-0.0004 ***	-0.0008 ***	0.0000	-0.0001
	(0.0001)	(0.0002)	(0.0001)	(0.0001)
ExpRatio	0.0007	0.1251	0.0118	0.0107
	(0.0438)	(0.0775)	(0.0358)	(0.0712)
TurnRatio	-0.0003 *	-0.0015	-0.0002	-0.0011
	(0.0002)	(0.0011)	(0.0002)	(0.0008)
Flow	0.0030	0.0146 *	-0.0005	-0.0026
	(0.0029)	(0.0080)	(0.0019)	(0.0037)
Size	-0.0032 ***	0.0159 ***	-0.0021 **	0.0003
	(0.0008)	(0.0019)	(0.0008)	(0.0009)
Value	0.0010	0.0074 ***	-0.0013	-0.0036 ***
	(0.0008)	(0.0016)	(0.0009)	(0.0010)
Momentum	0.0057 ***	-0.0154 ***	0.0043 ***	0.0019 *
	(0.0008)	(0.0020)	(0.0006)	(0.0010)
Constant	0.0059 *	-0.0160 ***	0.0001	-0.0039
	(0.0035)	(0.0060)	(0.0031)	(0.0038)
Observations	7842	3901	7842	3901

4.3.2 Performance of Top Picking Skilled Funds

Table 5 presents that top picking skilled funds have a little higher excess returns, alpha, than other funds by 0.02% per month or 0.24% per year using CAPM model. However, top picking skilled funds have a little lower excess returns than other funds by 0.36% per year using three-factor model and 0.48% per year using four-factor model. All results are not statistically significant. Therefore, top picking skilled funds outperform other funds only in using CAPM model, whereas they underperform other funds regarding to three-factor and four-factor models.

In addition, by given that top picking skilled funds exhibit significantly better picking skill in both expansions and recessions periods and better timing skills in recessions than the other funds as the finding from Table 4, the result of higher alpha of top picking skilled funds from CAPM model tell us that good picking skill in expansions, good picking and timing skills in recessions of top picking skilled can beat poor timing skill in expansions. However, poor timing skill in expansions of top picking skilled funds can destroy good picking skill in expansions and good picking and timing skills in recessions. This inference is supported by the lower excess return of top picking skilled funds from alphas of three-factor and four-factor models.

According to the result in U.S. funds of Kacperczyk et al. (2014), the outperformance of top picking skilled funds from other funds in the UK using CAPM model is consistent with result in the U.S., but the underperformance of top picking skilled funds from other funds using three-factors and four-factor model in the UK is inconsistent with the result in the U.S.

Table 5: Performance of Top Picking Skilled Funds

This table presents performance of top picking skilled funds. Excess returns are calculated from CAPM model, three-factor model, and four-factor model by using equation (6), (7), and (8), respectively. *Top* is a dummy variable for a superior group of skilled funds whose picking skill in expansions is in the highest 25th percentile of the picking skill distribution. *Log(Age)* is age in year of fund in term of natural logarithm. *Log(TNA)* is total net asset of fund in term of natural logarithm. *ExpRatio* is expense ratio (% per year) of fund. *TurnRatio* is turnover ratio (% per year) of fund. *Flow* is growth rate of fund's new money. *Size*, *Value*, and *Momentum* variables are the proxy of funds' style with the 3 dimensions depended on the average scores of holding stock in fund's portfolio in that month and sorted into quintile along each characteristics (1 for smallest or lowest and 5 for largest or highest). *Flow* and *Turnover* are winsorized at the 1% level, all control variables are demeaned and pooled regressions are run on equation (9) with clustering standard deviation by fund and time. The standard errors are given in parenthesis. ***, **, * indicate statistical significant at 1%, 5%, and 10%, respectively.

	CAPM	3-Factor	4-Factor
Top	0.0002	-0.0003	-0.0004
	(0.0008)	(0.0006)	(0.0006)
log(Age)	0.0002	0.0002	0.0002
	(0.0002)	(0.0002)	(0.0002)
log(TNA)	0.0002	0.0002	0.0002
	(0.0001)	(0.0001)	(0.0002)
ExpRatio	0.0079	0.0120	0.0019
	(0.0338)	(0.0344)	(0.0362)
TurnRatio	0.0003	0.0001	0.0001
	(0.0002)	(0.0001)	(0.0001)
Flow	0.0011	-0.0007	-0.0002
	(0.0014)	(0.0013)	(0.0014)
Size	0.0014 **	0.0000	-0.0003
	(0.0005)	(0.0005)	(0.0004)
Value	0.0014 **	0.0005	0.0006
	(0.0006)	(0.0005)	(0.0005)
Momentum	-0.0022 ***	-0.0001	0.0001
	(0.0007)	(0.0006)	(0.0006)
Constant	-0.0052 *	-0.0054 *	-0.0062 **
	(0.0030)	(0.0028)	(0.0032)
Observations	9682	9682	9682

Characteristics of Top Picking Skilled Funds in the UK

Table 6 shows that funds in top picking skilled group are younger by 4 years, have smaller size by 206.51 million pound, collect more expense ratio by 0.23% per year, have more turnover ratio by 0.98% per year, have more money inflow, have higher portfolio dispersion, and have less number of stocks in portfolio. These characteristics of top picking skilled funds in the UK are similar to the characteristics of top picking skilled funds in the U.S.[9] regardless of sample period. However, there is one different characteristic which is UK top picking skilled funds have lower industry dispersion or higher industry concentration than other funds, while U.S. top picking skilled funds have higher industry dispersion or lower industry concentration than other funds. Results of higher industry concentration and higher return of top picking skilled fund than other funds from this study support the finding of Kacperczyk et al. (2005) showing that active fund with more industry concentration can earn higher return from information advantaged in some industry.

[9]The characteristics of top skilled manager in the US are taken from the study of Kacperczyk et al. 2014).

Table 6: The Characteristic of Top Picking Skilled and Other Funds

This table presents characteristics of top picking skilled funds. *Top* equals to 1 if funds is in a superior group of skilled fund whose picking skill in expansions is in the highest 25th percentile of the picking skill distribution and 0 otherwise. *Age, TNA, Expense Ratio, Turnover Ratio* and *Flow* are the same as described in Table 2. *Portfolio Dispersion* is measured by using Herfindahl index of portfolio's weight in deviation from the market's weight. *Stock number* shows the number of stocks that funds have in their portfolios. *Industry Dispersion* indicates the industry concentration of fund's portfolio and is measured by using Herfindahl index of portfolio weights in a given industry in deviation from the market portfolio's weights. Top1 – Top0 is mean value of top which equals to 1 minus mean of top which equals to 0. Statistical significance of the different can see from p-value. The standard errors are given in parenthesis. ***, **, * indicate statistical significant at 1%, 5%, and 10%, respectively.

	Top = 1			Top = 0			Diff	
	Mean	Stdev.	Median	Mean	Stdev.	Median	Top1-Top0	p-value
Age (Years)	14.67	12.73	9.86	18.41	13.33	16.57	-3.74	0.0000
TNA (Mil.£)	170.48	265.17	69.49	376.99	1,186.91	87.50	-206.51	0.0000
Expense Ratio (%)	1.54	0.95	1.58	1.32	0.50	1.46	0.23	0.0000
Turnover Ratio (%)	35.63	98.50	19.92	34.64	102.39	18.13	0.98	0.6679
Flow (%)	1.23	9.16	-0.03	-0.27	7.24	-0.48	1.50	0.0000
Portfolio Dispersion (%)	1.57	0.93	1.44	1.02	0.70	0.96	0.55	0.0000
Stock Number	70.08	35.82	60.00	73.65	71.93	52.00	-3.57	0.0166
Industry Dispersion (%)	3.84	3.36	3.00	7.03	3.63	7.41	-3.19	0.0000

4.4 The Relation between Skills and Crisis

Table 7 presents that UK active funds significantly have timing skill in crisis period higher than they have in regular recession periods by 0.19% per month, but they have picking skill in crisis lower than they have in regular recession by 0.01% per month. Therefore, the third hypothesis, predicted that funds have timing skill in crisis more than they have in other recessions, is significantly failed to reject.

On the other hand, according to the result from table 2 summarizing that picking skill and timing skill has significantly negative relation with recessions, the additional hypothesis to be tested is that funds have timing skill and picking skill in great recession or crisis periods lower than they have in regular recessions. Therefore, due to significantly higher timing skill in crisis, this additional hypothesis of timing skill test is rejected.

In addition, although the persistent performance of the UK funds disappear during crisis, 2008 to 2011, as the study of Xydias (2012), this thesis shows that the UK funds have higher timing skill in crisis than regular recessions.

Table 7: Timing Skill and Picking Skill in Crisis

This table presents the relation between skills and crisis. *Recession*Crisis* equals to 1 if the observation months are in recessions and in great recession. Great recession or crisis is defined for months from April 2008 to September 2009 and 0 otherwise. *Picking* and *Timing* are explained variable calculated from equation (1) and (2) by using 12-month rolling window beta. *Recession* is explanatory variables which equal to 1 for every month that specify in recession periods and 0 otherwise. *Log(Age)* is age in year of fund in term of natural logarithm. *Log(TNA)* is total net asset of fund in term of natural logarithm. *ExpRatio* is expense ratio (% per year) of fund. *TurnRatio* is turnover ratio (% per year) of fund. *Flow* is growth rate of fund's new money. *Size*, *Value*, and *Momentum* variables are the proxy of funds' style with the 3 dimensions depended on the average scores of holding stock in fund's portfolio in that month and sorted into quintile along each characteristics (1 for smallest or lowest and 5 for largest or highest). *Flow* and *Turnover* are winsorized at the 1% level, all control variables are demeaned and pooled regressions are run on equation (10) and (11) with clustering standard deviation by fund and time. The standard errors are given in parenthesis. ***, **, * indicate statistical significant at 1%, 5%, and 10%, respectively.

	Timing	Picking
Recession	-0.0041 ***	-0.0055 ***
	(0.0005)	(0.0004)
Recession*Crisis	0.0019 ***	-0.0001
	(0.0005)	(0.0005)
log(Age)	0.0003	0.0003 *
	(0.0002)	(0.0002)
log(TNA)	-0.0005 ***	0.0000
	(0.0001)	(0.0001)
ExpRatio	0.0194	0.0067
	(0.0282)	(0.0515)
TurnRatio	-0.0004 *	-0.0003 *
	(0.0001)	(0.0002)
Flow	0.0068 **	0.0007
	(0.0030)	(0.0019)
Size	0.0039 ***	-0.0028 ***
	(0.0010)	(0.0007)
Value	0.0053 ***	-0.0003
	(0.0007)	(0.0006)
Momentum	-0.0017 **	0.0048 ***
	(0.0009)	(0.0006)
Constant	-0.0061 **	0.0005
	(0.0056)	(0.0033)
Observations	11743	11743

The Sensitivity of Skills to Crisis

Panel A and B of Table 8 shows that timing skill and picking skill returns in 95th percentile are more sensitive to crisis than timing skill and picking skill returns in 50th percentile by about 1.8 and 1.5 times, respectively. Moreover, the directions of the relation between crisis and skill returns in 95th percentile and in 50th percentile are different. Timing skill return in 95th percentile are significantly higher in crisis than in regular recessions, whereas timing skill return in 50th percentile are significantly lower in crisis than in regular recessions, 1.20% versus -0.99% return per month. Besides, picking skill return in 95th percentile are significantly higher in crisis than in regular recessions, whereas picking skill return in 50th percentile are significantly lower in crisis than in regular recessions, 0.96% versus -0.29% return per month. To summarize, in 95th percentile, timing and picking skill returns in crisis are significantly higher than in regular recessions, whereas in 50th percentile, timing and picking skill returns in crisis are significantly lower than regular recessions.

Table 8: The Sensitivity of Timing and Picking skills to Crisis

This table presents the sensitivity of timing and picking skill to crisis. *Recession*Crisis* equals to 1 if the observation months are in recessions and in great recession. Great recession or crisis is defined for months from April 2008 to September 2009 and 0 otherwise. *Picking* and *Timing* are explained variable calculated from equation (1) and (2) by using 12-month rolling window beta. *Recession* is explanatory variables which equal to 1 for every month that specify in recession periods and 0 otherwise. *Log(Age)* is age in year of fund in term of natural logarithm. *Log(TNA)* is total net asset of fund in term of natural logarithm. *ExpRatio* is expense ratio (% per year) of fund. *TurnRatio* is turnover ratio (% per year) of fund. *Flow* is growth rate of fund's new money. *Size*, *Value*, and *Momentum* variables are the proxy of funds' style with the 3 dimensions depended on the average scores of holding stock in fund's portfolio in that month and sorted into quintile along each characteristics (1 for smallest or lowest and 5 for largest or highest). *Flow* and *Turnover* are winsorized at the 1% level. Quantile regressions is estimated on model (10) and (11) with block bootstrapping of standard error. The standard errors are given in parenthesis. ***, **, * indicate statistical significant at 1%, 5%, and 10%, respectively.

Panel A: Timing Skill				
	Q25	Q50	Q75	Q95
Recession	0.0002	-0.0009 ***	0.0033 ***	0.0075 ***
	(0.0003)	(0.0002)	(0.0006)	(0.0010)
Recession*Crisis	-0.0238 ***	-0.0099 ***	0.0042 ***	0.0120 ***
	(0.0010)	(0.0008)	(0.0007)	(0.0022)
log(Age)	0.0009 *	0.0005	-0.0004	-0.0041 *
	(0.0004)	(0.0004)	(0.0010)	(0.0020)
log(TNA)	-0.0004	-0.0009 ***	-0.0013 **	-0.0014
	(0.0002)	(0.0002)	(0.0004)	(0.0010)
ExpRatio	-0.0508	-0.0262	0.1490	0.3821 *
	(0.0339)	(0.0325)	(0.0778)	(0.1890)
TurnRatio	-0.0001	-0.0004 ***	-0.0005	-0.0011
	(0.0003)	(0.0001)	(0.0004)	(0.0010)
Flow	0.0051 *	0.0034	0.0011	0.0059
	(0.0021)	(0.0026)	(0.0032)	(0.0065)
Size	-0.0023 ***	-0.0024 **	0.0047 ***	0.0020
	(0.0006)	(0.0007)	(0.0007)	(0.0021)
Value	-0.0038 ***	0.0017 **	0.0134 ***	0.0308 ***
	(0.0006)	(0.0005)	(0.0010)	(0.0027)
Momentum	0.0033 ***	0.0049 ***	-0.0041 ***	-0.0046 *
	(0.0008)	(0.0007)	(0.0008)	(0.0023)
Constant	0.0041	0.0032	-0.0030	0.0084
	(0.0027)	(0.0031)	(0.0049)	(0.0110)
Observations	11743	11743	11743	11743

Table 8 (continued)

Panel B: Picking Skill				
	Q25	Q50	Q75	Q95
Recession	-0.0043 ***	-0.0022 ***	-0.0016 ***	-0.0020 **
	(0.0005)	(0.0003)	(0.0003)	(0.0006)
Recession*Crisis	-0.0085 ***	-0.0029 ***	0.0019 *	0.0096 ***
	(0.0008)	(0.0004)	(0.0007)	(0.0013)
log(Age)	0.0011 *	0.0006	-0.0005	-0.0021 *
	(0.0004)	(0.0003)	(0.0005)	(0.0008)
log(TNA)	0.0004	0.0001	-0.0002	-0.0005
	(0.0002)	(0.0002)	(0.0002)	(0.0005)
ExpRatio	-0.0796	0.0089	0.1442 ***	0.2407 ***
	(0.0524)	(0.0238)	(0.0401)	(0.0571)
TurnRatio	-0.0001	-0.0001	-0.0002	-0.0004
	(0.0003)	(0.0001)	(0.0002)	(0.0004)
Flow	-0.0007	-0.0011	-0.0007	-0.0006
	(0.0016)	(0.0019)	(0.0028)	(0.0035)
Size	-0.0020	-0.0034 ***	-0.0044 ***	-0.0072 ***
	(0.0010)	(0.0006)	(0.0006)	(0.0011)
Value	-0.0079 ***	0.0011	0.0094 ***	0.0201 ***
	(0.0008)	(0.0006)	(0.0006)	(0.0011)
Momentum	0.0067 ***	0.0056 ***	0.0036 ***	0.0017
	(0.0008)	(0.0005)	(0.0006)	(0.0011)
Constant	-0.0082	-0.0026	0.0051	0.0227 ***
	(0.0044)	(0.0029)	(0.0034)	(0.0060)
Observations	11743	11743	11743	11743

4.5 Robustness Tests

4.5.1 Using CT and CS as Alternative Measures of Skills

Table 9 shows that funds have characteristic-timing (CT) in recessions more than they have in expansions by 0.07% per month and have characteristic-selectivity (CS) in expansions more than they have in recessions by 0.03% per month. These results are the evidence of the variation of CT and CS in the UK which are not statically significant and are inconsistent with the main result from Table 2. Moreover, the results from testing quantile regression in Panel A and B of Table A2 in Appendix section show that CT and CS in 95th percentile are more sensitive to recessions than those skills in 50th percentile, 1.06% versus 0.02% for CT and 0.39% versus -0.02% for CS. Therefore, the results of skills in 95th percentile are statistically significant and consistent with the main results in Table 3. Although the positive effect of recessions on CT in 50th percentile is inconsistent with the negative effect of the main result, the correlation is not statistically significant.

Funds with top characteristic-selectivity (top CS) funds in expansions are not the same funds who are top characteristic-timing (top CT) in the same periods as shown in Table 10. Besides, top CS funds, who have the highest 25th percentile of the fraction of observation months in expansions that have CS in the group of the highest 25th percentile of the overall CS return distribution, significantly have higher CS in recessions by 0.12% per month and have lower CT in both expansions and recessions than other funds by 0.31% and 0.07%, respectively. Therefore, these findings are consistent with the main result except for the result of lower CT in recessions of top CS funds, but the coefficient is not statistically significant. On the other hand, top CS funds can outperform other funds by giving higher alpha about 0.04%, 0.07% and 0.08% per month from CAPM, four-factor, and three-factor model, respectively, but only the result of four-factor model is statically significant. The outperformance of top CS from CAPM model in table 11 confirms the main result of CAPM in table 5. Besides the characteristics of top CS fund are similar to the characteristics of top picking skilled funds of the main result

including younger age, less AUM, more expense ratio, more turnover ratio, more flow, less number of stock, higher portfolio dispersion, and lower industry dispersion as shown in Table A3 in Appendix section.

Testing on crisis, Table 12 shows that funds have CS and CT in crisis less than they have in other recession periods by 0.02% per month. Therefore, picking skill measured by CS and by *Picking*, which is the method of Kacperczyk et al. (2014) gives the similar results. However, timing skill measured by CT and by *Timing* gives the different results by showing that funds have CT in recessions more than in crisis and more than in expansions. In Panel A and B of Table A4 in Appendix section, CS and CT in 95th percentile are more sensitive to crisis than in 50th percentile. The sensitivity of CS and CT in top percentile are statistically significant. These results are consistent to the main result in Table 8 except that crisis have positive relation between crisis and CT in 50th percentile.

Table 9: CT and CS with the Business Cycle

This table presents the relation between the business cycle and CS and CT. *CS* and *CT* are explained variable calculated from equation (12) and (13). *Recession*Crisis* equals to 1 if the observation months are in recessions and in great recession. Great recession or crisis is defined for months from April 2008 to Sep 2009. *Recession* is explanatory variables which equal to 1 for every month that specify in recession periods and 0 otherwise. *Log(Age)* is age in year of fund in term of natural logarithm. *Log(TNA)* is total net asset of fund in term of natural logarithm. *ExpRatio* is expense ratio (% per year) of fund. *TurnRatio* is turnover ratio (% per year) of fund. *Flow* is growth rate of fund's new money. *Size, Value,* and *Momentum* variables are the proxy of funds' style with the 3 dimensions depended on the average scores of holding stock in fund's portfolio in that month and sorted into quintile along each characteristics (1 for smallest or lowest and 5 for largest or highest). *Flow* and *Turnover* are winsorized at the 1% level, all control variables are demeaned and pooled regressions are run on equations (14) and (15) with clustering standard error by fund and time. The standard errors are given in parenthesis. ***, **, * indicate statistical significant at 1%, 5%, and 10%, respectively.

	CT	CT	CS	CS
Recession	0.0007	0.0009 **	-0.0003	-0.0004 *
	(0.0004)	(0.0004)	(0.0003)	(0.0002)
log(Age)	0.0001		0.0000	
	(0.0002)		(0.0001)	
log(TNA)	-0.0002 *		0.0001	
	(0.0001)		(0.0001)	
ExpRatio	-0.0579 **		0.0470 **	
	(0.0254)		(0.0224)	
TurnRatio	-0.0001		-0.0001	
	(0.0001)		(0.0001)	
Flow	-0.0012		0.0030 **	
	(0.0020)		(0.0013)	
Size	-0.0002		0.0007 *	
	(0.0005)		(0.0004)	
Value	-0.0009		0.0011 **	
	(0.0006)		(0.0004)	
Momentum	0.0009		-0.0005	
	(0.0007)		(0.0004)	
Constant	0.0017	-0.0012 ***	-0.0038 *	0.0011 ***
	(0.0027)	(0.0002)	(0.0021)	(0.0001)
Observations	11743	11743	11743	11743

Table 10: Top CS with the Business Cycle

This table presents the relation between the business cycle and skills of top CS. *Top*CS is a dummy variable for a superior group of skilled fund whose characteristic-selectivity (CS) in expansions is in the highest 25th percentile of the characteristic-selectivity (CS) distribution and 0 otherwise. *Log(Age)* is age in year of fund in term of natural logarithm. *Log(TNA)* is total net asset of fund in term of natural logarithm. *ExpRatio* is expense ratio (% per year) of fund. *TurnRatio* is turnover ratio (% per year) of fund. *Flow* is growth rate of fund's new money. *Size*, *Value*, and *Momentum* variables are the proxy of funds' style with the 3 dimensions depended on the average scores of holding stock in fund's portfolio in that month and sorted into quintile along each characteristics (1 for smallest or lowest and 5 for largest or highest). *Flow* and *Turnover* are winsorized at the 1% level, all control variables are demeaned and pooled regressions are run on equations (16) is used for running pooled regression with clustering standard error by fund and time for each subsample months; expansion subsample and recession subsample. The standard errors are given in parenthesis. ***, **, * indicate statistical significant at 1%, 5%, and 10%, respectively.

	CT	CT	CS	CS
	Expansion	Recession	Expansion	Recession
TopCS	-0.0031 ***	-0.0007	0.0032 ***	0.0012 *
	(0.0004)	(0.0009)	(0.0003)	(0.0007)
log(Age)	0.0001	0.0000	-0.0001	0.0003
	(0.0002)	(0.0003)	(0.0001)	(0.0002)
log(TNA)	-0.0001	-0.0003 **	0.0000	0.0002
	(0.0001)	(0.0002)	(0.0001)	(0.0001)
ExpRatio	-0.0140	-0.0799	-0.0003	0.0770 **
	(0.0215)	(0.0521)	(0.0244)	(0.0352)
TurnRatio	-0.0002 **	0.0005	-0.0001	-0.0006
	(0.0001)	(0.0006)	(0.0001)	(0.0004)
Flow	-0.0049 **	0.0096 **	0.0030 **	0.0006
	(0.0021)	(0.0044)	(0.0014)	(0.0029)
Size	-0.0005	0.0002	0.0009 *	0.0009
	(0.0005)	(0.0011)	(0.0005)	(0.0006)
Value	0.0010 **	-0.0021 **	-0.0002	0.0017 **
	(0.0005)	(0.0009)	(0.0004)	(0.0007)
Momentum	0.0000	0.0011	0.0001	-0.0012
	(0.0007)	(0.0014)	(0.0005)	(0.0007)
Constant	0.0018	0.0058	-0.0038 *	-0.0067 **
	(0.0021)	(0.0040)	(0.0022)	(0.0030)
Observations	7842	3901	7842	3901

Table 11: Performance of Top CS

This table presents performance of top CS. Excess returns are calculated from CAPM model, Three-Factor model, and Four-Factor model by using equation 6, 7, and 8, respectively. *Top*CS is a dummy variable for a superior group of skilled fund whose characteristic-selectivity (CS) in expansions is in the highest 25th percentile of the characteristic-selectivity (CS) distribution and 0 otherwise *Log(Age)* is age in year of fund in term of natural logarithm. *Log(TNA)* is total net asset of fund in term of natural logarithm. *ExpRatio* is expense ratio (% per year) of fund. *TurnRatio* is turnover ratio (% per year) of fund. *Flow* is growth rate of fund's new money. *Size*, *Value*, and *Momentum* variables are the proxy of funds' style with the 3 dimensions depended on the average scores of holding stock in fund's portfolio in that month and sorted into quintile along each characteristics (1 for smallest or lowest and 5 for largest or highest). *Flow* and *Turnover* are winsorized at the 1% level, all control variables are demeaned and pooled regressions are run on equations (17) with clustering standard error by fund and time. The standard errors are given in parenthesis. ***, **, * indicate statistical significant at 1%, 5%, and 10%, respectively.

	CAPM	3-Factor	4-Factor
TopCS	0.0004	0.0007	0.0008 *
	(0.0006)	(0.0004)	(0.0004)
log(Age)	0.0002	0.0002	0.0002
	(0.0002)	(0.0002)	(0.0002)
log(TNA)	0.0002	0.0002	0.0002
	(0.0001)	(0.0001)	(0.0002)
ExpRatio	0.0043	0.0051	-0.0064
	(0.0346)	(0.0352)	(0.0370)
TurnRatio	0.0003	0.0001	0.0001
	(0.0002)	(0.0001)	(0.0001)
Flow	0.0011	-0.0009	-0.0005
	(0.0014)	(0.0013)	(0.0014)
Size	0.0014 **	0.0001	-0.0002
	(0.0005)	(0.0005)	(0.0005)
Value	0.0013 ***	0.0002	0.0002
	(0.0005)	(0.0004)	(0.0004)
Momentum	-0.0022 ***	-0.0001	0.0001
	(0.0007)	(0.0006)	(0.0006)
Constant	-0.0052 *	-0.0052 *	-0.0060 *
	(0.0030)	(0.0028)	(0.0031)
Observations	9862	9862	9862

Table 12: CT and CS with Crisis

This table presents the relation between crisis and skills. *CS* and *CT* are explained variables calculated from equation (14) and (15). *Recession*Crisis* equals to 1 if the observation months are in recessions and in great recession. Great recession or crisis is defined for months from April 2008 to September 2009 and 0 otherwise. *Log(Age)* is age in year of fund in term of natural logarithm. *Log(TNA)* is total net asset of fund in term of natural logarithm. *ExpRatio* is expense ratio (% per year) of fund. *TurnRatio* is turnover ratio (% per year) of fund. *Flow* is growth rate of fund's new money. *Size*, *Value*, and *Momentum* variables are the proxy of funds' style with the 3 dimensions depended on the average scores of holding stock in fund's portfolio in that month and sorted into quintile along each characteristics (1 for smallest or lowest and 5 for largest or highest). *Flow* and *Turnover* are winsorized at the 1% level, all control variables are demeaned and pooled regressions are run on equations (18) and (19) with clustering standard error by fund and time. The standard errors are given in parenthesis. ***, **, * indicate statistical significant at 1%, 5%, and 10%, respectively.

	CT	CT	CS	CS
Recession	0.0007	0.0009 **	-0.0003	-0.0004 *
	(0.0004)	(0.0004)	(0.0003)	(0.0002)
Recession*Crisis	-0.0002	-0.0002	-0.0002	-0.0002
	(0.0005)	(0.0005)	(0.0003)	(0.0003)
log(Age)	0.0001		0.0000	
	(0.0002)		(0.0001)	
log(TNA)	-0.0002 *		0.0001	
	(0.0001)		(0.0001)	
ExpRatio	-0.0579 **		0.0471 **	
	(0.0254)		(0.0224)	
TurnRatio	-0.0001		-0.0001	
	(0.0001)		(0.0001)	
Flow	-0.0012		0.0029 **	
	(0.0020)		(0.0013)	
Size	-0.0002		0.0007 *	
	(0.0005)		(0.0004)	
Value	-0.0009		0.0011 **	
	(0.0006)		(0.0005)	
Momentum	0.0009		-0.0005	
	(0.0007)		(0.0004)	
Constant	0.0017	-0.0011 ***	-0.0038 *	0.0012 ***
	(0.0027)	(0.0002)	(0.0021)	(0.0001)
Observations	11743	11743	11743	11743

4.5.2 Using Conditional Alpha and Beta as Alternative Measure of Performance

Table 13 shows that if alpha or skill is based only on using private information, top picking skilled funds will underperform other funds by -0.11%, -0.15% and -0.40% per month using conditional four-factor, conditional CAPM, and conditional three-factor model, respectively. Only the result of alpha from conditional three-factor model is statistical significant. Moreover, the underperformance of top picking skilled funds using alphas from conditional three-factor and conditional four-factor model are robust to the results of using alphas from unconditional three-factor and unconditional four-factor model. These results mean that if skill means using only private information to take action, the alpha of top skilled funds becomes inferior to other funds in all risk-adjusted models.

In table 14, if the measure of skill is changed to CT and CS, the results of performance still be the same for conditional CAPM and conditional three-factor. However, for conditional four-factor, top CS funds can outperform other funds by 0.14% per month, which gives the different result from top picking skill (*Top*) in Table 16. On the other hand, comparing to the result from unconditional beta and alpha, the different result is top CS funds cannot outperform other funds measured by conditional CAPM and conditional three-factor models.

Table 13: Performance of Top Picking Skilled Fund by Conditional Alpha and Beta

This table presents performance from conditional alpha and beta model of top picking skilled funds. Excess returns are calculated from Conditional CAPM model, Conditional Three-Factor model, and Conditional Four-Factor model by using equation 20, 21, and 22, respectively. *Top* is a dummy variable for a superior group of skilled funds whose picking skill in expansions is in the highest 25th percentile of the picking skill distribution. *Log(Age)* is age in year of fund in term of natural logarithm. *Log(TNA)* is total net asset of fund in term of natural logarithm. *ExpRatio* is expense ratio (% per year) of fund. *TurnRatio* is turnover ratio (% per year) of fund. *Flow* is growth rate of fund's new money. *Size*, *Value*, and *Momentum* variables are the proxy of funds' style with the 3 dimensions depended on the average scores of holding stock in fund's portfolio in that month and sorted into quintile along each characteristics (1 for smallest or lowest and 5 for largest or highest). *Flow* and *Turnover* are winsorized at the 1% level, all control variables are demeaned and pooled regressions are run on equation (23) with clustering standard deviation by fund and time. The standard errors are given in parenthesis. ***, **, * indicate statistical significant at 1%, 5%, and 10%, respectively.

	Conditional CAPM	Conditional 3-Factor	Conditional 4-Factor
Top	-0.0015	-0.0040 *	-0.0011
	(0.0020)	(0.0024)	(0.0021)
log(Age)	0.0000	-0.0004	0.0002
	(0.0007)	(0.0009)	(0.0007)
log(TNA)	0.0004	-0.0004	0.0000
	(0.0004)	(0.0004)	(0.0003)
ExpRatio	-0.0581	-0.0921	-0.1864
	(0.1834)	(0.1076)	(0.1285)
TurnRatio	-0.0013 **	-0.0009	-0.0007 **
	(0.0007)	(0.0006)	(0.0003)
Flow	-0.0026	-0.0104	-0.0107 *
	(0.0070)	(0.0107)	(0.0062)
Size	0.0039 ***	0.0070 ***	-0.0017
	(0.0015)	(0.0025)	(0.0018)
Value	0.0025	0.0043 **	0.0008
	(0.0016)	(0.0021)	(0.0020)
Momentum	-0.0062 ***	-0.0099 ***	0.0025
	(0.0019)	(0.0033)	(0.0024)
Constant	-0.0121	0.0053	0.0048
	(0.0080)	(0.0072)	(0.0080)
Observations	9682	9682	9682

Table 14: Performance of Top CS Fund by Conditional Alpha and Beta

This table presents performance from conditional alpha and beta of top CS. *Top*CS is a dummy variable for a superior group of skilled fund whose characteristic-selectivity (CS) in expansions is in the highest 25th percentile of the characteristic-selectivity (CS) distribution and 0 otherwise. Excess returns are calculated from CAPM model, Three-Factor model, and Four-Factor model by using equation 20, 21, and 22, respectively. *Log(Age)* is age in year of fund in term of natural logarithm. *Log(TNA)* is total net asset of fund in term of natural logarithm. *ExpRatio* is expense ratio (% per year) of fund. *TurnRatio* is turnover ratio (% per year) of fund. *Flow* is growth rate of fund's new money. *Size*, *Value*, and *Momentum* variables are the proxy of funds' style with the 3 dimensions depended on the average scores of holding stock in fund's portfolio in that month and sorted into quintile along each characteristics (1 for smallest or lowest and 5 for largest or highest). *Flow* and *Turnover* are winsorized at the 1% level, all control variables are demeaned and pooled regressions are run on equations (24) with clustering standard error by fund and time. The standard errors are given in parenthesis. ***, **, * indicate statistical significant at 1%, 5%, and 10%, respectively.

	Conditional CAPM	Conditional 3-Factor	Conditional 4-Factor
TopCS	-0.0023	-0.0028	0.0014
	(0.0017)	(0.0017)	(0.0019)
log(Age)	0.0001	-0.0003	0.0002
	(0.0007)	(0.0009)	(0.0007)
log(TNA)	0.0004	-0.0005	-0.0001
	(0.0004)	(0.0004)	(0.0003)
ExpRatio	-0.0361	-0.0679	-0.2012
	(0.1893)	(0.1098)	(0.1293)
TurnRatio	-0.0013 *	-0.0009	-0.0007 **
	(0.0007)	(0.0006)	(0.0004)
Flow	-0.0026	-0.0113	-0.0113 *
	(0.0070)	(0.0108)	(0.0062)
Size	0.0038 ***	0.0073 ***	-0.0015
	(0.0015)	(0.0024)	(0.0018)
Value	0.0024 *	0.0032	-0.0001
	(0.0014)	(0.0022)	(0.0018)
Momentum	-0.0062 ***	-0.0100 ***	0.0024
	(0.0018)	(0.0033)	(0.0024)
Constant	-0.0123	0.0056	0.0053
	(0.0080)	(0.0073)	(0.0079)
Observations	9682	9682	9682

CHAPTER V

CONCLUSION

This thesis employs the holding-based measure to investigate the variation of using picking and timing skill of fund with the business cycle and to compare the uses of these skills between regular recessions and crisis period of UK funds. The sample used in this study are 295 domestic open-end equity mutual funds from January 2005 to December 2013 including a great recession period during April 2008 to September 2009. Therefore, this thesis is the stress test and the external validity test of Kacperczyk et al. (2014).

This study finds that funds significantly have both picking skill and timing skill in expansions more than in recessions, so there is no variation of picking and timing skills with the business cycle in the UK mutual fund industry. In addition, from running quantile regression, higher timing skill returns are more sensitive to recessions than lower timing skill returns. Besides, in 95th percentile, timing and picking skill returns are significantly higher in recessions than in expansions, whereas in 50th percentile, timing and picking skill returns are significantly lower in recessions than in expansions.

Furthermore, when top picking skilled funds in expansions is defined as funds having the highest 25th percentile of the fraction of observation months in expansions that have picking skill in the group of the highest 25th percentile of the overall picking skill return distribution, the result shows that top picking skilled funds significantly pick stock well not only in expansions but also in recessions and they can time the market well in recessions. In addition, to investigate the performance, the result shows that top picking skilled funds outperform other funds only in using CAPM model, whereas they underperform others fund regarding to three-factor and four-factor models. Moreover, top picking skilled funds in the UK and in the U.S. have many characteristics in common including younger age, smaller AUM, more expense ratio, more turnover ratio, more new money inflow, higher portfolio dispersion, less number of stock holding. However, there is one different characteristic that is lower industry dispersion of

top picking funds in the UK but higher industry dispersion of top picking skilled funds in the U.S. than other funds.

To investigate picking skill and timing skill in crisis period, this thesis finds that UK funds significantly have higher timing skill but have lower picking skill in crisis period than in regular recessions. From quantile regressions, picking skill and timing skill returns in higher level are more sensitive to crisis than skill returns in lower level. Besides, in 95^{th} percentile, timing skill and picking skill returns in crisis are significantly higher than in regular recessions, whereas in 50^{th} percentile, timing skill and picking skill returns in crisis are significantly lower than regular recessions.

The contribution of this thesis is that it is the evidence to support top skilled funds of the UK open-end equity mutual fund in the aspect of the linkage between their source of skills and the state of economy by finding that top picking skilled fund in the UK, have higher picking skill in both expansions and recessions, and also have higher timing skill in recessions. In term of performance, top picking skilled fund can provide higher alpha in CAPM than other funds. These findings also help investor to know the skill function with the business cycle of top picking skilled funds in the UK and to identify them by using characteristics, including younger age, smaller AUM, more expense ratio, more turnover ratio, more new money inflow, higher portfolio dispersion, lower industry dispersion, and less number of stock holding.

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APPENDIX

Table A1: Definitions and Formulas of Variables

Variable	Definition	Formula
i	Stock i	
j	Fund j	
t	Time t	
$w_{i,t}^{j}$	Weight of stock i in fund j at time t	$\frac{\$\ invest\ in\ asset\ i\ of\ fund\ j}{\$Total\ asset\ of\ fund\ j}$
$w_{i,t}^{m}$	Market weight of stock i in fund j at time t	$\frac{market\ capitalization\ in\ asset\ i}{Total\ market\ cap}$
$\beta_{i,t}$	The sensitivity of the stock i's return to the market returns	$\beta_i = \frac{Cov(R^i, R^m)}{\sigma_m^2}$ (Run the rolling-window regression between month t and 12 months prior on single index model)
R_{t+1}^{i}	The stock i's returns from time t to time t+1	$\frac{P_{t+1}^{i}}{P_t^{i}} - 1$
R_{t+1}^{m}	The market returns of the next period from time t to time t+1 (FT All Share Index of total returns)	$\frac{P_{t+1}^{m}}{P_t^{m}} - 1$
$(\beta_{i,t}R_{t+1}^{m})$	The systematic component of stock i's return	
$(R_{t+1}^{i} - \beta_{i,t}R_{t+1}^{m})$	Firm specific component of stock i's returns	
$Picking_t^j$	The measurement of picking skill of fund j at time t	$\sum_{i=1}^{N^j}(w_{i,t}^{j} - w_{i,t}^{m})(R_{t+1}^{i} - \beta_{i,t}R_{t+1}^{m})$
$Timing_t^j$	The measurement of timing skill of fund j at time t	$\sum_{i=1}^{N^j}(w_{i,t}^{j} - w_{i,t}^{m})(\beta_{i,t}R_{t+1}^{m})$
$Recession_t$	An indicator variable equal to one for recession months due to OECD indicator, and zero otherwise	
Log(Age)_t^j	The natural logarithm of fund j's age in year at time t	

Table A1 (continued)

Variable	Definition	Formula
$Log(TNA)_t^j$	The natural logarithm of total net asset of fund j at time t	
$Expenses_t^j$	Expense ratio (% per year) of fund j at time t	
$Turnover_t^j$	Turnover ratio (% per year) of fund j at time t	
$Flow_t^j$	% growth in fund's new money	$\frac{TNA_t^j - TNA_{t-1}^j (1 + R_t^j)}{TNA_{t-1}^j}$
$Size_t^j$	Size style of fund which is value-weighted score of stock holdings' quintile score ranked by market capitalization of fund j	$\sum_{i=1}^{n} w_{it}^j * Q_{it}^j$
$Value_t^j$	Value style of fund which is value-weighted score of stock holdings' quintile score ranked by book-to-market ratio of fund j	$\sum_{i=1}^{n} w_{it}^j * Q_{it}^j$
$Momentum_t^j$	Momentum style of fund which is value-weighted score of stock holdings' quintile score ranked by stocks' past 12-month return of fund j	$\sum_{i=1}^{n} w_{it}^j * Q_{it}^j$
$Recession_t * Crisis_t$	The interaction term equal to one if month t is in recessions and in crisis, and zero otherwise	
$Ability_t^j$	Can be picking or timing variable	
R_{ft}	Risk free rate at time t which is 1- month UK T-bill rate	

Table A1 (continued)

Variables	Definitions	Formulas
α_t^j	Risk-adjusted excess return (CAPM, 3-factor, and 4-factor models)	$R_{it} - R_{ft} = \alpha_i + b_i(R_{Mt} - R_{ft}) + s_i SMB_t + h_i HML_t + m_i MOM_t + e_{it}$
SMB_t	Size factor standing for small (market capitalization) minus big	$TRI^{HGSC}_{month\ t}$ - $TRI^{FT}_{month\ t}$
HML_t	Value factor standing for high (book-to-market ratio) minus low	$TRI^{MSCI\ UK\ Value}_{month\ t}$ - $TRI^{MSCI\ UK\ Growth}_{month\ t}$
MOM_t	Momentum factor	Total return index of past year.
Z_1	is one-month T-bill yield at t-1	
Z_2	is dividend yield at t-1	
Z_3	is term spread at t-1 (yield on the UK 20 years – yield on the UK three-month T-bill)	

Table A2: The Sensitivity of CT and CS on the Business Cycle

CS and *CT* are explained variable calculated from equation (12) and (13). *Recession*Crisis* equals to 1 if the observation months are in recessions and in great recession. Great recession or crisis is defined for months from April 2008 to Sep 2009. *Recession* is explanatory variables which equal to 1 for every month that specify in recession periods and 0 otherwise. *Log(Age)* is age in year of fund in term of natural logarithm. *Log(TNA)* is total net asset of fund in term of natural logarithm. *ExpRatio* is expense ratio (% per year) of fund. *TurnRatio* is turnover ratio (% per year) of fund. *Flow* is growth rate of fund's new money. *Size*, *Value*, and *Momentum* variables are the proxy of funds' style with the 3 dimensions depended on the average scores of holding stock in fund's portfolio in that month and sorted into quintile along each characteristics. *Flow* and *Turnover* are winsorized at the 1% level. Equation (14) and (15) are used for running quantile regression in Stata program with block bootstrapping of standard error. The standard errors are given in parenthesis. ***, **, * indicate statistical significant at 1%, 5%, and 10%, respectively.

Panel A: Characteristic–timing (CT)				
	Q25	Q50	Q75	Q95
Recession	-0.0011 **	0.0002	0.0022 ***	0.0106 ***
	(0.0004)	(0.0001)	(0.0003)	(0.0018)
log(Age)	0.0005	-0.0001	0.0006	-0.0057 **
	(0.0005)	(0.0001)	(0.0004)	(0.0017)
log(TNA)	0.0000	-0.0001	-0.0008 ***	-0.0012
	(0.0003)	(0.0001)	(0.0002)	(0.0009)
ExpRatio	-0.1648 **	-0.0318	0.0679	0.4175 **
	(0.0501)	(0.0183)	(0.0471)	(0.1209)
TurnRatio	0.0001	-0.0001	-0.0002	-0.0009
	(0.0002)	(0.0001)	(0.0002)	(0.0005)
Flow	-0.0011	0.0001	-0.0032	-0.0066
	(0.0018)	(0.0009)	(0.0017)	(0.0058)
Size	0.0012 *	-0.0002	-0.0021 **	-0.0027
	(0.0005)	(0.0003)	(0.0008)	(0.0018)
Value	-0.0034 ***	-0.0004	0.0012	0.0052 ***
	(0.0005)	(0.0003)	(0.0006)	(0.0015)
Momentum	0.0004	0.0003	0.0011	0.0022
	(0.0006)	(0.0003)	(0.0006)	(0.0018)
Constant	-0.0067 *	0.0016	0.0133 **	0.0243 *
	(0.0029)	(0.0016)	(0.0043)	(0.0115)
Observations	11743	11743	11743	11743

Table A2 (continued)

Panel B: Characteristic–selectivity (CS)				
	Q25	Q50	Q75	Q95
Recession	-0.0013 ***	-0.0002	0.0005	0.0039 ***
	(0.0003)	(0.0001)	(0.0003)	(0.0007)
log(Age)	-0.0007	0.0003 **	0.0004	-0.0017
	(0.0004)	(0.0001)	(0.0004)	(0.0011)
log(TNA)	0.0005 *	0.0000	-0.0002	-0.0002
	(0.0002)	(0.0001)	(0.0002)	(0.0006)
ExpRatio	-0.0652	0.0092	0.1205 **	0.3360 ***
	(0.0442)	(0.0152)	(0.0381)	(0.0942)
TurnRatio	0.0001	0.0000	-0.0002	-0.0003
	(0.0001)	(0.0001)	(0.0002)	(0.0003)
Flow	0.0036 *	0.0007	0.0031	0.0029
	(0.0016)	(0.0010)	(0.0018)	(0.0030)
Size	0.0014 *	0.0000	-0.0015 **	-0.0031 **
	(0.0007)	(0.0002)	(0.0005)	(0.0011)
Value	-0.0013 *	0.0003	0.0035 ***	0.0063 ***
	(0.0005)	(0.0003)	(0.0005)	(0.0010)
Momentum	-0.0004	0.0002	0.0006	0.0012
	(0.0005)	(0.0002)	(0.0006)	(0.0011)
Constant	-0.0092 *	-0.0014	0.0050	0.0160 **
	(0.0036)	(0.0012)	(0.0026)	(0.0055)
Observations	11743	11743	11743	11743

Table A3: The Characteristics of Top CS

*Top*CS is a dummy variable for a superior group of skilled fund whose characteristic-selectivity (CS) in expansions is in the highest 25th percentile of the characteristic-selectivity (CS) distribution and 0 otherwise. *Log(Age)* is age in year of fund in term of natural logarithm. *Log(TNA)* is total net asset of fund in term of natural logarithm. *ExpRatio* is expense ratio (% per year) of fund. *TurnRatio* is turnover ratio (% per year) of fund. *Flow* is growth rate of fund's new money. *Size*, *Value*, and *Momentum* variables are the proxy of funds' style with the 3 dimensions depended on the average scores of holding stock in fund's portfolio in that month and sorted into quintile along each characteristics. *Portfolio Dispersion* is measured by using Herfindahl index of portfolio's weight in deviation from the market's weight. *Stock number* shows the number of stocks that funds have in their portfolios. *Industry Dispersion* indicates the industry concentration of fund's portfolio and is measured by using Herfindahl index of portfolio weights in a given industry in deviation from the market portfolio's weights. Top1 – Top0 is mean value of top equaling to 1 minus mean of top equaling to 0.

	TopCS = 1			TopCS = 0			Diff	
	Mean	Stdev.	Median	Mean	Stdev.	Median	Top1-Top0	p-value
Age	16.07	12.90	11.63	18.04	13.37	15.14	-1.96	0.0000
TNA	217.78	333.94	79.54	364.75	1,185.89	84.13	-146.97	0.0000
Expense Ratio (%)	1.62	0.92	1.59	1.29	0.51	1.43	0.33	0.0000
Turnover Ratio (%)	38.77	115.93	18.00	33.78	97.29	18.66	4.99	0.0289
Flow (%)	0.84	8.65	-0.16	-0.17	7.42	-0.47	1.00	0.0000
Portfolio Dispersion (%)	1.61	0.97	1.47	1.01	0.67	0.95	0.61	0.0000
Stock Number	59.38	29.37	50.00	76.58	72.39	53.00	-17.19	0.0000
Industry Dispersion (%)	5.24	4.04	4.26	6.66	3.69	7.04	-1.42	0.0000

Table A4: The Sensitivity of CT and CS in Crisis

CS and *CT* are explained variables calculated from equation (14) and (15). *Recession*Crisis* equals to 1 if the observation months are in recessions and in great recession. Great recession or crisis is defined for months from April 2008 to September 2009 and 0 otherwise. *Log(Age)* is age in year of fund in term of natural logarithm. *Log(TNA)* is total net asset of fund in term of natural logarithm. *ExpRatio* is expense ratio (% per year) of fund. *TurnRatio* is turnover ratio (% per year) of fund. *Flow* is growth rate of fund's new money. *Size, Value,* and *Momentum* variables are the proxy of funds' style with the 3 dimensions depended on the average scores of holding stock in fund's portfolio in that month and sorted into quintile along each characteristics. *Flow* and *Turnover* are winsorized at the 1% level. Quantile regressions is estimated on model (18) and (19) with block bootstrapping of standard error. The standard errors are given in parenthesis. ***, **, * indicate statistical significant at 1%, 5%, and 10%, respectively.

Panel A: Characteristic-timing (CT)				
	Q25	Q50	Q75	Q95
Recession	-0.0002	0.0001	0.0011 **	0.0036 **
	(0.0004)	(0.0002)	(0.0003)	(0.0012)
Recession*Crisis	-0.0026 ***	0.0002	0.0035 ***	0.0146 ***
	(0.0006)	(0.0002)	(0.0007)	(0.0023)
log(Age)	0.0006	-0.0001	0.0008	-0.0054 ***
	(0.0005)	(0.0001)	(0.0004)	(0.0014)
log(TNA)	0.0001	-0.0001	-0.0007 ***	-0.0014
	(0.0003)	(0.0001)	(0.0002)	(0.0008)
ExpRatio	-0.1567 **	-0.0349	0.0663	0.3710 **
	(0.0469)	(0.0185)	(0.0434)	(0.1116)
TurnRatio	0.0001	-0.0001	-0.0002	-0.0010 *
	(0.0002)	(0.0001)	(0.0002)	(0.0004)
Flow	-0.0015	-0.0001	-0.0034 *	-0.0052
	(0.0017)	(0.0009)	(0.0016)	(0.0059)
Size	0.0008	-0.0001	-0.0017 *	-0.0003
	(0.0005)	(0.0003)	(0.0008)	(0.0018)
Value	-0.0037 ***	-0.0003	0.0015 *	0.0069 ***
	(0.0005)	(0.0003)	(0.0006)	(0.0014)
Momentum	0.0009	0.0002	0.0004	-0.0012
	(0.0006)	(0.0003)	(0.0006)	(0.0016)
Constant	-0.0071 *	0.0016	0.0124 **	0.0250 *
	(0.0030)	(0.0015)	(0.0043)	(0.0121)
Observations	11743	11743	11743	11743

Table A4 (continued)

Panel B: Characteristic-selectivity (CS)				
	Q25	Q50	Q75	Q95
Recession	-0.0010 **	0.0000	-0.0001	0.0018 **
	(0.0003)	(0.0001)	(0.0003)	(0.0007)
Recession*Crisis	-0.0008	-0.0002	0.0016 **	0.0050 ***
	(0.0005)	(0.0001)	(0.0006)	(0.0011)
log(Age)	-0.0007 *	0.0003 **	0.0003	-0.0014
	(0.0004)	(0.0001)	(0.0004)	(0.0010)
log(TNA)	0.0005 *	0.0000	-0.0002	-0.0005
	(0.0002)	(0.0001)	(0.0003)	(0.0005)
ExpRatio	-0.0614	0.0099	0.1132 **	0.2673 **
	(0.0397)	(0.0151)	(0.0372)	(0.0899)
TurnRatio	0.0001	0.0000	-0.0002	-0.0004
	(0.0002)	(0.0001)	(0.0001)	(0.0003)
Flow	0.0035 *	0.0008	0.0032	0.0026
	(0.0017)	(0.0010)	(0.0019)	(0.0032)
Size	0.0014	0.0000	-0.0010	-0.0023 *
	(0.0007)	(0.0002)	(0.0006)	(0.0010)
Value	-0.0013 *	0.0003	0.0037 ***	0.0068 ***
	(0.0006)	(0.0003)	(0.0006)	(0.0009)
Momentum	-0.0002	0.0002	0.0002	0.0000
	(0.0006)	(0.0002)	(0.0006)	(0.0011)
Constant	-0.0094 *	-0.0014	0.0042	0.0180 **
	(0.0039)	(0.0011)	(0.0027)	(0.0054)
Observations	11743	11743	11743	11743

VITA

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