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Article

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Global Business & Finance Review (GBFR)

Provided in Cooperation with:

People & Global Business Association (P&GBA), Seoul

Suggested Citation: Cheong, Mun-Kyung; Kim, Yong-Hyeon; Chung, Jellna (2020) : Fund performance during recessions and expansions in Korea, Global Business & Finance Review (GBFR), ISSN 2384-1648, People & Global Business Association (P&GBA), Seoul, Vol. 25, Iss. 3, pp. 60-74,
<https://doi.org/10.17549/gbfr.2020.25.3.60>

This Version is available at:

<https://hdl.handle.net/10419/253306>

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Fund Performance During Recessions and Expansions in Korea

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ABSTRACT

Purpose: This study explores the relationship between the performances of national equity funds and business cycles in Korea.

Design/methodology/approach: First, this research examines how fund performance is better in recessions than in expansion periods and then analyzes fund performance by dividing funds into active and passive operating styles. Last, what risk factors affect performance with respect to business cycles and operating cycles are investigated.

Findings: The empirical findings show that fund performance is affected by the economic variables of short-term interest rates, credit risk spread, growth in money stock, and corporate value. However, the effects change with the business cycle. In addition, the fund performance of overall, internal, and outsourcing investments is better in recessions than in expansion periods, which agrees with foreign studies.

Research limitations/implications: When assessing fund managers' abilities, not only quantitative performance but also qualitative assessment - economic conditions - become important. It is necessary to evaluate fund performance with a system that considers economic fluctuations.

Originality/value: This is the first research to analyze the performance of the national pension fund using the regime-switching model in the Korean market.

Keywords: Pension funds, Fund operating styles, Economic fluctuations, Regime-switching model

1. Introduction

Risk-adjusted alpha, which is the difference between the actual return of the fund and the benchmark return, is used for the measurement of fund performance. The benchmark returns are derived from the capital assets pricing model (CAPM), which studies the relationship between asset return and risk. Since Jensen (1968) measured excess return using the CAPM,

many scholars have estimated risk-adjusted returns using multi-factor models. In particular, the three-factor model of Fama and French (1993) and the four-factor model of Carhart (1997) are used to measure asset returns and risk. All the models of Jensen (1968), Fama and French (1993), and Carhart (1997) estimate the alpha based on factor betas, assuming the betas are constant.

However, recent studies show that risk-adjusted returns are also related to changes in economic conditions. Specifically, Glode (2011), Kosowski (2011), Banegas, Gillen, Timmermann, and Wermers (2013), Kacperczyk, Nieuwerburgh, and Veldkamp

Received: Mar. 5, 2020; Revised: Aug. 31, 2020; Accepted: Sep. 14, 2020

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(2014) showed that so-called time-varying returns change with economic conditions. If the beta changes with economic conditions, fund performance will be changed. For example, Kosowski (2011) analyzed U.S. mutual funds and found that fund performance (risk-adjusted return) was positive (+) in the contraction period and negative (-) in the economic expansion period. Moreover, Barberis and Shleifer (2003) suggested that security prices in an economy where investors divide risky assets into different styles, so called style investing. They provided a model that unrelated securities could move together simply because they have been categorized into the same asset class. In this paper, we try to discover whether fund performance varies with the economic situation and investment styles in Korea.

In related domestic studies, Kang and Lee (2010) examined the effect of investment style on fund performance using Sharpe's style analysis methodology. Lee (2012) analyzed the performance of a fund after the introduction of an installment-type fund as a turning point in the structural change of the domestic fund market. So far as the authors know, there is no paper that analyzes the performance of funds with variations in the economic cycle in the Korean market.

The purpose of this study is to examine the effect of changes in economic variables on the performance of funds in the Korean market. Firstly, this paper examines whether fund performance in a recession is different from fund performance in expansion periods. Secondly, the current study investigates whether fund performance in an economic recession period is better than in an expansion period. Thirdly, we analyze fund performance by dividing funds into active and passive operating styles. Finally, we use the Carhart (1997) model to analyze which risk factors affect fund performance. This is the first paper that shows how the performance of the national pension fund in the Korean market varies with the business cycle using the regime-switching model.

II. Literature Review

A. Theoretical Literature

Glode (2011) argued that fund managers can adjust fund performance (risk-adjusted returns) according to the state of the economy and that fund managers focus their efforts toward realizing higher performance during recessions. Specifically, investors' marginal utility of consumption is greater during a recession period than during an expansion period, so fund managers claim to have incentives to achieve excellent performance during recession periods. In addition, he argued that the existing valuation models of Jensen alpha, Fama-French alpha, and Carhart alpha fail to adequately explain the poor performance of funds in an expansion period and good performance in a recession period, respectively. If we measured the performance of active U.S. funds in a way that is based on the existing valuation models, the average performance would be negative. This means that index fund performance is better than active fund performance in terms of risk-adjusted returns. Glode analyzed U.S. mutual funds from 1980 to 2005 and found that fund performance was higher in bad economic states than good states.

B. Empirical Literature

Perez-Quiros and Timmermann (hereafter PQT, 2000) found that during a recession period, the risk for small firms is most strongly affected by a worsening credit crunch in the financial market. They argued that small firms lose collateral and their assets become more risky, causing investors to require a higher premium for holding their shares during the period. Moreover, they found that the volatility of the stock price and the expected return are higher for smaller firms across recession states.

Kosowski (2011) accounted for the state dependence relationship between risk (beta) and performance (alpha), motivated by the regime-dependent performance measures of Grinblatt and Titman (1989). Specifically,

he analyzed fund performance using CAPM alpha, Fama-French alpha and Carhart alpha, and found that the difference in fund performance (risk-adjusted return) between expansion and recession periods is statistically significant. In an analysis of U.S. mutual funds using the regime-switching model from 1962 to 2005, he found negative (-) fund performance in economic expansion periods. On the contrary, he found positive (+) fund performance in contraction periods when investors' marginal utility of consumption is high. Moreover, he found that the characteristics of a fund, such as the market beta, size beta, book-to-market beta, and momentum beta of the fund, varied with the economic state.

Banegas, Timmermann, Gillan, and Wermers (2013) showed that outperforming European funds can be selected by using macroeconomic variables. Specifically, fund managers in the UK are better informed about the UK's economic states and sectors than those in other countries. Therefore, fund performance will be better because the funds are managed efficiently under certain macroeconomic conditions. In the same vein, Scandinavian managers are better informed about local IT companies than fund managers in other countries, so they choose which firms might recover when IT collapses. This implies that macroeconomic information can aid to point out when local specialization is most needed in a particular market. They showed that excellent funds in Europe could be found using economic variables such as the industrial production index, price index, and volatility index of the stock market. In addition, they found that the performance of fund investing in a particular country is superior to that of fund investing in Europe as a whole, and that this performance varies with time and is highly correlated with economic variables.

More recently, Steger (2017) showed that macroeconomic conditions influence private equity fund (PEF) returns. He found that weak economic growth, low corporate bond yields, and declining stock market valuations for the period when investments are taking place favor returns. In addition, a positive change in strong economic growth and rising stock market valuations over the fund lifetime also support private

equity fund returns.

As discussed above, it was found in the overseas literature that fund performance (risk-adjusted return) varies with the economic situation and investment styles. Barberis and Shliefer (2003) argue that style investing is an important equity investment strategy for institutional investors, such as pension funds, which may have a significant impact on the stock market. The national fund system in Korea is also using these styles to invest in stocks. There could be a limit to the stock valuation method using the existing market benchmark, such as Korea Stock Price Index (KOSPI), and rather, the stock benchmark considering the style investing may be important. The performance evaluation using existing methods may show varying results during the recession or expansion periods. It may be important to consider the style of investment in the evaluation process. This paper examines how different fund styles are influenced by the economic states of recession and expansion.

In this context, this study investigates evidence of fund performance using data of the national pension fund in Korea. First, we specifically analyze whether stock fund performance varies with economic phases. Second, we examine whether performance in a recession period is better than that in an expansion period. Third, fund performance is analyzed by dividing funds into passive and active operating styles. Fourth, we analyze the risk factors of performance over a benchmark with respect to the economic phases.

III. Data and Methodology

Barberis and Schleifer (2003) theoretically explained that fund performance is different when a fund is invested with a different goal. Since the National Pension Investment Guidelines in Korea specify that internal (or direct) investment should be aimed at passive management, while outsourcing (or external) investment must be aimed at active investment, we

analyze the overall fund performance of domestic stocks by dividing overall investment into internal investment and outsourcing investment. We examine how different fund styles are influenced by the respective economic states.

A. Data

In order to investigate the relationship between domestic stock market performance and economic variables, monthly data from January 2002 to December 2013 were used. The economic variables are short-term interest rates, credit risk spread, growth in money stock, and the firm value variables used by PQT (2000). The short-term yield is the three-month CD rate, and the credit risk spread (DEF) is the yield difference between three-year BBB- corporate bonds and the three-year government bond yield. The growth in the money stock (ΔM) is the rate of change in the monetary base, and the corporate value (BPS) is the ratio of market value to the book value of the Korea Stock Price Index (KOSPI). We also used the leading business index (BLI) as a variable of the time-varying transition probability.

As shown in Table 1, the yield of internal investment of the national pension fund is 1.20% per month, and that of the outsourcing investment is 1.26% per month. During the sample period, short-term interest rates (CD rates) remained at around 3% per annum with a downward trend, and credit spreads varied from a maximum of 8% to a minimum of 3% depending on the economic phase.

The national pension investment guidelines estab-

lished by the fund management committee present benchmarks and asset allocations for domestic stocks, domestic bonds, foreign stocks, foreign bonds, and alternative investments, respectively. Based on the guidelines, the fund management team presents the benchmarks to individual fund managers. The guidelines also specify that internal investment is aimed at a passive style and outsourcing investment is aimed at an active style. Because the internal management team of the national pension system (NPS) has relatively few employees than outsourcing fund team, the guidelines specify passive style for internal investment.

Under the passive investment, fund managers form a stock portfolio to follow the benchmark established by the committee. For example, if the benchmark for domestic stock investment is the KOSPI, the fund manager invests in all stocks included in the KOSPI. The goal is to achieve the same performance of the stock portfolio as the performance of the KOSPI. On the contrary, active investment refers to investing in stocks that are expected to perform well in the future to achieve higher performance than a given benchmark. The internal investment is the investment in stocks by the internal management team of the NPS. Outsourcing investment is to invest in stocks by delegating funds to external management agencies (i.e., fund managers).

According to the guidelines, the benchmark of domestic stocks is the KOSPI, the benchmark of internal investment is the KOSPI 200, and benchmark of outsourcing investment is the composite index of KOSPI + KOSDAQ 100, respectively. This is shown in Table 2.

Table 1. Summary Statistics

	Internal investment yield	Outsourcing investment yield	CD rates	Credit spread	Money growth	BPS	BLI
Mean	0.0120	0.0126	0.03	0.05	0.04	0.81	0.02
Maximum	0.139	0.138	0.05	0.08	0.12	1.33	0.05
Minimum	-0.203	-0.208	0.02	0.03	-0.01	0.48	-0.006
Std. dev.	0.06	0.06	0.009	0.01	0.02	0.15	0.01
Sample no.	144	144	144	144	144	144	144

Whereas internal investment and outsourcing investment yields are monthly returns, CD rates and spreads are annual returns, respectively.

Table 2. Domestic Stock Benchmark Index

Category	Benchmark index	Remarks
Domestic stock (total)	KOSPI (including dividends)	
Internal investment	KOSPI200 (including dividends)	
Outsourcing investment	Composite index of KOSPI (including dividends) and KOSDAQ100	Weighted average by market capitalization

KOSPI stands for Korea Stock Price Index, and KOSDAQ stands for Korean Securities Dealers Automated Quotations, respectively.

B. Methodology

1. Relationship between fund performance over risk-free interest rate and economic variables

We use the regime-switching model to determine whether the performance of the national pension fund varies over time. Similar to PQT (2000), we use the dependent variables as excess returns over risk-free rate. The explanatory variables are the CD rate, the credit risk spread, the money growth rate compared to the same period of the previous year, and the change rate of the market value to the book value.

The short-term interest rate (CD rate) is a key variable for investors to predict future economic changes. If there is a negative shock to economic activity, expected inflation will rise, which will lead to an increase in short-term interest rates. In addition, monetary authorities raise short-term policy rates to control inflation when the economy overheats, and on the contrary, use lower short-term policy rates to stimulate the economy when it slows. Also, the short-term interest rate is an indicator of a company's interest cost. If the short-term interest rate rises, the interest cost of the corporation increases, which causes the corporate value to fall. On the contrary, when the short-term interest rate falls, the interest cost of the corporation decreases, which causes the corporate value to increase.

The DEF variable, which is the credit risk spread, is measured as the difference between 3-year corporate BBB-bond and 3-year government bond yields. Credit risk spread is commonly used as a predictor of business cycles and is widely used as a key variable in the study of stock market predictability (e.g., Keim and Stambaugh, 1986; Fama and French, 1989; Kandel

and Stambaugh, 1990).

The growth in money stock (ΔM) is the rate of change of the monetary base in the same period of the previous year. The money growth rate is widely used as an indicator of economic changes. It is a policy variable announced by the Bank of Korea (the monetary authority in Korea) that is used as a predictor of the liquidity situation in the economy.

The ratio of book value to market value (BPS) is used as an indicator of corporate value at the end of the year, which indicates the overheating and depression of the stock market. The indicator is a measure of the mean reversion of the expected return on the stock market. Specifically, a high value of BPS indicators represents that corporate value in a depressed stock market is valued at a high discount rate, so the share price tends to return (i.e., rise in this case) to the average level in the future. On the contrary, a lower BPS means that enterprise value in an overheated stock market is evaluated at a low discount rate, so the share price tends to go back (i.e., decrease in this case) to the average level in the future.

Based on PQT (2000), the fund performances of overall investment, internal investment and outsourcing investment of the national pension were analyzed by the following regime-switching model.

$$r_t^i = \beta_{0,S_t}^i + \beta_{1,S_t}^i \Delta CD_{t-1} + \beta_{2,S_t}^i \Delta DEF_{t-1} + \beta_{3,S_t}^i \Delta M_{t-2} + \beta_{4,S_t}^i BPS_{t-1} + \epsilon_t^i$$

where

$$r_t^i: \text{the month } t \text{ excess return (return minus the risk-free rate) of overall equity investments. } (R_{i,t} - R_{F,t})$$

- $R_{i,t}$: the month t return of overall equity investments
- $R_{F,t}$: the month t risk-free rate
- ΔCD_{t-1} : the log-difference in three month CD rates at t-1 and three month CD at t-2
- ΔDEF_{t-1} : the log-difference in DEF at t-1 and DEF at t-2 where DEF is difference between three-year corporate BBB-bond and three-year government bond yields
- ΔM_{t-2} : log-difference in monetary base in the same period of previous year with a lag of two months, reflecting the publication delay for this variable.
- BPS_{t-1} : corporate book value included in the KOSPI at the end of year divided by the market value of KOSPI over the previous 12 months
- ϵ_t^i : the error term having the distribution of $N(0, \sigma_{i,S_t}^2)$
- S_t : the state variable for 1 and 2

According to PQT (2000), $\log(\sigma_{i,S_t}^2) = \lambda_{S_t}^i$ since the conditional variance of excess returns is allowed to depend on the state of the economy. Based on the study of PQT (2000), state transition probabilities are specified as follows:

$$p_t^i = P(S_t^i = 1 \mid S_{t-1}^i = 1, Y_{t-1}) = \Phi(\pi_1^i \Delta CLI_{t-2})$$

$$q_t^i = P(S_t^i = 1 \mid S_{t-1}^i = 2, Y_{t-1}) = \Phi(\pi_2^i \Delta CLI_{t-2})$$

where

- ΔCLI_{t-2} : the two-month lagged value of the year-on-year log-difference in the business leading indicator
- S_t^i : the state variable for excess return of internal and outsourcing investments
- Φ : the cumulative density function of a standard normal variable

2. Excess return over benchmark to economic state

We analyze whether the excess returns over the benchmark of domestic stocks vary with the economic state.

$$R_{i,t} - R_{B,t} = r_t = \mu_{i,S_t} + \sigma_{i,S_t} \epsilon_t$$

where

- $R_{i,t}$: the month t fund return
- $R_{B,t}$: the month t benchmark return
- μ_{i,S_t} : the month t excess return (fund return minus benchmark return)
- ϵ_t : the error term having the distribution of $N(0, \sigma_{i,S_t}^2)$
- S_t : the state variable for 1 and 2

3. Performance analysis of excess return over benchmark to economic state

We analyze what factors influence the performance of the fund with respect to economic phases and whether the performance over the benchmark is different for each phase. Specifically, we use the regime-switching regression model where the excess return over the benchmark ($R_{i,t} - R_{B,t}$) is the dependent variable, and firm size (SMB_t), book-to-market (HML_t), and momentum (UMD_t) factors are the explanatory variables.

Fama and French (1993) identified the role of market, firm size, and book-to-market as factors explaining stock portfolio returns. Carhart (1997) added a momentum factor to the three factors of Fama and French (1993). The three-factor model and the four-factor model are the most commonly used methodologies for evaluating the performance of equity funds.

The stock data set is provided by Fn-Guide a financial data provider in Korea. According to the Fama-French method, stocks listed on the KOSPI and KOSDAQ markets are ranked at 50%/50% based on market capitalization at the end of June of each year during the sample period. We created three groups of 30%/40%/30% of stocks in each market size group based on the book value of net assets divided by the market value at the end of December of the last year. For the six portfolios in total, the weighted average returns for each portfolio are calculated by holding one year. The SML (small minus big) portfolio returns are the differences in average returns for the three small and three large portfolios, and the HML (high minus low) portfolio returns are the differences in average returns for the two small and two large book-to-market portfolios, based on the return data of the six portfolios.

Table 3. Unit Root Test

Variables	Augmented Dickey-Fuller		Elliot-Rothenberg-Stock	
	ADF statistics	p-value	p-statistics	test critical value
BPS	-2.696	0.077	1.951	
Change in CD rate (ΔCD)	-3.438	0.011	1.706	1% : 1.932
Money growth (ΔM)	-7.413	0.000	1.604	5% : 3.136
Change in spread (ΔDEF)	-3.333	0.015	1.406	10% : 4.240
Rate of return of domestic stocks	-11.272	0.000	0.603	

We calculated the return of momentum factors following Carhart's methodology. Three groups of 30%/40%/30% were generated based on the stock returns over the past 11 months between t-12 month and t-2 month. The equally weighted returns for each portfolio were calculated by holding one month t. The momentum factor of the month t is the difference between the average return of the top 30% portfolio with high past performance and that of the bottom 30% portfolio with low past performance. The following is the regime-switching model including the Carhart (1997) model, which is similar to the model of Kosowski (2011).

$$R_{i,t} - R_{B,t} = r_t = \alpha_{i,S_t} + b_{i,S_t}SMB_t + h_{i,S_t}HML_t + m_{i,S_t}UMD_t + e_{i,t}$$

where

- $R_{i,t}$: the month t fund return
- $R_{B,t}$: the month t benchmark return
- α_i : the fund's risk-adjusted return (stock selection skill)
- SMB_t : size factor (small size return minus large size return)
- HML_t : book-to-market factor (value style of high book-to-market return minus growth style of low book-to-market return)
- UMD_t : momentum factor (high past 11-month return minus low past 11-month return)
- $e_{i,t}$: the error term having the distribution of $N(0, \sigma_{i,S_t}^2)$
- S_t : the state variable for 1 and 2

IV. Empirical Results

A. Result of unit root test

We examine all the variables for stationarity. We use two forms of unit root test. They are the Augmented Dickey-Fuller test and the Elliott-Rothenberg-Stock test. Specifically, before analyzing the relationship between the excess return of domestic stocks and economic variables (BPS, change in CD rate, money growth, and change in DEF rate), two unit root tests were conducted to check the stability of each variable.

Table 3 shows the result of the Augmented Dickey-Fuller (ADF) test and Elliot-Rothenberg-Stock test. In the Augmented Dickey-Fuller test, most of the variables reject the null hypothesis that unit roots exist at a 5% significance level, except BPS which is at a 10% significance level. The empirical result using Eliot-Rothenberg-Stock test shows similar results to ADF test. Specifically, the variables of change in CD rate, money growth, change in credit spread, and rate of return of domestic stocks reject the null hypothesis at a 1% significance level, except BPS which is at a 5% significance level. Therefore, we can conclude that the variables used in this study are stable.

B. Relationship between fund performance over risk-free rate and economic variables

Table 4 shows the domestic stock performance of national pension funds with respect to economic phases. The volatility of state 2 is higher than that

Table 4. The Relationship between the Overall Investment and Economic Variables

	All periods	State 1	State 2
Constant	1.139 (33.37)	-0.090 (-7.10)	0.194 (5.80)
ΔCD	-0.162 (-2.99)	0.094 (10.39)	-0.199 (-3.73)
ΔDEF	0.029 (0.54)	-0.194 (-40.40)	-0.067 (-1.15)
ΔM	-0.200 (-1.18)	1.323 (70.07)	-0.489 (-2.86)
BPS	-0.133 (-3.77)	0.098 (9.26)	-0.186 (-5.34)
Transition probability parameters			
ΔCLI	-	9.172 (0.12)	-414.39 (-3.46)
Variance parameters			
$\log(\sigma)$	-	-6.735 (0.12%) (-22.16)	-2.962 (5.17%) (-46.41)
Log likelihood	206.79	238.47	

of state 1, and the estimates of volatility are statistically significant in each state.

This table shows that the residual standard deviation of returns is 0.12% in state 1 and 5.17% in state 2. It indicates that the residual standard deviation of state 2 is much higher than state 1. This is consistent with previous studies (Schwert, 1989; Campbell et al., 2001; Gulen et al., 2011) that reported stock price volatility is higher in a recession period than in an expansion period. Moreover, the transition probability parameter of the leading economic index (CLI) shows a positive value in state 1 and a negative value in state 2. Kosowski (2011) concluded that the recession regime is identified based on negative loading on the CLI (the variable driving the time-varying transition probability) and higher residual standard deviation. Therefore, state 2 can be identified as a recession state in terms of transition probability parameters and variance parameters. However, the transition probability parameter of state 1 is not statistically significant, which could be caused by the relatively short sample period of our study.

While change in short-term interest rates (ΔCD) and corporate value (BPS) have negative effects on stock performance, change in credit risk spread (ΔDEF) has positive impact on the performance for the whole period. The variables of ΔCD and BPS are statistically significant. Therefore, the results show that fund performance declines as the interest

rate rises. On the other hand, performance declines as the book value to stock price increases for the whole period.

However, the relationships do not hold in the sub-period analysis of economic recession (state 2) and expansion (state 1) phases. Specifically, short-term interest rates (ΔCD) have a negative impact on fund performance for the whole period. However, the decline in interest rates improves fund performance during the economic recession period, whereas it does not affect fund performance during the economic expansion period. An increase in the credit spread (ΔDEF), which indicates credit risk, has no impact on fund performance for the whole period. However, while the relationship between fund performance and credit risk is negatively related in the expansion period, the relationship does not hold in the recession period.

The relationship between growth in the money stock (ΔM) and fund performance is not significant for the whole period. However, there is a statistically significant positive relationship in the economic expansion period. This means that the stock price will be negatively affected if the monetary authority reduces the money volume to prevent the overheating of the economy. However, the relationship becomes negatively significant for the recession period. This implies that the stock price would be decreased if policy authority increases the money volume to

stimulate the economy.

The book value relative to the market value (BPS) has a negative effect on stock performance during the whole period and recession period. It means that the stock price will rise next month and fund performance will be enhanced next month if the stock price is undervalued relative to book value. However, opposite phenomenon does occur in the expansion period. Therefore, the results show that the excess returns over risk-free rate are influenced by the economic states of recession and expansion.

C. Excess return over benchmark to economic state

Table 5 shows that the excess returns of overall investment of the national pension fund over benchmark vary with the economic phase.

The table shows that the pension fund outperformed the benchmark by 0.189% (monthly average). Whereas the average of the excess return was 0.879% in the high volatility period (1.30% per month), the average of the excess return was 0.087% in the low volatility period (0.46% per month).

Figure 1 presents the time series of the estimated transition probabilities for the low and high variances.

Since the states are treated as endogeneous in the regime-switching model, variation of economic index is used to determine the recession and expansion situation variables. Negative fluctuations in the index can be defined as recession and positive fluctuations in the index can be defined as expansion. Therefore, this may differ from the definition of recession and

expansion periods announced by the National Statistical Office (i.e., the Statistics Korea). The high-low variance of a stock defines a change in stock volatility with each state. Thus, the highly volatile period and the less volatile period can be defined as separate states.

Table 6 shows business cycles published by Statistics Korea, a government agency. The cycles are excerpted

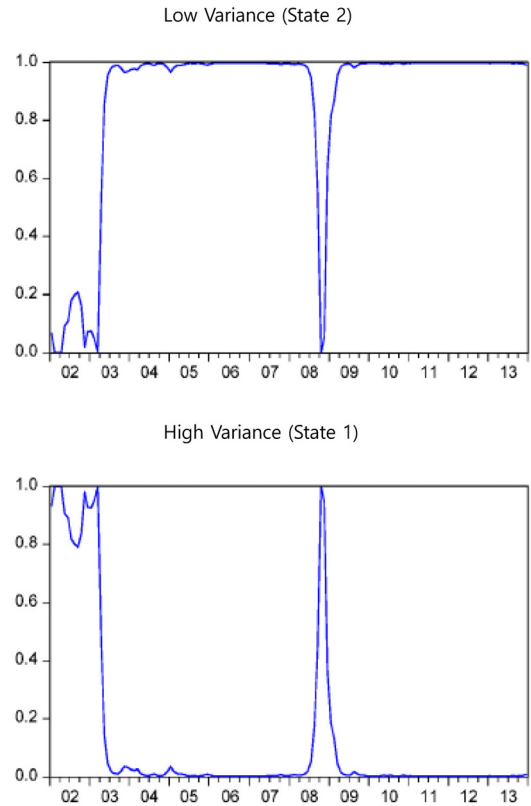


Figure 1. Probability of Low Variance and High Variance States

Table 5. The Excess Returns of Overall Investment over Benchmark to Economic States

	All periods	State 1	State 2
Constant	0.189% (3.299)	0.879% (2.518)	0.087% (2.058)
Transition probability parameters			
Transition probability	-	0.896	0.980
Variance parameters			
log(σ)	-	-4.339 (1.30%) (-23.57)	-5.389 (0.46%) (80.82)
Log likelihood	513.2		541.8

including the sample period of this study. This table shows the number of cycles, bottom and peak terms, and continuing months of each cycle.

The figure shows that the low volatility status persists for a considerable period of time. Although volatility was high in 2008, which was the financial crisis, it remained low in early 2009. The ninth business cycle of the recession period from December 2002 to April 2005 and the 10th business cycle of the recession period from January 2008 to 2009 overlap considerably with the estimated transition probabilities for the large variance in Figure 1. Therefore, the figure provides evidence that the period of high

volatility is the economic recession period and that of low volatility is the economic expansion period.

Table 7 shows the results of excess returns of internal investment of the national pension fund over benchmark by all periods and economic phases.

This table shows that the internal management of the national pension fund over benchmark is 0.738% during the high volatility period, but is 0.055% during the low volatility period. Therefore, it is believed that fund outperformance is achieved during the high volatility period.

Table 8 shows the results of excess returns of outsourcing investment over benchmark by all periods

Table 6. Business Cycle by the Statistics Korea

Business Cycle	Term			Continuing Months		
	Bottom	Peak	Bottom	Expansion	Recession	Total
⋮	⋮	⋮	⋮	⋮	⋮	⋮
8th cycle	July of 2001	Dec. of 2002	Apr. of 2005	17	28	45
9th cycle	Apr. of 2005	Jan. of 2008	Feb. of 2009	33	13	46
10th cycle	Feb. of 2009	Aug. of 2011	Mar. of 2013	30	19	49
11th cycle	Mar. of 2013					
⋮	⋮	⋮	⋮	⋮	⋮	⋮

Table 7. The Excess Returns of Internal Investment over Benchmark to Economic States

	All periods	State 1	State 2
Constant	0.132% (2.658)	0.738% (2.348)	0.055% (1.417)
Transition probability parameters			
Transition probability	-	0.980	0.993
Variance parameters			
log(σ)	-	-4.475 (1.14%) (-24.43)	-5.457 (0.43%) (-81.94)
Log likelihood	533.4		541.8

Table 8. The Excess Returns of Outsourcing Investment over Benchmark to Economic States

	All periods	State 1	State 2
Constant	0.241% (3.473)	1.028% (2.786)	-0.082% (-0.928)
Transition probability parameters			
Transition probability	-	0.838	0.612
Variance parameters			
log(σ)	-	-4.695 (0.91%) (-26.74)	-5.249 (0.52%) (-38.36)
Log likelihood	513.2		498.04

and economic phases.

The table shows that the fund performance of outsourcing investment over the benchmark is 1.028% during the high volatility period, but is -0.082% during the low volatility period. Again, it is assumed that outperformance occurred during the high volatility period.

Collectively, the results of Table 5, Table 7, and Table 8 show that the overall management, internal management, and outsourcing management of the national pension fund over the benchmark is better in high volatility periods than in low volatility periods. The empirical results are consistent with most overseas studies, including Kosowski (2011).

D. Performance analysis of excess return over benchmark to economic state

In the previous section, we confirmed that fund performance over the benchmark varied with the economic phase. We will analyze what factors influence fund performance by economic phase in this section. To do this, we will use the Carhart (1997) four-factor model, which is commonly used in fund performance evaluation. Theoretically, excess returns over the benchmark stems from the ability of fund managers to manage stock selections and risk factors. Therefore, determining which factors influence excess returns is crucially important to understand the sources of excess returns.

1. Performance analysis of overall investment

Table 9 shows the empirical results of overall management by estimating regime-switching regression analysis, where the dependent variable is the excess return of overall investment over the benchmark and the independent variables are the firm size (SMB), book-to-market (HML), and momentum (UMD) factors.

The table shows that the excess returns over the benchmark are positively affected by risk-adjusted alpha (stock selection ability) and momentum factor. Specifically, if the stock market's momentum (UMD) factor changes by 1%, the excess returns over the benchmark increase by 0.038%. The fund manager's skill (α), which is not affected by risk factors, led to 0.178% per month (2.14% per year). This means that the risk-adjusted stock selection skill measured by Carhart's four factors is statistically significant at 0.178% per month. On the other hand, firm size (SMB) and corporate book-to-market (HML) have negative impacts on the excess returns. Specifically, if the firm size factor increases by 1%, fund performance decreases by 0.034%. Overall, the excess returns over the benchmark are affected by alpha, SMB and UMD factors.

When the whole period is divided into high and low volatility periods, the effect of each risk factor on the excess returns of overall management over the benchmark is different. The volatility of state 1 is as high as 0.78% and that of state 2 is relatively low at 0.45%. As shown in Figure 1, state 1 and

Table 9. The Excess Returns of Overall Investment over Benchmark to Risk Factors

	All periods	State 1	State 2
Constant	0.178% (2.963)	0.599% (2.628)	0.088% (1.870)
HML	-0.024 (-1.543)	-0.086 (-1.578)	-0.010 (-0.792)
SMB	-0.034 (-2.833)	-0.198 (-3.121)	-0.009 (-1.062)
UMD	0.038 (2.948)	0.078 (1.634)	0.015 (1.500)
Transition probability parameters			
Transition probability	-	0.983	0.921
Variance parameters			
log(σ)	-	-4.854 (0.78%) (-27.531)	-5.408 (0.45%) (-81.042)
Log likelihood	522.9		552.96

state 2 are identified as recession and expansion periods, respectively. Thus, state 1 must be a recession phase and state 2 must be an expansion phase. The alpha is statistically significantly positive at 0.599% (7.188% per year) in high volatility periods, while it is weakly positive at 0.088% (1.056% per year) in low volatility periods. This indicates that stock selection skill is more relevant during an expansion period.

The relationship between excess returns of overall investment over the benchmark and risk factors also varies with the economic state. Specifically, the SMB factor has a negative impact on excess returns, whereas the UMD factor exclusively has a positive effect on excess returns in the recession period.

2. Performance analysis of internal investment

Table 10 shows the results of internal management by estimating regime-switching regression analysis, where the dependent variable is the excess return of internal investment over the benchmark and the independent variables are the SMB, HML, and UMD factors.

This table shows that excess returns of internal investment over the benchmark are positively affected by risk-adjusted alpha (stock selection ability). The ability of fund managers to operate (α), which is not influenced by market risk factors, resulted in 0.154% per month (1.85% per year). In other words, the risk-adjusted stock selection skill measured by

Carhart's four factors is 0.154%, which is statistically significant. The size factor (SMB) has a negative impact on excess returns over the benchmark. Specifically, if the SMB factor increases by 1%, fund performance decreases by 0.025%. The corporate book-to-market factor (HML) and momentum factor (UMD) have negative impacts on excess returns, though not statistically significant.

When the whole period is divided into high and low volatility periods, the effect of each risk factor on the excess returns of internal management over the benchmark is different. While the alpha is low at 0.064% (per month) in the low volatility phase, the alpha is high at 0.70% (per month) in the high volatility phase. Therefore, we can conclude that the stock selection ability of internal management mainly occurred in the high volatility period.

The relationship between excess returns of internal investment over benchmark and risk factors also varied with the economic state. Specifically, the firm size (SMB) factor has a negative impact on excess returns both in the recession period and the expansion period, but is statistically significant in the recession period only.

3. Performance analysis of outsourcing investment

Table 11 shows the empirical results of outsourcing management by estimating regime-switching regression analysis, where the dependent variable is the excess return of outsourcing investment over the benchmark

Table 10. The Excess Returns of Internal Investment over Benchmark to Risk Factors

	All periods	State 1	State 2
Constant	0.154% (2.812)	0.700% (2.974)	0.064% (1.526)
HML	-0.018 (-1.244)	-0.131 (-2.516)	0.001 (0.106)
SMB	-0.025 (-2.350)	-0.185 (-3.447)	-0.005 (-0.691)
UMD	-0.001 (-0.054)	0.039 (0.830)	-0.013 (-1.513)
Transition probability parameters			
Transition probability		0.981	0.993
Variance parameters			
log(σ)		-4.954 (0.71%) (26.703)	-5.470 (0.42%) (83.309)
Log likelihood	536.55		569.86

Table 11. The Excess Returns of Outsourcing Investment over Benchmark to Risk Factors

	All periods	State 1	State 2
Constant	0.146% (2.118)	1.284% (3.012)	0.019% (0.231)
HML	0.005 (0.315)	-0.017 (-0.287)	0.013 (0.604)
SMB	0.020 (1.438)	0.085 (1.782)	0.015 (0.848)
UMD	0.089 (6.064)	0.208 (3.079)	0.078 (4.699)
Transition probability parameters			
Transition probability		0.648	0.962
Variance parameters			
log(σ)		-4.881 (0.76%) (-18.789)	-5.138 (0.59%) (-49.737)
Log likelihood	503.14		517.05

and the independent variables are the SMB, HML, and UMD factors.

This table shows that excess returns of outsourcing investment over the benchmark are positively affected by risk-adjusted alpha (stock selection ability) and momentum factor. If the momentum (UMD) factor rises by 1%, excess returns over the benchmark increase by 0.089%. The ability of fund managers to operate (α), which is not affected by market risk factors, resulted in 0.146% per month (1.75% per year). The firm size factor (SMB) and corporate book-to-market factor (HML) have positive impacts on the excess return over the benchmark, though not statistically significant. Therefore, we can draw the conclusion that the fund performance of outsourcing management is mainly determined by the momentum factor.

When the whole period is divided into high and low volatility periods, the effect of each risk factor on the excess returns of outsourcing management over the benchmark is different. The volatility of state 1 is 0.76% and that of state 2 is 0.59%. Since the alpha of the outsourcing is 1.284% (per month) in the high volatility phase and 0.019% (per month) in the low volatility period, the stock selection ability of outsourcing management mainly occurred in the high volatility period.

With respect to the relationship between excess returns of outsourcing investment over the benchmark and risk factors, the effects of the momentum (UMD) factor on excess returns are greater in the high

volatility period than in the low volatility period. Specifically, if the UMD factor increases by 1%, fund performance increase by 0.208% in the high volatility period, as opposed to 0.078% in the low volatility period. Therefore, the momentum factor seems to affect fund performance, and it has a much more intense effect in the high volatility period.

V. Conclusion

This paper analyzes whether the performance of national pension equity funds varies with business cycles, and then investigates whether the performance over the benchmark is different in varying economic states. In addition, this paper analyzes what factors influence fund performance over the benchmark with respect to the economic state. Finally, the overall fund is divided into internal and outsourcing funds to find evidence of active and passive operating styles. This is the first paper to analyze the relationship between the performance of the national pension fund in Korea and business cycles using the regime-switching model.

We used monthly return data from January 2002 to December 2013. We also used the economic variables of short-term interest rates, credit risk spread, growth in money volume, and corporate value

following PQT (2000).

We found that fund performance is affected by the economic variables. Specifically, short-term interest rates and credit risk spread have negative impacts, and growth in money stock and corporate value have positive effects on the performance of overall investment. However, the relationships do not hold in the sub-period results of business cycles. While short-term interest rates and credit risk spread have negative effects exclusively in recession periods, money stock growth and corporate value have positive impacts only in expansion periods. Since these patterns appeared in internal and outsourcing investments, a strategy considering the effects of economic variables is important.

We also found that the fund performances of overall, internal, and outsourcing investments over the benchmark are better in high volatility periods than in low volatility periods. Therefore, fund outperformance mainly occurs in recession periods, which is consistent with most foreign studies. We use the Carhart (1997) model to analyze what factors affect the pension fund performance. We estimate the regime-switching model, where the explanatory variables are the firm size (SMB), book-to-market (HML), and momentum (UMD) factors. We found that the relationship between pension fund performance and risk factors varied with business cycles.

In general, fund managers are assessed as being superior when their performance is superior to the benchmark and vice versa. Since the National Pension Service (NPS) in Korea pays performance-based bonuses to fund managers, the NPS has emphasized quantitative aspects to evaluate the fund's performance. However, the fund manager's abilities (performance over the benchmark) may vary depending on economic conditions, not over time. For example, under the weak economy, the performance would be more dependent on economic conditions than the fund manager's ability. Therefore, when assessing fund managers' abilities, not only quantitative performance but also qualitative assessment - economic conditions - become important. In a nutshell, the empirical findings suggest that it is necessary to evaluate performance by consid-

ering economic fluctuations.

Acknowledgments

This paper is based in part on the research project of time-varying performance measure of pension fund at the National Pension Research Institute. The second author thanks to Seungjin Jo for organizing the resources systematically.

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