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Time-Varying Fund Manager Skill in Korea

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A B S T R A C T

Purpose: This study utilizes the KNV measure to evaluate performance of national pension funds of Korea.
Design/methodology/approach: First, this study investigates whether fund managers pick stocks in expansions and time the market in recessions. Second, we examine skilled funds that have both high picking skill in booms and high timing skill in recessions. Third, we examine whether skilled managers have timing ability as well as picking ability. Finally, persistence of skill indexes is investigated.
Findings: First, market timing skill is more relevant in recessions whereas stock selection skill is more relevant in expansions. Second, the performance differences between superior and inferior funds are persistent over one-year. Finally, there is no evidence that the same fund managers who display superior stock picking skill in expansions show superior market timing skill in recessions.
Research limitations/implications: Since no institutions or organizations provide real-time indicators of the business cycle, switching strategy between timing and picking is not available.
Originality/value: This is the first research to analyze the national pension fund using KNV methodology in the Korean market.

Keywords: National pension fund, Business cycle, Market timing, Stock selection

I. Introduction

Since the fund performance can depend largely on the manager's capability or skill, the performance evaluation should be based on accurate measurements of fund performance. The fund performance is measured by the risk-adjusted alpha, which is the difference between the actual return of the fund and the benchmark return. The benchmark returns are originally derived from the capital assets pricing model (CAPM). Since the CAPM of Jensen (1968), the three-factor model of Fama and French (1993) and the four-factor model of Carhart (1997) have appeared to gauge the excess return. All the models of Jensen (1968), Fama and French (1993), and Carhart (1997) estimate the fund alpha based on factor betas, assuming the betas are not changing.

However, recent studies show that fund performance is related to changes in economic or market conditions. For example, Glode (2011), Kosowski (2011), de Souza and Lynch (2012), Banegas, Gillen, Timmermann, and Wermers (2013), and Kacperczyk, Nieuwerburgh, and Veldkamp (2014) report that the risk-adjusted returns are changing with market conditions. The

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fund performance, which is dependent on the fund manager's ability, will change if the factor betas change with market fluctuations. The fund manager's ability can be branched to stock selection ability and market timing capability. Kacperczyk, Nieuwerburgh, and Veldkamp (hereafter, KNV) (2014) found that fund managers mainly use market timing skills during the recession periods and stock selection skills during the expansion periods. They also argued that their skill index, a linear combination of market timing and stock selection abilities of fund managers, were valid and persistent. The recent empirical studies show that fund performances vary based on different economic conditions, so evaluation should consider the economic environment.

As of the end of 2020, the investment size of the national pension fund is about 834 trillion won or 905,724 trillion US dollars, and the fund intends to diversify its investment portfolio to domestic bonds and stocks, foreign stocks, and alternative investments. The investment size in domestic stocks is about 176.7 trillion won or 191,896.2 trillion US dollars, which is 21.2 percent of total funds. The overseas stocks investment size is about 192.8 trillion won or 209,380.8 trillion US dollars, which is 23.1 percent of its total funds. This is the first empirical study that analyzes whether the performance of the national pension fund of Korea varies with the business cycle.

Based on empirical results, the fund manager's ability will be assessed and practically used for the manager's selection process in the future. Specifically, if the results of this paper are similar to those of KNV (2014), good fund performance will be achieved by selecting fund managers with excellent market timing in recession periods and fund managers with excellent stock selection in expansion periods. In addition, long-term excess returns can be expected by selecting asset management companies or fund managers using the KNV index.

The research methodology of KNV(2014) was used only by Shin, Jung, and Hwang (2015) in Korea. However, they did not investigate the national pension fund, which is a public pension fund of Korea, although they analyzed domestic stock funds. Since the size of the national pension fund of Korea has grown to the world's third largest since 2015, with its influence or importance on domestic and overseas financial markets getting enormous, it will be necessary to analyze the fund. We can also compare the results of the national pension fund of this paper with those of domestic stock funds of Shin et al. (2015), since the research period has been set to the same as theirs.

To repeat, this study aims to analyze the impact of economic conditions on the performance of the national pension fund of Korea which is the third largest fund in the world. For this, we use KNV methodology which asserts fund managers to focus on different capabilities at different economic environments.

The rest of this paper is organized as follows. Section II reviews the previous literature. In Section III, we present data and empirical methodology. We report empirical results for diverse skills over time in Section IV. Section V concludes this paper.

II. Literature Review

A. Fund performance across market conditions

Glode (2011) argued that fund managers can adjust fund performance (risk adjusted returns) depending on economic conditions and that fund managers focus their efforts toward realizing higher performance in recession periods. Specifically, investors' consumption-marginal utility is greater in recessions than in expansions, so fund managers have incentives to achieve better performance in recession periods. He also demonstrated that the existing models of Jensen alpha, Fama-French alpha, and Carhart alpha cannot appropriately explain the fund's inferior performance in expansions and the fund's superior performance in recessions. If the performance of US active funds is measured based on the existing models, the average performance would be negative which means that active fund performance is worse than index fund performance. He found that US mutual fund perform-

ance was better in bad market conditions than in good ones.

Kosowski (2011) considered the state dependence relationship between risk (beta) and performance (alpha) motivated by Grinblatt and Titman's(1989) regime-dependent measurements. Specifically, he investigated the fund performance using CAPM alpha, Fama-French alpha and Carhart alpha, and found that the fund performance difference between expansion and recession periods is economically significant. He found negative fund performance in expansion periods using the regime-switching model. He also found positive fund performance in recession periods, where the investors' marginal utility of consumption is highest. In addition, he found that the factor betas of market, size, book-to-market, and momentum of the fund varies with the economic conditions. However, he did not distinguish between the fund managers' skills, which can be branched into marketing timing skills and stock picking skills.

Similarly, de Souza and Lynch (2012) investigated cyclical performance of the US mutual fund style using a Generalized Method of Moments (GMM) methodology. They argued that not all fund styles (growth and income, growth, capital gains, and income) yield counter-cyclical performance, while many fund styles show pro-cyclical or non-cyclical performance. Finally, Banegas, Timmermann, Gillan, and Wermers (2013) found that performance of funds invested in a particular country is better than that of funds invested in Europe as a whole, and that the performance changes depending on time and economic conditions. In addition, they reported that some macro-variables are helpful in locating funds with outperformance and that country-specific funds provide the best opportunities for fund rotation strategies exploiting macroeconomic information.

B. Fund manager's skill

KNV (2014) assumed that fund managers' skills could be divided into two dimensions: market timing and stock selection, which have always been and still are used for fund management. They argued that fund managers' market timing and stock selection skills vary over the economic situation. Specifically, if a fund manager has funds for many years, it is assumed that the fund manager with excellent stock selection skills uses skill to select undervalued stocks, and the fund manager with excellent market timing skills also utilizes skill to achieve better performance than the benchmarks through asset allocation. They also demonstrated whether funds with stock selection skills or funds with market timing skills exist.

The fund managers' skills were analyzed in two ways. First, they analyzed whether the fund manager's ability to select stocks exists independent of market and economic fluctuations. In other words, they analyzed whether there are areas where a fund manager's skill to select stocks exercised well or poorly depending on market movements. Second, they analyzed whether the same fund manager uses the skill to select stocks for a certain period of time, and uses the skill for market timing in other times. They found evidence for stock selection in boom periods and market timing in recession periods. They also found that the skilled fund manager who picks stocks well in expansion periods also time the market well in recession periods.

This paper empirically analyzes whether fund managers of the national pension fund mainly use market timing skills in recession periods and stock picking skills in expansion periods using methodology of KNV(2014). If the results are similar to theirs, we can expect excess returns of funds by selecting asset management companies or fund managers using the skill index of KNV (2014). Specifically, we can expect good fund performance by choosing fund managers with market timing skill in the recession period and fund managers with stock picking skill in the expansion period.

III. Data and Methodology

A. Outsourcing investment of national pension funds

According to the National Pension Investment Guidelines, domestic stock investment is classified as internal (or direct) investment and outsourcing (or external) investment. As of the end of 2013, internal investments and outsourcing investments are about 50 percent each. Internal investment is intended for passive style and it is managed by personnel of the national pension system. Outsourcing investment is intended for active style, and this paper deals with outsourcing investment. There are two ways in which funds are allocated in outsourcing investment: the first is to evaluate existing asset management companies and allocate additional funds, and the second is to select new asset management companies and inject funds.

Evaluation of existing asset management companies, which is the former, is conducted every half year by examining aspects such as career and stability of management personnel, fund performance, and the investment process. Additional funds will be allocated to excellent asset management companies. Selection of a new asset management company, which is the latter, is conducted through the proposal evaluation, on-site inspection, and the selection committee evaluation. New company is also evaluated every half a year, and is replaced if its fund performance is poor.

B. Data

The data on the funds are from KG Zeroin's Inc., which provides comprehensive information on financial investment products including funds in Korea. Information on funds can be divided into three categories. First, fund performance data with the status of the previous day's results are provided daily through the Financial Investment Association. Second, information on the fund portfolio is provided on a monthly basis with the status of its holdings at the end of the month. Third, data of the fund characteristics, such as transaction costs and turnover, are provided monthly. The research period is from March 2003 to May 2014 because of constraints in simultaneous use of funds and stocks data.

We use the business cycle classified by Statistics Korea, a government agency. The agency has classified the nation's business cycles from the first cycle to the 11th cycle. The 10th cycle includes the expansion period from March 2009 to August 2011 and the recession period from September 2011 to March 2013. The 11th cycle includes the expansion period from April 2013 to May 2014. It is known that the business cycle classified by the Bank of Korea is similar to that by Statistics Korea.

C. Stock selection and market timing

We use the research methodology developed by KNV(2014). The following is their measurement of market timing and stock selection skills. If an investor times the market, he is more (less) exposed to the market portfolio in periods when the realized market return is high (low). In a similar way, stock selection means holding more (less) of a stock in periods when the firm's realized stock return is high (low).

For fund j at time t, $Stock\ Selection_t^j$ measures how a fund's holdings of each stock i, relative to the market, comove with the idiosyncratic component of the stock return. A fund with a high stock selection overweights (underweights) stocks that have subsequently high (low) idiosyncratic returns. Specifically, the estimates of the product of a fund's portfolio weights in deviation from market weights and the firm-specific component of stock returns for each firm are constructed.

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

where

$\omega_{i,t}^j$: the fraction of fund j's total assets held in stock i at the start of time t

$\omega_{i,t}^m$: the fraction of total market capitalization

in stock I at the start of time t

$\beta_{i,t}$: the beta of stock i at the start of time t (estimate using monthly data over the past 12 months from t-1)

R_{t+1}^i : the stock i return between the start of t and the start of t+1

R_{t+1}^m : the benchmark return between the start of t and the start of t+1

Similarly, $Market\ Timing_t^j$ measures how a fund's holdings of each asset, relative to the market, comove with the systematic component of the stock return. Before the market return rises (declines), a fund with a high timing skill overweights (underweights) stocks that have high betas. Specifically, the estimates of the product of a fund's portfolio weights in deviation from market weights and the aggregate component of stock returns for each firm are constructed.

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

Both measurements are variants of the performance measures of Grinblatt and Timan (1993) and Daniel, Grinblatt, Titman, and Wermers (1997).

D. Skills and market conditions

The skilled managers would rebalance their portfolios after analyzing the business cycle. They choose portfolio holdings that comove more with firm-specific information in expansion periods. Conversely, they select holdings that comove more with the aggregate shock in recession periods. For this, KNV (2014) estimated the following panel regression model.

$$Stock\ Selection_t^j = a_0 + a_1 Recession_t + a_2 X_t^j + \epsilon_t^j \qquad (3)$$

$$Market\ Timing_t^j = b_0 + b_1 Recession_t + b_2 X_t^j + \epsilon_t^j \qquad (4)$$

where

$Recession_t$: an indicator variable equal to 1 if the economy in month t is in recession,

as defined by Statistics Korea, and 0 otherwise

X_t^j : a vector of control variables for j fund at month t

We included the following KNV's control variables that are demeaned:

- ln(Age): natural logarithm of age in months since inception
- ln(TNA): natural logarithm of total net assets
- Turnover: turnover rate
- Flow: percentage flow of new funds
- Size: value-weighted score of its stock holdings' quintile scores calculated based on the stocks' market capitalizations
- Value: value-weighted score of its stock holdings' quintile scores calculated based on the stocks' book-to-market ratios
- Momentum: value-weighted score of its stock holdings' quintile scores calculated based on the stocks' past 12-month returns

In the stock selection equation, the constant a_0 indicates the picking skill level in expansion periods, and a_1 denotes how much skill increases in recession periods. Likewise, in the market timing equation, the constant b_0 indicates the timing skill level in expansions, and b_1 denotes how much skill increases in recessions.

Table 1 shows descriptive statistics and correlations among variables we used.

The values in Panel A of Table 1 are pre-demeaned. The mean of return is 1.46% per month. Whereas market timing has negative values, stock selection has positive values. Among the Pearson correlation coefficients in Panel B of Table 1, the correlation between market timing and stock selection, which is the focus of interest, is -0.847, showing a very strong negative value. This indicates that if market timing is good, the stock selection is not, and vice versa. The strong negative correlation also forces the signs of correlation between market timing and other variables in the opposite direction to those between the stock selection and the same other

Table 1. Summary Statistics

	Panel A: Descriptive Statistics									
	Return	Market Timing	Stock Selection	Recession	ln (AGE)	ln (TNA)	Flow	Size	Value	Momentum
Mean	1.46	-0.07	0.10	0.42	3.40	25.80	0.01	1.05	4.14	2.31
Std. Dev.	5.91	2.10	2.52	0.49	1.07	1.30	0.08	0.11	0.30	0.55
Minimum	-23.62	-15.78	-15.03	0.00	0.00	22.94	-0.55	0.00	0.00	0.00
Maximum	20.70	11.99	17.42	1.00	5.04	28.61	1.39	1.84	4.83	3.90
	Panel B: Pearson Correlation Coefficients									
	Return	Market Timing	Stock Selection	Recession	ln (AGE)	ln (TNA)	Flow	Size	Value	Momentum
Return	1.000									
Market Timing	-0.102	1.000								
Stock Selection	0.153	-0.847	1.000							
Recession	-0.156	0.127	-0.160	1.000						
ln(AGE)	-0.001	-0.059	0.037	-0.196	1.000					
ln(TNA)	-0.040	-0.023	0.028	-0.344	0.484	1.000				
Flow	-0.014	-0.014	0.014	0.058	0.015	0.048	1.000			
Size	0.045	-0.234	0.198	-0.223	0.091	0.017	-0.046	1.000		
Value	0.031	-0.229	0.128	0.168	-0.122	-0.142	-0.033	0.062	1.000	
Momentum	0.133	-0.111	0.127	-0.418	0.183	0.079	-0.064	0.329	-0.118	1.000

variables. Specifically, the market timing has a positive relationship with recession, while it has negative relationships with control variables, which are ln(AGE), ln(TNA), Flow, Size, Value, and Momentum. On the contrary, stock selection has a negative relationship with recession, whereas it has positive relationships with the control variables.

E. Same managers vs. both abilities

KNV(2014) examined whether some managers have timing ability as well as picking ability. Specifically, they analyzed and found that the same funds that exhibit stock selection ability in expansion periods also show market timing ability in recession periods. For application to the national pension fund, this paper first identifies outsourcing funds with superior stock selection skill in expansions: for all expansion months, we choose the highest 25% fund-month observations using $Stock\ Selection_t^j$. We then make

the dummy variable $T25_t^j$, that is equal to 1 for the upper 25% funds and 0 otherwise. We finally estimate the following panel regression model for expansions and recessions, respectively. The coefficient of interest is c_1.

$$Stock\ Selection_t^j = c_0 + c_1 T25_t^j + c_2 X_t^j + e_t^j \qquad (5)$$

$$Market\ Timing_t^j = c_0 + c_1 T25_t^j + c_2 X_t^j + e_t^j \qquad (6)$$

where

$T25_t^j$: an indicator variable for the upper 25% of funds

X_t^j : a vector of previously defined control variables

KNV found that $T25_t^j$ funds are significantly better at stock selection in expansion periods. They also reported that the same funds are better at market timing in recession periods.

F. Skilled funds

Previous results of KNV reported that $T25_t^j$ funds present both high stock selection ability in expansions and high market timing ability in recessions. However, if skilled funds switch between stock selection and market timing, the funds should outperform unskilled funds both in expansions and in recessions. They examined whether the performance of $T25_t^j$ funds outperform all other funds across the business cycle. The dependent variables were CAPM, Fama and French's three-factor, and Carhart's four-factor alphas, and the explanatory variables were previously described ones.

G. KNV index

KNV (2014) presented *Skill Index* for an investor or an agency who wants to form a timely gauge of funds' skill. They linearly combined the abilities which put more emphasis on stock selection skill in expansion and market timing skill in recessions, respectively. Specifically, they define the index for fund j in month t+1 as a weighted average of *Market Timing* and *Stock Selection*, depending on the state of business cycle:

$$Skill\ Index_{t+1}^j = \omega_t Market\ Timing_t^j \qquad (7)$$
$$+ (1-\omega_t)Stock\ Selection_t^j$$

where
ω_t : probability of recessions
$1\text{-}\omega_t$: probability of expansions
$Market\ Timing_t^j$: normalized (a mean of zero and a standard deviation of one) market timing skill for j fund at the beginning of time t
$Stock\ Selection_t^j$: normalized (a mean of zero and a standard deviation of one) stock selection skill for j fund at the beginning of time t

KNV used the probability of Chauvet and Piger (2008) for real-time of business cycles. However, we generated real-time indicators of the business cycle

by linear discriminant analysis described in Appendix because none of the entities provide real-time indicators of business cycles in Korea.

H. Persistence of KNV index

This paper also examines the persistence of market timing, stock selection, and KNV's skill index. For this, we first sort funds into quintiles (bottom Q1 to top Q5) based on scores of market timing, stock selection, and KNV's skill index, respectively. We then analyze the differences of Q1 and Q5 in three skill scores over 12 months.

IV. Empirical Results

The empirical results about the outsourcing stock funds of the national pension using KNV's methodology are as follows.

A. Skills vs. market conditions

Table 2 shows the differences in market timing ability and stock selection ability across the business cycle using pooled panel regression model. Column (1) reports the effect of recessions on market timing ability without a vector of fund-specific control variables (unconditional model). Column (2) presents the effect of recessions on market timing ability with a vector of fund-specific control variables (conditional model). Likewise, column (3) reports the effect of recessions on stock selection ability without a vector of fund-specific control variables (unconditional model). Column (4) presents the effect of recessions on stock selection ability with a vector of fund-specific control variables (conditional model).

Columns (1) and (2) show that market timing skill increases significantly in recession periods. Since market timing is expressed on a monthly basis, the

columns imply that market timing skill is 41 basis points per month or 4.92% per year higher in recession periods than in expansion periods. Similarly, columns (3) and (4) show that stock selection ability decreases significantly in recession periods. The columns imply that market timing skill is 72.7 basis points per month, or 8.72% per year, lower in recession periods than in expansion periods. Therefore, the results show meaningful differences in market timing and stock selection ability across the business cycle.

We estimated this and subsequent specifications by using a pooled panel regression model, and calculating standard errors with 2-way clustering method along the fund and time dimensions. This method may solve the problem in a way that the errors, and

conditional on explanatory variables, could be correlated with the fund and time dimensions.

B. All managers vs. both abilities

If skilled managers choose to deploy different skills over the business cycle, we should observe variation in the use of skill among them most of the time. KNV assumed that the distribution of timing and selection skills should be more sensitive to the recession variable in the right tail than at the median. They estimated the models of equations (3) and (4) using quantile regression, and considered three different quantiles: 50th percentile (median, Q50),

Table 2. Market Timing and Stock Selection Skills with Business Cycle

	(1) Market Timing			(2) Conditional Market Timing		
	Coeff.	Std. Err.	T-val.	Coeff.	Std. Err.	T-val.
Recession	0.480	0.114	4.20	0.416	0.135	3.08
ln(Age)				-0.127	0.048	-2.64
ln(TNA)				0.017	0.050	0.34
Turnover				-0.013	0.005	-2.90
Flow				-0.906	0.565	-1.60
Size				-3.156	0.454	-6.96
Value				-1.748	0.209	-8.37
Momentum				-0.176	0.123	-1.43
Constant	-0.278	0.107	-2.59	-0.251	0.118	-2.12
F-val.(p-val)	6.82 (0.01)			17.96 (0.00)		
Observations	2,986			2,986		
	(3) Stock Selection			(4) Conditional Stock Selection		
	Coeff.	Std. Err.	T-val.	Coeff.	Std. Err.	T-val.
Recession	-0.910	0.222	-4.09	-0.727	0.213	-3.41
ln(Age)				0.062	0.067	0.93
ln(TNA)				-0.036	0.083	-0.43
Turnover				0.013	0.007	1.82
Flow				0.972	0.833	1.17
Size				3.514	0.770	4.56
Value				1.342	0.369	3.64
Momentum				0.220	0.193	1.14
Constant	0.528	0.150	3.52	0.488	0.152	3.20
F-val.(p-val)	10.00 (0.00)			6.16 (0.00)		
Observations	2,986			2,986		

75th percentile (Q75), and 95th percentile (Q95). In this regression, bootstrapping (with 1,000 repetitions) is used for calculating standard errors. Table 3 shows the results of national pension funds.

The table shows that the effect of market condition on abilities is much stronger for excellent fund managers (Q95) than for the median fund managers (Q50). The effect is statistically significant, both for market timing and stock selection. Specifically, the effect of *Recession* on *Market Timing* for Q95 is more than seven times larger than that for Q50, at 8.7 versus 62.5 basis points per month. Also, the effect of *Recession* on *Stock Selection* for Q95 is about five times larger than that for Q50, at 33.2 versus 160.1 basis points per month. The results clearly indicate

that the effect of business cycle on abilities matters for excellent fund managers.

C. Same managers vs. both abilities

Whereas some fund managers might only have market timing ability, others might only have stock selection ability. To investigate whether some managers have both skills, we test the same funds which exhibit stock selection ability in expansion periods and show market timing ability in recession periods. We form the indicator variable $T25_t^j$, that is equal to 1 for the upper 25% funds and 0 otherwise, for all expansion periods. Table 4 shows the empirical results of pooled

Table 3. Skills and Market Condition

	Market Timing								
	(1) Q50			(2) Q75			(3) Q95		
	Coeff.	Std. Err.	T-val.	Coeff.	Std. Err.	T-val.	Coeff.	Std. Err.	T-val.
Recession	0.087	0.044	1.98	0.097	0.047	2.06	0.625	0.228	2.74
ln(Age)	-0.019	0.025	-0.77	-0.012	0.027	-0.43	0.055	0.100	0.55
ln(TNA)	0.006	0.022	0.27	-0.110	0.022	-5.09	-0.402	0.080	-5.04
Turnover	-0.009	0.002	-5.14	-0.013	0.002	-6.63	-0.021	0.005	-4.17
Flow	-0.367	0.356	-1.03	-0.260	0.265	-0.98	0.070	1.010	0.07
Size	-1.844	0.302	-6.10	-1.994	0.364	-5.47	-0.152	0.744	-0.20
Value	-1.360	0.141	-9.67	-2.005	0.104	-19.35	-3.237	0.394	-8.22
Momentum	-0.450	0.058	-7.82	-0.547	0.068	-8.07	0.012	0.191	0.06
Constant	0.039	0.025	1.55	0.771	0.028	27.13	2.502	0.090	27.85
Obs.	3,942			3,942			3,942		
	Stock Selection								
	(1) Q50			(2) Q75			(3) Q95		
	Coeff.	Std. Err.	T-val.	Coeff.	Std. Err.	T-val.	Coeff.	Std. Err.	T-val.
Recession	-0.332	0.075	-4.43	-0.624	0.085	-7.38	-1.601	0.282	-5.69
ln(Age)	-0.010	0.042	-0.25	0.096	0.038	2.50	0.260	0.128	2.03
ln(TNA)	-0.014	0.037	-0.39	-0.159	0.036	-4.39	-0.587	0.117	-5.03
Turnover	0.011	0.003	3.95	0.005	0.005	1.17	0.001	0.010	0.12
Flow	0.285	0.379	0.75	0.955	0.396	2.41	3.442	1.489	2.31
Size	2.420	0.411	5.89	4.644	0.594	7.82	7.417	2.914	2.54
Value	1.109	0.135	8.22	0.923	0.183	5.04	-0.585	0.482	-1.21
Momentum	0.345	0.062	5.57	0.006	0.092	0.07	-0.498	0.239	-2.08
Constant	0.132	0.043	3.09	1.480	0.070	21.28	4.856	0.278	17.46
Obs.	3,942			3,942			3,942		

panel regression models for expansions and recessions, respectively.

The results show that T25 funds that are significantly better at stock selection in expansion periods also display stock selection ability in recession periods. Specifically, The stock selection is 196.7 basis points per month or 23.6% per year higher for T25 funds than for the remaining funds in expansions. Also, the stock selection is 39 basis points per month or 4.68% per year higher for T25 funds than for the remaining funds in recessions. However, T25 funds unexpectedly show underperformance compared with the remaining funds in expansions as well as in recessions. On the contrary, T25 funds are better at stock selection and worse at market timing across market conditions.

In fact, Table 4 is intended to examine the characteristics of the same funds in recession periods which exhibited excellent performance in expansion periods. Since the analysis is focused on Column (2) and (4), there would be no endogeneity problem.

D. Skilled funds vs. returns

The skilled T25 funds exhibit stock selection ability

Table 4. Same Manager and Both Skills

	Market Timing					
	(1) Expansion			(2) Recession		
	Coeff.	Std. Err.	T-val.	Coeff.	Std. Err.	T-val.
T25	-1.970	0.174	-11.31	-0.257	0.148	-1.73
ln(Age)	-0.005	0.056	-0.09	0.146	0.045	3.22
ln(TNA)	-0.104	0.083	-1.25	-0.033	0.080	-0.41
Turnover	-0.005	0.007	-0.75	-0.013	0.008	-1.70
Flow	-2.365	0.643	-3.68	0.108	0.586	0.18
Size	-3.831	0.620	-6.18	-4.768	1.412	-3.38
Value	-1.300	0.308	-4.23	-2.413	0.550	-4.38
Momentum	0.138	0.253	0.54	-0.258	0.189	-1.37
Constant	0.173	0.103	1.68	0.240	0.102	2.36
F-val.(p-val)	16.54 (0.00)			4.86 (0.00)		
Obs.	1,732			1,254		
	Stock Selection					
	(3) Expansion			(4) Recession		
	Coeff.	Std. Err.	T-val.	Coeff.	Std. Err.	T-val.
T25	1.967	0.193	10.16	0.390	0.179	2.18
ln(Age)	-0.093	0.066	-1.41	-0.216	0.088	-2.45
ln(TNA)	0.182	0.095	1.91	-0.062	0.117	-0.53
Turnover	0.011	0.008	1.39	0.002	0.011	0.17
Flow	2.030	0.557	3.64	0.439	1.120	0.39
Size	3.047	0.718	4.24	5.415	1.653	3.28
Value	0.994	0.450	2.21	1.127	0.808	1.40
Momentum	0.213	0.282	0.75	0.095	0.261	0.36
Constant	-0.053	0.125	-0.42	-0.486	0.140	-3.47
F-val.(p-val)	3.02 (0.01)			12.97 (0.00)		
Obs.	1,732			1,254		

in expansion periods. Table 5 compares the performance of T25 funds to that of all other funds. The dependent variables are the average abnormal fund return, CAPM alpha, three-factor alpha, and four-factor alpha, and the explanatory variables are previously defined ones.

We find that, except for the average abnormal return, the CAPM, three-factor, and four-factor alphas are 3.1~6.4 basis points per month or 37~77 basis points per year higher for the T25 portfolio. We believe that the unexpected results of abnormal returns are caused by ignoring fund style characteristics. Therefore, the results show that outperformance of the highly skilled funds like T25 exists irrespective of business cycle.

E. KNV index

For application of the KNV index to the national pension funds, we sort each fund into one of five quintiles based on the KNV index each month, ranked from low to high. We then compute equal-weighted average portfolio returns for each quintile portfolio and estimate a time-series regression. Table 6 shows the average abnormal fund return, CAPM alpha, three-factor alpha, and four-factor alpha over the 1-, 3-, 6-, 9-, 12-month periods after formation of the portfolio.

The table shows that performance of national pension funds are increased monotonically with KNV index (from Q1 to Q5) except for three-month abnormal

Table 5. Skilled Funds

	(1) Abnormal Returns			(2) CAPM Alpha		
	Coeff.	Std. Err.	T-val.	Coeff.	Std. Err.	T-val.
T25	-0.034	0.070	-0.50	0.031	0.028	1.12
ln(Age)	-0.064	0.031	-2.03	-0.115	0.016	-7.10
ln(TNA)	0.004	0.044	0.08	0.062	0.014	4.43
Turnover	-0.005	0.004	-1.14	-0.004	0.001	-3.72
Flow	0.600	0.356	1.69	0.485	0.166	2.93
Size	0.627	0.364	1.72	0.695	0.089	7.77
Value	-0.042	0.159	-0.26	-0.196	0.058	-3.37
Momentum	0.032	0.149	0.21	-0.168	0.035	-4.75
Constant	0.279	0.078	3.58	0.232	0.030	7.83
F-val.(p-val)	1.83 (0.08)			7.05 (0.00)		
Obs.	3,942			2,943		
	(3) Three-Factor Alpha			(4) Four-Factor Alpha		
	Coeff.	Std. Err.	T-val.	Coeff.	Std. Err.	T-val.
T25	0.060	0.021	2.84	0.064	0.031	2.06
ln(Age)	-0.101	0.013	-7.81	-0.082	0.019	-4.26
ln(TNA)	0.066	0.016	4.05	0.052	0.017	3.07
Turnover	-0.005	0.001	-4.42	-0.004	0.002	-2.63
Flow	0.467	0.172	2.72	0.485	0.190	2.55
Size	0.188	0.077	2.44	-0.016	0.102	-0.15
Value	-0.057	0.064	-0.89	-0.147	0.079	-1.87
Momentum	-0.187	0.047	-3.98	-0.011	0.044	-0.24
Constant	0.138	0.031	4.46	0.081	0.032	2.51
F-val.(p-val)	4.16 (0.00)			2.23 (0.04)		
Obs.	2,943			2,943		

Table 6. Performance of KNV Index

	Abnormal Returns					CAPM Alpha				
	1 mo	3 mo	6 mo	9 mo	12 mo	1 mo	3 mo	6 mo	9 mo	12 mo
Q1	-0.631	0.243	0.246	0.172	0.210	0.051	0.067	0.087	0.086	0.054
Q2	-0.051	0.220	0.300	0.257	0.252	0.107	0.106	0.103	0.114	0.101
Q3	0.252	0.206	0.143	0.188	0.232	0.097	0.107	0.125	0.132	0.127
Q4	0.570	0.300	0.175	0.244	0.177	0.136	0.129	0.133	0.143	0.149
Q5	1.108	0.190	0.257	0.308	0.153	0.213	0.197	0.157	0.129	0.130
Q1 - Q5	-1.739	0.053	-0.011	-0.135	0.057	-0.162	-0.130	-0.070	-0.044	-0.076
Average	0.254	0.232	0.224	0.234	0.205	0.121	0.121	0.121	0.121	0.112
	Three-Factor Alpha					Four-Factor Alpha				
	1 mo	3 mo	6 mo	9 mo	12 mo	1 mo	3 mo	6 mo	9 mo	12 mo
Q1	0.152	0.165	0.157	0.146	0.143	0.015	0.031	0.044	0.040	0.019
Q2	0.179	0.174	0.176	0.185	0.177	0.065	0.064	0.074	0.079	0.069
Q3	0.178	0.177	0.183	0.187	0.186	0.070	0.080	0.092	0.107	0.104
Q4	0.223	0.222	0.231	0.224	0.221	0.102	0.092	0.091	0.100	0.109
Q5	0.294	0.291	0.282	0.283	0.258	0.170	0.155	0.120	0.095	0.073
Q1 - Q5	-0.142	-0.126	-0.126	-0.137	-0.115	-0.154	-0.123	-0.076	-0.054	-0.054
Average	0.205	0.205	0.205	0.205	0.197	0.084	0.084	0.084	0.084	0.075

returns. The different results of three-month abnormal returns could be caused by ignoring fund style characteristics. In general, the fund in the top quintile (Q5) of the KNV index performs substantially better than a fund in the bottom quintile (Q1).

We also examine the funds whether KNV index at time t+1 can predict fund performance, using the CAPM, three-factor, and four-factor alphas one month ahead and one year ahead. Table 7 reports the empirical results.

The table shows that performances of higher KNV index funds are better than those of lower KNV index funds only in the short-run. Specifically, the coefficient of the KNV index is positive and statistically significant for one-month-ahead alphas. However, the sign of the coefficient becomes mixed and insignificant for one-year-ahead alphas.

F. Persistence of skill measures

We examine the persistence of market timing, stock selection, and KNV's skill index using the national

pension funds. We subtract the average score in quintile 5 (Q5) from that in quintile 1 (Q1) in each of the following twelve months. The upper and lower limits indicate two standard errors of the point estimate in Figure 1. The graph shows whether the difference in three performance measures is maintained over twelve months, after forming five quintiles (Q1 to Q5).

If the difference between the top quintile (Q5) and the bottom quintile (Q1) is persistent, it would have a positive value over time. On the contrary, if the difference is not persistent, it would have a negative value or mixed signs. Figure 1 reveals that all three performance measures are positive over one year, and hence, market timing, stock selection, and KNV's skill index have considerable persistence.

We noted that outsourcing asset management companies of this study are constrained to invest in domestic stocks for more than 90% of the funds received from the national pension service at all times. On the other side, the companies in Shin et al. (2015) do not have the constraint. Due to this constraint, this study and Shin et al. (2015) differed in the following ways: First, this study finds that outsourcing

Table 7. Prediction of KNV Index

	One Month Ahead								
	CAPM Alpha			Three-Factor Alpha			Four-Factor Alpha		
	Coeff.	Std. Err.	T-val.	Coeff.	Std. Err.	T-val.	Coeff.	Std. Err.	T-val.
KNV Index	0.041	0.018	2.26	0.046	0.020	2.27	0.048	0.022	2.15
ln(Age)	-0.090	0.013	-7.02	-0.083	0.014	-5.97	-0.063	0.020	-3.20
ln(TNA)	0.037	0.014	2.54	0.040	0.018	2.20	0.017	0.017	0.96
Turnover	-0.004	0.001	-2.86	-0.005	0.001	-3.76	-0.004	0.002	-2.43
Flow	0.249	0.119	2.09	0.105	0.164	0.64	0.182	0.190	0.96
Size	0.655	0.122	5.35	0.012	0.140	0.09	-0.256	0.088	-2.91
Value	-0.195	0.071	-2.74	-0.191	0.078	-2.44	-0.265	0.095	-2.80
Momentum	-0.047	0.042	-1.12	-0.086	0.052	-1.66	0.090	0.042	2.15
Constant	0.227	0.028	8.09	0.143	0.033	4.38	0.098	0.031	3.18
F-val(p-val)	4.13 (0.00)			2.64 (0.01)			2.90 (0.01)		
Obs.	2,945			2,945			2,945		
	One Year Ahead								
	CAPM Alpha			Three-Factor Alpha			Four-Factor Alpha		
	Coeff.	Std. Err.	T-val.	Coeff.	Std. Err.	T-val.	Coeff.	Std. Err.	T-val.
KNV Index	0.005	0.009	0.50	-0.019	0.016	-1.14	-0.036	0.014	-2.59
ln(Age)	-0.006	0.012	-0.55	-0.014	0.011	-1.30	0.006	0.012	0.55
ln(TNA)	-0.023	0.012	-1.87	0.007	0.015	0.49	-0.008	0.013	-0.58
Turnover	-0.001	0.001	-0.84	0.000	0.002	0.13	0.000	0.002	0.09
Flow	-0.078	0.145	-0.54	-0.283	0.181	-1.56	-0.127	0.168	-0.76
Size	0.105	0.149	0.71	-0.250	0.086	-2.90	-0.506	0.081	-6.27
Value	-0.476	0.079	-5.99	-0.429	0.096	-4.48	-0.477	0.094	-5.07
Momentum	-0.031	0.040	-0.78	0.011	0.054	0.20	-0.005	0.045	-0.10
Constant	0.198	0.023	8.77	0.111	0.027	4.17	0.074	0.023	3.19
F-val(p-val)	3.67 (0.00)			2.03 (0.06)			3.03 (0.01)		
Obs.	2,738			2,738			2,738		

companies display different tasks of market timing skills and stock selection skills even in recession periods, in spite of holding stocks constraint. Second, outsourcing companies have limited short-term prediction ability due to the constraint. Specifically, we found that it displays lower short-term future prediction ability than the one from Shin et al. (2015). Third, despite the constraint, the long-term future prediction power of outsourcing companies is slightly higher than that of Shin et al. (2015). This may imply that the national pension service is selecting excellent asset management companies.

V. Conclusion

In assessing fund performance or fund managers' abilities, the CAPM of Jensen(1968), the three-factor model of Fama and French(1993), and the four-factor model of Carhart(1997) are traditionally used. These models assume that factor betas are constant in measuring asset returns and risk. However, more recent studies reported that the fund performance is related to change in business cycle (Glode, 2011; Kosowski, 2011; de Souza and Lynch, 2012; Banegas. et al., 2013; KNV 2014). These studies argue that
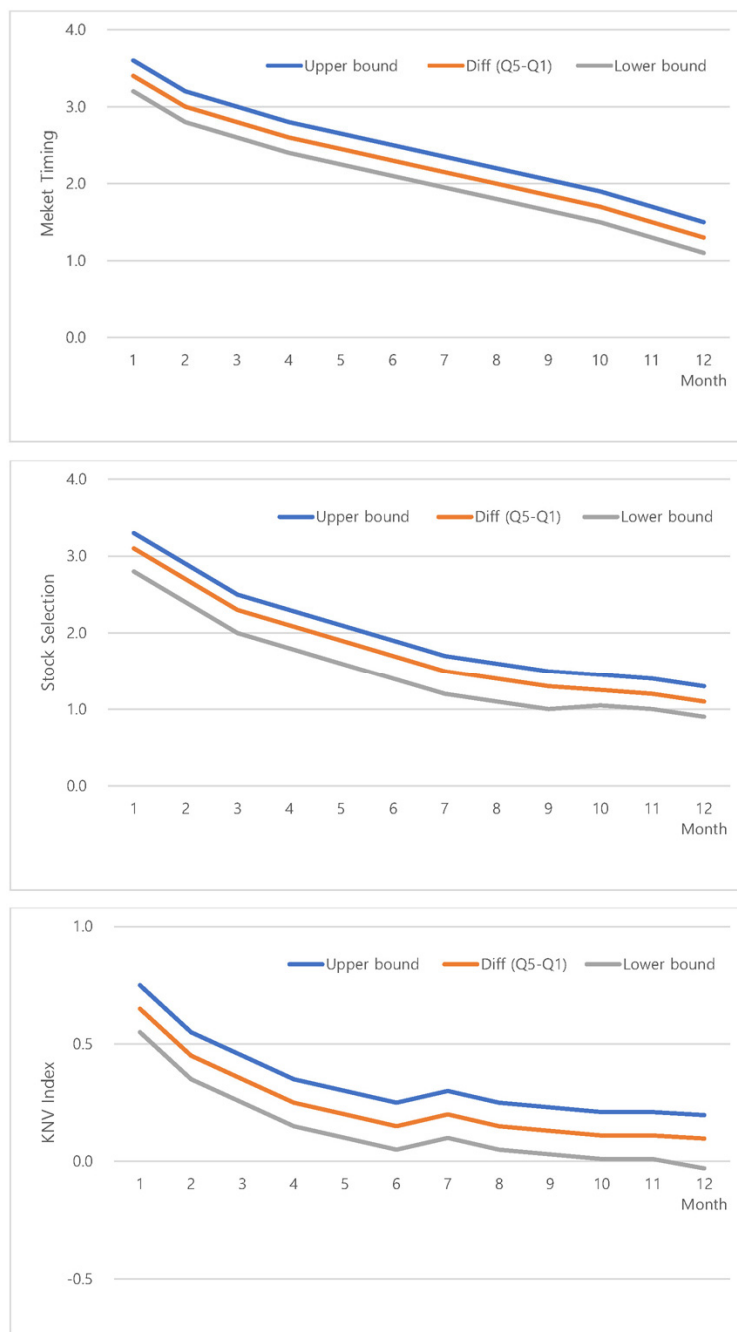
Figure 1. Persistence of Timing, Selection, and KNV Index

when assessing fund managers' abilities, business cycle or market conditions should be considered. Moreover, KNV (2014) demonstrated that skilled managers deployed their skills differently over the market conditions. Specifically, skilled managers employed their stock selection ability in expansion periods and utilized their market timing ability in recession periods.

This is the first research paper to analyze the national pension fund of Korea which is the third largest fund in the world using KNV methodology. This study analyzes whether the performance of outsourcing funds of the national pension system varies with the business cycle from March 2003 to May 2014 in the Korean market using KNV methodology. The results are similar to KNV in the following. First, the fund managers deploy market timing skills in recession periods and stock selection skills in expansion periods. Second, highly skilled funds like T25 outperform all other funds in terms of CAPM, three-factor, and four-factor alphas across expansions and recessions. Third, the performance of higher KNV index funds are better than that of lower KNV index funds and the persistence of KNV's skill index is considerable. The first result, which is also the most important result in this paper, implies that the fund managers process information about economy-wide conditions in a way that enhances the values.

The results not consistent with KNV are as follows. First, highly skilled funds like T25 show stock selection ability - not market timing ability - in recession periods. Second, the performances of T25 are inferior to those of the remaining funds across the market conditions. The results imply that fund managers do not deploy both market timing skill and stock selection skill with respect to market conditions.

The following could be the causes of different results from KNV, which also act as limitations to this study. First, most benchmarks of domestic stock funds in Korea are the market returns. We find that funds that actively use market timing strategy are rare, since the most important objective of such funds is to follow the benchmark return. In addition, portfolio rebalancing is normally rare and, in particular, rebalancing is very limited for outsourcing stock funds of the national pension system. Second, the switching strategy between market timing and stock selection is not available, because no institutions or organizations provide real-time indicators of the business cycle at this time in Korea. Also, our results are very similar

to Shin et al. (2015) which analyzed domestic stock funds of Korea. The similarity might be caused by the unique characteristics of the Korean market. Cross-country differences in the financial system might play a role in explaining the variants of financial performances among countries. These may be the limitations of this study and the challenging tasks of future research.

Acknowledgments

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Appendix. Skills vs. indicators

KNV used the probability of Chauvet and Piger (2008) as real-time indicators of business cycles. However, Statistics Korea categorizes business cycles into expansions or recessions in two to three years. Moreover, there are no institutions or organizations that provide real-time indicators of business cycles in Korea. We generate real-time indicators of the business cycle by linear discriminant analysis (LDA) which uses information of business leading index, business coincidence index, and business lagging index released by Statistics Korea. LDA makes predictions by estimating the probability of belonging to each business cycle. The cycle that gets the highest probability is the output cycle.

We examine whether the results of Table 2 utilizing the business cycle of Statistics Korea hold for real-time indicators of the business cycle. Table A shows the market timing ability and stock selection ability for real-time indicators of the business cycle using the pooled panel regression model. Column (1) presents the effect of real time recessions on market timing ability with a vector of fund-specific control variables (conditional model). Likewise, Column (2) presents the effect of real time recessions on stock selection ability with a vector of fund-specific control variables (conditional model).

Table A. Market Timing and Stock Selection Skills with Indicators

	(1) Market Timing			(2) Stock Selection		
	Coeff.	Std. Err.	T-val.	Coeff.	Std. Err.	T-val.
Real Time Recession	0.413	0.143	2.89	-0.572	0.219	-2.62
ln(Age)	-0.116	0.047	-2.49	0.051	0.055	0.93
ln(TNA)	-0.019	0.052	-0.36	0.039	0.068	0.58
Turnover	-0.015	0.005	-3.23	0.014	0.006	2.28
Flow	-0.835	0.577	-1.45	0.866	0.752	1.15
Size	-3.271	0.451	-7.25	3.243	0.654	4.96
Value	-1.708	0.216	-7.91	1.192	0.345	3.45
Momentum	-0.170	0.129	-1.32	0.207	0.189	1.10
Constant	-0.232	0.120	-1.93	0.328	0.153	2.14
F-val.(p-val)	13.64 (0.00)			5.63 (0.00)		
Observations	3,942			3,942		

The results of this table are very similar to those of Table 2. Specifically, the real-time recession for market timing ability is almost identical to that of Table 2. In addition, the real-time recession for stock selection ability is somewhat weaker than the result of Table 2 due to increased standard error.