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Do Economicand Technical Variables Matter on Equity Premium Forecasting?: An Evidence of the Korean Stock Markets*

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〈Abstract〉

Stock return forecasting is a long-lasting issue in the field of finance. This study investigates on the equity premium predictability of economic and technical indicators in the Korean stock markets. To this end, we select a set of 33 technical and 14 economic variables for KOSPI 200 and KOSDAQ index and extract the principal components of these variables by principal component analysis (PCA). Then, based on a standard predictive regression framework, the variables and principal components' predictability on the equity premium and the investor sentiment are examined. Also, we test the relationship between investor sentiment and the equity premium. The major results of this study are as follow: First, economic variables have a reliable predictive power on equity premium compared to technical variables. Technical indicators have an explanatory power during economic expansions, and a considerable improvement in explanatory power is achieved by controlling the economic conditions and combining the principal components extracted from the two predictor groups. Second, technical indicators better detect the changes in the sentiment of investors than the economic variables do. The predictive power of technical indicators of investor sentiment is more robust in the KOSDAQ market than in the KOSPI 200 market, regardless of economic conditions. Third, in the KOSPI market, where institutional investors have a relatively high share of trading, investors appear to consider all three types of technical indicators in their investment decisions. On the other hand, in the KOSDAQ market, where the proportion of individual investors is high, investors tend to rely on price indicators.

Keywords : Equity Premium, Predictability, Economic Variables, Technical Indicators, Principal Component Analysis, Investor Sentiment

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Ⅰ. Introduction

The efficient market hypothesis (EMH) explains that stock prices are always of fair value because they fully and instantaneously reflect all available information. Notably, in scenarios of semi-strong form efficiency, neither fundamental nor technical analysis can achieve abnormal returns (Malkiel and Fama, 1970). Nevertheless, numerous studies discover and highlight the stock return predictability of fundamental and technical variables. Several studies report the forecasting power of valuation ratios (Campbell and Shiller, 1988; Fama and French, 1988, 2002), while some report the effects of inflation and interest rates on stock returns (Schwert, 1981; Ratanapakorn and Sharma, 2007). On the other hand, a few papers emphasize the profitability of technical analysis, moving average (Brock, Lakonishok, and LeBaron, 1992), momentum (Jegadeesh and Titman, 1993), and trading volume (Gervais, Kaniel, and Mingelgrin, 2001).

Recent studies put more effort into forecasting the equity premium[1] rather than average stock returns (Goyal and Welch, 2003, 2008; Neely, Rapach, Tu, and Zhou, 2014; Baetje and Menkhoff, 2016). Neely et al. (2014) incorporate economic and technical indicators in predicting the equity premium of the S&P 500. They demonstrate that technical indicators outperform economic variables in forecasting excess returns, both in-sample and out-of-sample tests. Moreover, these predictors play different roles in cyclical changes of recession and expansion, where technical indicators track a downturn in the equity premium after peaks in the business cycle and economic variables detect an upturn in the equity premium after the troughs. Also, they show that components from the principal component analysis (PCA) explicitly reveal the stable and complement forecasting power on equity premium. Overall, they summarize the significant role of technical indicators in the U.S. equity premium forecasting.

In Korea, many studies analyze the stock return predictability of economic and technical variables. Chung and Kim (2010) show that E/P (earnings-price) ratios well forecast the KOSPI returns. Kim and Yeo (2017) conclude that the D/P ratio has the most reliable forecasting power among economic variables. Kam and Shin (2017) report that interest

1) In this study, we use “equity premium” as the term “market risk premium of the stock market.”

rates (91-day CD) have significant predictive power on stock returns in the KOSPI 200 and the KOSDAQ markets. Kim and Cho (2003, 2004), using a moving average, trading range break, and filter rule analyses, show that strategies based on moving average and trading range break achieve higher daily returns than buy-hold strategies in the KOSDAQ market. Park (2011) shows that the relationship between expected return and volatility varies depending on the economic condition.

In an inefficient market, technical indicators can affect forecasting stock returns in three ways. First, long-run price reversals, momentums, and short-run reversals occur in the stock markets due to the investors' over- or under-reaction to information (De Bondt and Thaler, 1985; Jegadeesh and Titman, 1993; Lehmann, 1990; Jegadeesh, 1990). Second, in the market where information diffuses gradually across the investors, news-watchers under-react, momentum traders profit from trend-chasing strategy in the short-run (Hong and Stein, 1999). Third, investor sentiment explains the cross-section of the equity returns (Baker and Wurgler, 2006, 2007), and technical indicators better detect investor sentiment than economic variables (Neely et al., 2014).

Our research aims to find the novel implication on equity premium predictability of economic and technical variables in the Korean stock markets. We develop a bivariate regression model to regress excess returns with lagged predictors. We perform the predictive regression based on PCA after the bivariate regression analysis of 14 economic and 33 technical indicators. PCA incorporates the information from a large number of predictors in a predictive regression. Afterward, a regression analysis is conducted for each business cycle stage to see if there is a difference in the predictors' predictive power according to the business cycle situation. Finally, we test the relationship between investor sentiment and two types of predictors economic variables and technical indicators.

The major empirical results of this study are as follows: First, economic variables have a strong predictive power on equity premium compared to technical variables. Dividend-price ratio, dividend yield, and book-to-market ratio have the most significant coefficients, while technical variables have negative coefficients on equity premium in the predictive regression. Second, principal components from PCA steadily predict stock returns in all business cycle stages. Principal components of economic variables and compounded components of economic and technical variables show more stable and

improved effects on the equity premium forecasting. Third, technical indicators track the investor sentiment better than economic variables, especially in expansion stages and in the KOSDAQ market. Also, they have a reliable predictive power on forecasting the investor sentiment, which is known to have a significant correlation with equity premium. Our results suggest that the economic variables, including fundamental variables, have stable equity premium predictability regardless of the economic conditions in the Korean stock markets. However, technical variables that reflect investor sentiment better than economic variables have higher explanatory power in the expansion than in the recession and in markets with a high proportion of individual investors such as the KOSDAQ market.

In section Ⅱ we describe our data and empirical methods. In section Ⅲ we show our test results on the equity premium prediction. Section Ⅳ explains our findings on investor sentiment, and section Ⅴ concludes.

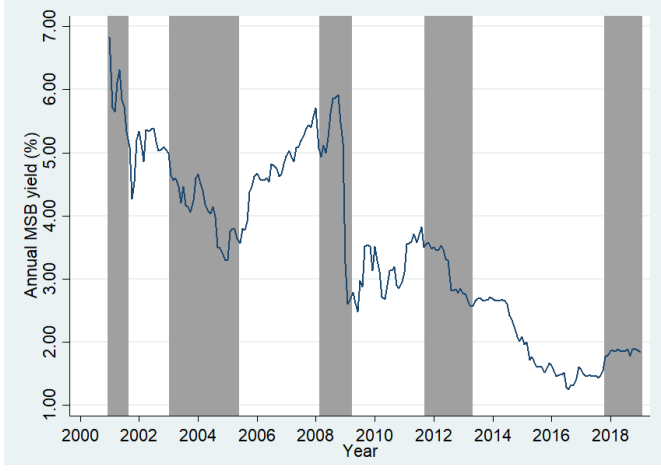
Ⅱ Data and Methodology

1. Data

Our sample comprises monthly data from December 2000 to December 2018, sum up to 217 months. Stock data, including prices, dividends, market capitalizations, earnings, and book-to-market values, are from FnGuide. Government and corporate bond data are from the Bank of Korea. Business cycles are determined and outsourced by Statistics Korea. The predicted variable, equity premium, is obtained by subtracting the risk-free rate from market returns, $EP = R_m - R_f$, where EP is the equity premium, R_m is the continuous compound return on the market, and Rf is the risk-free rate. We use monetary security bond (MSB) yield for the risk-free rate. The average monthly continuous compound return on the KOSPI 200 assets in our sample is 0.65%, with a minimum return of -23.5% and a maximum return of 20.8%. Assets in the KOSDAQ have more volatile returns compared to the KOSPI 200 assets, averaging 0.002% from a minimum of -35.8% to a maximum of 47.3%. The lowest annual risk-free rate is 1.25%, increasing up to 6.83% and displays an average of 3.48%.

[Figure 1] depicts the annual MSB yield from December 2000 to December 2018. The gray vertical lines refer to recession stages. At the beginning of the sample, the risk-free rate had a maximum of 6.83% but then suffered a catastrophic fall during the financial crisis. In 2018, the risk-free rate in Korea had been approximately 2% a year.

[Figure 1] Annual Risk-Free Rate on a Monthly Scale, December 2000～December 2018



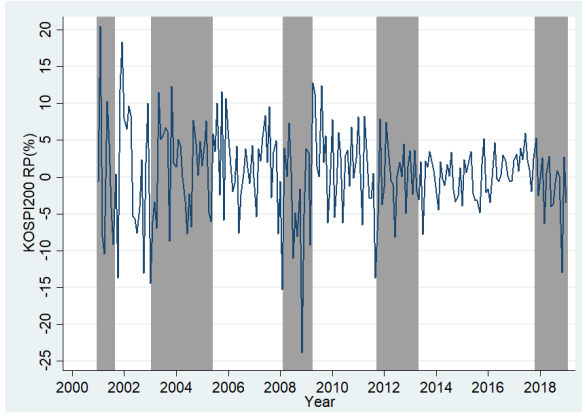
2. Measuring Equity Premium

Damodaran (2013) introduces three types of methods in measuring equity risk premium.[2] This paper implements the historical equity premium using log-returns of the historical KOSPI 200 and KOSDAQ indices.

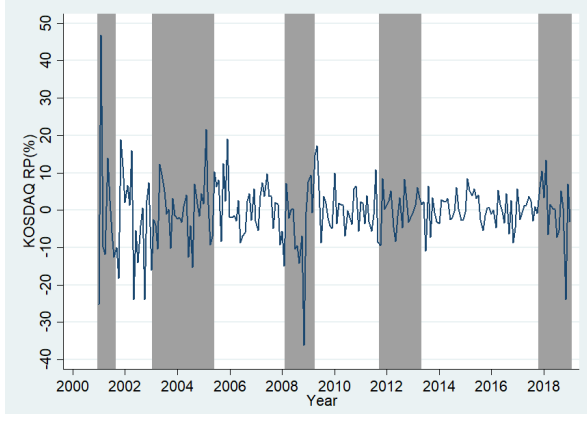
[Figure 2] illustrates the monthly equity premium in the KOSPI 200 from 2001 to 2018. The monthly equity premium shows similar trends with the stock returns. At the beginning of the sample, the equity premium reached 20.5%. Whenever the economy experienced recessions (shown in gray bars), the market equity premium declined significantly. Especially in the global financial crisis period, October 2008, the equity premium is -23.9%.

2) Damodaran, A. (2013), Equity risk premiums (ERP): Determinants, estimation, and implications-the 2013 edition, 23-117.

[Figure 2] Monthly equity premium in the KOSPI 200, January 2001~December 2018



[Figure 3] Monthly equity premium in the KOSDAQ, January 2001~December 2018



[Figure 3] shows the monthly equity premium in the KOSDAQ from 2001 to 2018. Equity premium was highest in January 2001, 46.9%. Three separate recessions in 2001, 2009, and 2018 (illustrated in gray bars) experienced large decreases in the market risk premium. A different feature from the KOSPI 200 is high volatility in the KOSDAQ that is observed over time.

3. Variables

Economic and technical indicators herein are based on the work of Neely et al. (2014), with exceptions for the long-term bond return and default return spread on account

of the data insufficiency. Instead, delta long-term bond yield and credit spread are implemented. For technical indicators, we add more "long-term" indicators in the desire of a more secure setting. The economic variables used are:

- Dividend-price ratio (DP): Log dividends minus log prices
- Dividend yield (DY): Log dividends minus log of lagged prices
- Earnings-price ratio (EP): Log earnings[3] minus log prices
- Dividend-payout ratio (D/E): Log dividends minus log earnings
- Market risk premium volatility (RVOL): Standard deviation of the daily risk premium for each month
- Book-to-market ratio (BM): Book value divided by market value of equity
- Net equity expansion (NTIS): Ratio of new shares issuance to number of shares outstanding
- Short-term yield (STY): One-year monetary stabilization bond(MSB) yield
- Long-term yield (LTY): Five-year government bond yield
- Delta long-term government bond yield (ΔLTY): Monthly change in five-year government bond yield
- Term spread (TMS): Difference between long-term government bond yield and one-year monetary stabilization bond yield
- Default yield spread (DFY): Difference between BBB-rated and AA-rated corporate bond yields, rated according to the investment-grade credit ranking system
- Credit spread (CDS): AA-rated corporate bond yield minus three-year government bond yield
- Inflation (INFL): Change in Consumer Price Index (CPI)

We implement technical indicators based on three widely utilized methods (Neely et al., 2014), namely, the moving average rule, momentum rule, and on-balance volume. There are 11 indicators for each of the methods, comprising a total of 33 technical indicators for use in predictive regressions.

3) Earnings of certain months in the KOSDAQ are negative; therefore, natural logs do not hold, we use the simple fraction of earnings to price for EP ratios and dividends to earnings for DE ratio in the KOSDAQ.

The following describes briefly the construction method of the technical indicators by the three methods. First, the process of extracting buy-sell signals from moving averages is as follows.

$$MA_{j,t} = (1/j)\sum_{i=0}^{j-1} P_{t-i} \text{ for } j = s,l \tag{1}$$

Equation (1) explains how we get simple moving averages, where P_t is the price level at month t, and j is either s (1, 2, 3) or l (3, 6, 9, 12). A higher value of short-term moving average sends buy signal or vice versa as illustrated in equation (2).

$$S_{i,t} = \begin{cases} 1 \ if \ MA_{s,t} \geq MA_{l,t} \\ 0 \ if \ MA_{s,t} < MA_{l,t} \end{cases} \tag{2}$$

In equation (2), signal $S_{i,t}$ is collected by comparing short-term and long-term moving averages. When the short-term moving average at time t, $MA_{s,t}$, is larger or equal to the long-term moving average at time t, $MA_{l,t}$, it infers that the price at time t is trending upward, thereby generating a buy signal at time t. On the other hand, when the short-term moving average at time t, $MA_{s,t}$, is less than the long-termmoving average at time t, $MA_{l,t}$, and then the price is trending downward at time t therefore, generating a sell signal. Based on equation (2), 61% and 51% of signals are buy-signals in the KOSPI 200 and the KOSDAQ indices, respectively.

The second technical method is a simple momentum strategy in which signals are obtained by (3), (4), and (5).

$$S_{i,t} = \begin{cases} 1 \ if \ P_t \geq P_{t-m} \\ 0 \ if \ P_t < P_{t-m} \end{cases} \tag{3}$$

$$S_{i,t} = \begin{cases} 1 \ if \ P_{t-2} \geq P_{t-m} \\ 0 \ if \ P_{t-2} < P_{t-m} \end{cases} \tag{4}$$

$$S_{i,t} = \begin{cases} 1 \ if \ P_{t-3} \geq P_{t-m} \\ 0 \ if \ P_{t-3} < P_{t-m} \end{cases} \tag{5}$$

This simple momentum strategy allows us to immediately detect positive or negative

momentum by comparing two price levels of different times. If the price at time t is larger or equal to the price at m (3, 6, 9, 12) periods ago, then positive momentum is in place, giving a value of 1 for $S_{i,t}$, and *vice versa*. Some papers are suggesting that momentum effects do not appear in the Korean markets.[4] Fortunately, we include past two to three months of momentum signals, as seen in (4) and (5). In our momentum analysis, 61% are buy-signs in the KOSPI 200, and 51% are in the KOSDAQ.

The final technical method is an on-balance volume strategy (Granville, 1963). Apart from the stock price, trading volume is an essential indicator in technical analysis practically and empirically. To obtain information from volume data, we define OBV_t as follows:

$$OBV_t = \sum_{k=1}^{t} VOL_k D_k \tag{6}$$

In equation (6), VOL_k is a measure of trading volume during period k, and D_k takes a value of one if P_k is larger or equal to P_{k-1}. Otherwise, D_k takes a value of zero. Summing the products of VOL_k and D_k for time t gives OBV_t. Each moving average on OBV is calculated by equation (7).

$$MA_{j,t}^{OBV} = (1/j)\sum_{i=0}^{j-1} OBV_{t-i} \; for \; j = s, l \tag{7}$$

And then the volume indicators are constructed from equation (8). The volume indicators generate the fewest buy-signals among all three measures in both KOSPI 200 and KOSDAQindices, 49% and 50%, respectively.

$$S_{i,t} = \begin{cases} 1 \; if \; MA_{s,t}^{OBV} \geq MA_{l,t}^{OBV} \\ 0 \; if \; MA_{s,t}^{OBV} < MA_{l,t}^{OBV} \end{cases} \tag{8}$$

4) Kim and Cho (2004) report that momentum only appears within the firm characteristics of small size and foreign investment in the KOSDAQ. Eom (2013) reports that momentum is not observed in either the KOSPI or the KOSDAQ market.

4. Empirical Method and Research Hypothesis

This section discusses our research hypothesis, regression models, and summary statistics.

Regression models testing the predictability of economic and technical variables on equity premium are given below.

$$r_t = \alpha_i + \beta_i x_{i,t-1} + \epsilon_{i,t} \tag{9}$$

$$r_t = \alpha_i + \beta_i S_{i,t-1} + \epsilon_{i,t} \tag{10}$$

In equation (9) and (10), r_t is the equity premium measured by the difference of monthly continuous compound returns of the Market (dividends included) and monthly MSB yields (log risk-free rate). The term $x_{i,t}$ is the economic variable available at time t, and $S_{i,t}$ is the technical indicator at time t. The term $\epsilon_{i,t}$ is a zero-mean disturbance term.

The null hypothesis, $H_0 : \beta_i = 0$, implies that none of the predictors can predict equity premium. However, we define $x_{i,t-1}$ and $S_{i,t-1}$ such that β_i is expected to be positive under the alternative hypothesis. Thereby, we test $H_0 : \beta_i = 0$ against $H_A : \beta_i > 0$.[5] Stambaugh (1999) argues that the t-value is inflated, thus more likely to reject the null hypothesis when a stochastic regressor such as dividend yield is input in a bivariate predictive model. To eliminate the heteroskedasticity features of the variables and replace inflated t-values, we conduct wild bootstrap methods. To do this, we first generate a large number of bootstrap samples by data generating process (DGP), and then each of the samples is used to compute t-statistics in the same test model of ours. Finally, the proportions of bootstrap t-statistics higher than the original ones become the unbiased p-values.[6]

<Table 1> reports summary statistics for the equity premium and economic variables in the sample periods of December 2000 to December 2018. The average monthly market risk premium in the KOSPI 200 is 0.51%, with a standard deviation of 5.99%, which

5) Theory and construction method of technical indicators suggest that the sign of β_i will be positive and Inoue and Kilian (2005) recommend a one-sided alternative hypothesis to increase the power of in-sample tests of predictability.

6) We first conduct 9999 times of bootstrapping procedure then find the proportions that bootstrap t-statistics higher than the original t-statistics (For details, see Roodman, Nielsen, MacKinnon, and Webb, 2019).

yields higher returns but more volatile than in the S&P 500.[7] The Sharpe ratio is 0.09 in the KOSPI 200 compared to 0.11 in the S&P 500, implicating that investors in Korea are compensated less for the higher risks. DP, DY, EP, and DE ratios in the KOSPI 200 are all lower than those in the S&P 500, indicating that shareholders in Korea are subject to lower dividend yields, earnings yields, and dividend payouts. The higher BM ratio of 0.96 in the KOSPI 200 compared to 0.54 in the S&P 500 shows that a larger proportion of value stocks compose the KOSPI 200. Term spread (TMS) in Korea is 0.49, where it is 1.64 in the U.S. that suggest the gap between long-term and short-term

<Table 1> Summary Statistics, KOSPI 200, 2000.12-2018.12

This table reports summary statistics of the KOSPI 200 market risk premium (in percent) and economic variables. Market risk premium (MRP) is the log return (dividends included) on KOSPI 200 index minus the continuous compound risk-free rate, one-year MSB yield. The Sharpe ratio is themean of MRP divided by its standard deviation. Dividend-price ratio (DP) is defined as the log dividend minus log price. Dividend yield (DY) is the log dividend minus log $price_{t-1}$. Earnings-price ratio (EP) is the log earnings minus log price. Dividend pay-out ratio (D/E) is the log dividend minus log earnings. Market risk premium volatility (RVOL) is defined as the standard deviation of risk premium each month. Book-to-Market ratio (BM) is equal to the book value divided by the market value of the equity. Net equity expansion (NTIS) is proxied by the ratio of new issuance to the number of shares outstanding. Short-term yield (STY) and Long-term yield (LTY) isproxied by one-year MSB and five-year government bond yields. Delta long-term government bond yield (ΔLTY) is the monthly change in five-year government bond yield. Term spread (TMS) is the difference between long-term government bond yield and one-year MSB. Default yield spread (DFY) is the difference between BBB- and AA- rated corporate bond yields and credit spread (CDS) is the difference between AA- rated corporate bond and three-year government bond yields. All of the bond data are scaled in annual percentage (%). Inflation rate (INFL) is obtained from the Consumer Price Index (CPI).

Variables	N	Mean	Std. Dev.	Min	Max	Autocorrelation	Sharpe ratio
MRP	217	0.51	5.99	-23.87	20.49	0.02	0.09
DP	217	-4.10	0.29	-4.64	-3.42	0.90	
DY	217	-4.09	0.29	-4.64	-3.42	0.90	
EP	217	-2.51	0.30	-3.50	-1.73	0.85	
DE	217	-1.59	0.30	-2.03	-0.34	0.84	
RVOL	217	0.06	0.03	0.02	0.24	0.63	
BM	217	0.96	0.16	0.57	1.51	0.84	
NTIS	217	0.00	0.04	-0.38	0.33	0.02	
STY	217	3.49	1.38	1.26	6.72	0.89	
LTY	217	3.98	1.47	1.25	7.24	0.89	
ΔLTY	217	-0.48	5.72	-16.83	23.16	0.25	
TMS	217	0.49	0.49	-0.50	2.08	0.88	
DFY	217	4.88	1.27	2.14	6.27	0.91	
CDS	217	0.75	0.57	0.22	4.38	0.76	
INFL	217	0.20	0.37	-0.74	1.19	0.27	

7) See Neely et al. (2014) for more information for S&P 500.

bond yields are lower in Korea. In other words, the spread between the five-year government bond yield (LTY) and the one-year monetary stabilization bond yield (STY) is 49 basis points.

<Table 2> shows the summary statistics in the KOSDAQ. Two novel findings in the KOSDAQ market are that the average risk premium is negative, and the returns are more volatile than in the KOSPI 200. The negative Sharpe ratio of -0.02 tells that investors in the KOSDAQ are compensated less than the investors in the bond market and the KOSPI 200. DP and DY ratios are all smaller than the U.S. and even smaller than those in theKOSPI 200. BM ratio of 0.68 explains more growth stocks comprise the KOSDAQ than the KOSPI 200.

<Table 2> Summary Statistics, KOSDAQ, 2000.12~2018.12

This table describes the summary statistics of the KOSDAQ market risk premium (in percent) and economic variables.

Variables	N	Mean	Std. Dev.	Min	Max	Autocorrelation	Sharpe ratio
MRP	217	-0.21	8.43	-36.22	46.87	0.00	-0.02
DP	217	-4.77	0.30	-5.34	-3.99	0.88	
DY	217	-4.76	0.30	-5.34	-3.98	0.86	
EP	217	0.01	0.03	-0.15	0.03	0.89	
DE	217	-0.68	4.21	-17.82	2.09	0.92	
RVOL	217	0.06	0.04	0.02	0.25	0.46	
BM	217	0.68	0.15	0.36	1.16	0.81	
NTIS	217	0.01	0.01	-0.05	0.05	0.31	
STY	217	3.49	1.38	1.26	6.72	0.89	
LTY	217	3.98	1.47	1.25	7.24	0.89	
ΔLTY	217	-0.48	5.72	-16.83	23.16	0.25	
TMS	217	0.49	0.49	-0.50	2.08	0.88	
DFY	217	4.88	1.27	2.14	6.27	0.91	
CDS	217	0.75	0.57	0.22	4.38	0.76	
INFL	217	0.20	0.37	-0.74	1.19	0.27	

Ⅲ Empirical Results

1. Forecasting Equity Premium

This section addresses the empirical outcomes from the standard bivariate predictive regressions. <Table 3> describes the estimation results for our models (9) and (10)

in both markets of KOSPI 200 and KOSDAQ.[8)]

<Table 3> Predictive Regression Results, 2001.01~2018.12

This table shows the bivariate predictive regression results for equity premium in Korean stock markets from Jan. 2001 to Dec. 2018. The regression model is $r_{t+1} = \alpha_i + \beta_i x_{i,t} + \epsilon_{i,t+1}$. Dependent variable, r_{t+1} is the equity premium of the month t+1, and the independent variables, $x_{i,t}$ are macroeconomic or technical variables of the month t. Only variables that are significant at least 10% level are reported in the table. t-statistics are reported in the parentheses. *, **, and *** describe the p-value significance level 10%, 5%, 1% respectively.

Panel A: KOSPI 200

Economic Variables	Coefficients	t-value	R-squared	Technical Indicators	Coefficients	t-value	R-squared
DP	3.43***	(2.50)	2.40%	MA 2-6	1.23*	(1.51)	0.59%
DY	3.46***	(2.58)	2.58%	MOM 2-3	2.01***	(2.50)	2.40%
EP	3.62**	(2.65)	2.74%				
BM	6.84**	(2.76)	3.01%				
NTIS	-12.01*	(-1.21)	0.22%				
ΔLTY	0.13**	(1.89)	-0.38%				
TMS	1.66**	(2.04)	1.45%				
INFL	-1.57*	(-1.43)	0.49%				

Panel B: KOSDAQ

Economic Variables	Coefficients	t-value	R-squared	Technical Indicators	Coefficients	t-value	R-squared
DP	3.39**	(1.94)	1.28%	MA 2-6	1.65*	(1.58)	0.70%
DY	3.87**	(2.25)	1.86%	OBV 1-3	1.45*	(1.40)	0.44%
BM	10.17***	(2.91)	3.38%	OBV 3-12	1.97**	(1.90)	1.21%
STY	-1.02***	(-2.71)	2.89%				
LTY	-0.85**	(-2.38)	2.14%				
DFY	0.69*	(1.68)	0.85%				

In <Table 3>, the dividend-price ratio, dividend yield, and book-to-market ratio have significant predictability on equity premium in both markets. BM ratio with the largest coefficient and highest R-squared in both markets, implies that value stocks are compensated higher returns in both Korean markets. Government bond yields (STY and LTY) show adverse effects on equity premium, leading a controversy with

8) Since stock returns contain partially unpredictable characteristics, variables with an adjusted R-squared value of more than 0.5% and significant coefficient estimates are identified and reported as having predictive power (Campbell and Thompson, 2007; Neely et al., 2014).

Ratanapakorn and Sharma (2007), where they argue the U.S. long-term government bond rates are positively related to stock prices in the S&P 500. In the U.S. market (Neely et al., 2014), thirteen out of fourteen technical indicators positively and significantly predict the risk premium. However, only a few technical indicators have predictive power in the Korean market. In the KOSPI market, volume indicators display minus coefficients, while price indicators show positive coefficients. MOM 2-3 is significant at the 1% level, and MA 2-6 is significant at the 10% level. A possible inference can be drawn that traders in the KOSPI 200 extract information from prices rather than trading volumes. In the KOSDAQ market, MA 2-6 and OBV indicators have significant positive effects, but momentum indicators have adverse effects on market risk premiums.

2. Predictive Regressions in the Business Cycle Stages

This section discusses whether the predictability of the predictors depends on the economic conditions. To this end, this study classifies economic conditions into expansion and recession stages and analyzes the predictive power of predictors in each stage. <Table 4> reports the empirical outcomes in the KOSPI 200 and the KOSDAQ throughout the cyclical changes. The Statistics Korea reports business cycle stages of recession and expansion.[9)]

In the KOSPI market, more economic variables and technical indicators have significant predictive powers on equity premium during the expansion than in the recession. Among economic variables, volatility, book-to-market ratio, government bond yields, default spread, and credit spread show significant positive predictive power. Dividend-related variables, however, have a negative relationship. The inflation rate, in support of Schwert (1989), displays a negative coefficient in the expansion. In the recession, however, most economic variables have no predictive power over equity premiums, and only the ratio of new shares to outstanding shares has a negative relationship. Technical indicators also show a significant negative relationship.[10)]

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9) http://kostat.go.kr/portal/korea/kor_nw/1/1/index.board?bmode=read&aSeq=377597.

10) The stock market is known to precede the economic conditions and our results in <Table 4> support this idea. Economic variables have negative (positive) coefficients in the recession (expansion) stages. Technical indicators in the KOSPI 200 (panel A and B) take the negative signs in the recessions, but these are changed to positive in the expansion stages.

<Table 4> Predictive Regressions by Business Cycles, 2001.01～2018.12

This table shows the bivariate predictive regression results for recession and expansion periods during Jan. 2001 to Dec. 2018. Recession periods, reported by Statistics Korea, are from Jan 2001 to Jul 2001, Jan 2003 to Apr 2005, Feb 2008 to Feb 2009, Sep 2011 to Mar 2013, Oct 2017 to Dec 2018. Expansion periods, reported by Statistics Korea, are from Aug 2001 to Dec 2002, May 2005 to Jan 2008, Mar 2009 to Aug 2011, Apr 2013 to Sep 2017. The regression model is $r_{t+1} \times D = \alpha_i + \beta_i x_{i,t} \times D + \epsilon_{i,t+1}$. Dependent variable, r_{t+1} is the equity premium of the month t+1 and the independent variables, $x_{i,t}$ are macroeconomic or technical variables of the month t. Each dependent and independent variable are multiplied by dummy variables indicating business cycle stages, D_{REC} or D_{EXP}. Only variables that are significant at least 10% level are reported in the table. t-statistics are reported in the parentheses. *, **, and *** describe the p-value significance level 10%, 5%, 1% respectively.

Panel A: Predictive regressions in Recessions, KOSPI 200

Economic Variables	Coefficients	t-value	R-squared	Technical Indicators	Coefficients	t-value	R-squared
NTIS	-13.88*	(-1.72)	0.90%	OBV 2-3	-1.38*	(-2.13)	1.62%
				OBV 2-6	-1.31*	(-1.92)	1.23%
				OBV 2-12	-1.45*	(-2.05)	1.48%

Panel B: Predictive regressions in Expansions, KOSPI 200

Economic Variables	Coefficients	t-value	R-squared	Technical Indicators	Coefficients	t-value	R-squared
DP	-0.17*	(-1.15)	0.15%	MA 1-3	1.33**	(2.17)	1.70%
DY	-0.17*	(-1.12)	0.12%	MA 1-6	1.10**	(1.81)	1.05%
DE	-0.46**	(-1.24)	0.25%	MA 2-6	1.50***	(2.49)	2.38%
RVOL	21.42**	(2.32)	2.01%	MOM 1-3	1.37**	(2.24)	1.85%
BM	1.31**	(2.05)	1.47%	MOM 2-3	1.70***	(2.79)	3.07%
ΔLTY	0.15*	(1.99)	1.36%	OBV 2-12	1.01*	(1.59)	0.71%
TMS	1.56**	(2.68)	2.80%	OBV 3-6	1.41**	(2.17)	1.71%
DFY	0.15**	(1.34)	0.37%	OBV 3-9	1.43**	(2.26)	1.89%
CDS	1.98**	(2.81)	3.12%	OBV 3-12	1.13*	(1.79)	1.02%
INFL	-2.91**	(-2.61)	2.64%				

Panel C: Predictive regressions in Recessions, KOSDAQ

Economic Variables	Coefficients	t-value	R-squared	Technical Indicators	Coefficients	t-value	R-squared
STY	-0.48*	(-2.67)	2.78%	-	-	-	-
LTY	-0.42*	(-2.48)	2.36%	-	-	-	-

Panel D: Predictive regressions in Expansions, KOSDAQ

Economic Variables	Coefficients	t-value	R-squared	Technical Indicators	Coefficients	t-value	R-squared
-	-	-	-	MOM 1-9	-1.28*	(-1.65)	0.80%
-	-	-	-	OBV 1-3	1.60*	(1.99)	1.37%

Compared to the KOSPI market, the predictive power of economic variables and technical indicators is significantly lower in the KOSDAQ market. In the recession, only government bond yield-related variables show a significant negative relationship, while in the expansion period, only the volume variable shows a positive relationship. The results of <Table 4> are different from those of Neely et al. (2014) where economic variables predict increasing equity premium near the business troughs, and technical indicators detect decreasing equity premium near the business peaks in the S&P 500. Overall, we get the positive predictive power of economic variables and technical indicators on equity premium in the expansion period. During the recession, most of these variables do not significantly predict the equity premium, and some variables have a negative relationship. In the case of the KOSDAQ market, the variables with significant predictive power during the expansion period are greatly reduced.

3. Predictability of Principal Components

This section conducts a principal component analysis (PCA) on economic variables and technical indicators and examines whether the principal components predict equity premiums. PCA is a statistical method that implements an orthogonal transformation to convert correlated variables into principal components.

Principal components of economic variables (PC-ECON) involve five distinct principal components by the process of compounding 14 economic variables. Principal components of technical indicators (PC-TECH) consist of six to seven components from the input of 33 technical indicators. Finally, 47 economic and technical variables make up the principal components-all (PC-ALL) that have ten to eleven components. We conduct additional predictive regressions with the three types of components.

The predictive regression model using principal component is as follows.

$$r_{t+1} = \alpha + \sum_{k=1}^{K} \beta_k \hat{F}_{k,t}^{j} + \epsilon_{t+1} \tag{11}$$

In equation (11), r_{t+1} is the equity premium (in percent), and $\hat{F}_{k,t}^{j}$ is the kth principal component extracted from the 14 economic variables ($j = ECON$), the 33 technical indicators ($j = TECH$), or all 47 variables together ($j = ALL$). K is the number of components that

are selected based on the eigenvalue.[11)]

<Table 5> reports the estimation results of equation (11) for the KOSPI 200 and KOSDAQ markets. Panel A describes the predictive ability of the principal components on the equity premium of KOSPI 200, and Panel B reports the results for the KOSDAQ market. In Panel A, adjusted R-squareds of ECON are stable throughout all-sample and subsamples classified by the business cycle stage. The explanatory power of ECON is relatively large, ranging from 5.95% to 7.57%. Tech, on the other hand, ranges from 0.27% to 2.23%. ECON has the largest predictive ability in the expansion stages but TECH does not, R-squared of TECH peaks in recessions. When the full sample is classified into subsamples by business cycle stages, ALL, which combines ECON and TECH, has improved explanatory power on equity premium forecasting compared to using ECON or TECH only. During the recession, ECON has an explanatory power of 6.73%, but ALL increases explanatory power to 7.38%. In the expansion period, the explanatory

<Table 5> Principal Component Predictive Regression Results, 2001.01~2018.12

This table reports the predictive regression results with principal components for full-sample and subsamples by business cycle stages. Recession periods, reported by Statistics Korea, are from Jan 2001 to Jul 2001, Jan 2003 to Apr 2005, Feb 2008 to Feb 2009, Sep 2011 to Mar 2013, Oct 2017 to Dec 2018. Expansion periods are from Aug 2001 to Dec 2002, May 2005 to Jan 2008, Mar 2009 to Aug 2011, Apr 2013 to Sep 2017. ECON is the 5-principal component of 14 economic variables, TECH is the 6-principal component for 33 technical indicators and ALL is the 10-principal component for 14 economic and 33 technical indicators altogether. After the estimation of equation (11) for each sample, adjusted R-squareds are reported in the table.

Panel A: Principal Component Predictive Regression in the KOSPI 200

Components	Full sample	Recessions	Expansions
ECON	5.95%	6.73%	7.57%
TECH	0.27%	2.23%	1.01%
ALL	4.12%	7.38%	7.71%

Panel B. Principal Component Predictive Regression in the KOSDAQ

Components	Full sample	Recessions	Expansions
ECON	5.53%	10.7%	5.12%
TECH	-2.46%	-2.41%	-0.61%
ALL	1.33%	7.92%	0.07%

11) This study omits examining the characteristics and effects of individual components derived from PCA analysis and focuses on analyzing the collective effects of PCA components. Readers interested in the results of [Figure 1] to [Figure 5] shown in Neely et al. (2014) can request the authors.

power increases from 7.57% to 7.71%. Our results for the KOSPI 200 are not fully consistent with those in the S&P 500 where Neely et al. (2014) report that ECON predicts the equity premium near troughs while TECH does near the business peaks. However, our results are partly consistent with Neely et al. (2014) in that the combination of economic variables and technical indicators can increase the predictability of stock premiums in case of controlling the economic conditions.

Panel B shows the results in the KOSDAQ market. TECH has no explanatory power for equity premium forecasts in both full and sub-samples. On the other hand, ECON has a relatively high explanatory power, especially during the recession. Unlike the KOSPI market, the combination of the economic and technical variables shows no improvement in explanatory power.

Ⅳ Investor Sentiment and Technical Indicators

1. Investor Sentiment and Equity Premium

Baker and Wurgler (2006, 2007) find a positive correlation between investor sentiment and stock returns in the U.S. market. In the following, based on their work, we analyze the relationship between investor sentiment, stock premium, and predictor variables. In their work, variables used to form investor sentiment include the New York Stock Exchange (NYSE) share turnover, equity share in new issues, number of initial public offerings (IPOs), average first-day returns on IPOs, dividend premiums, and closed-end fund discounts. However, we cannot construct the sentiment index with the same variables due to the absence of data for monthly IPOs and dividend payments in Korea. Kim and Byun (2010, 2013) propose a different measurement in building investor sentiment index in Korea. They use trading imbalance of individual investor (BSI),[12] stock fund flow (FUND),[13] consumer sentiment index (CSI), customer deposit for stock investment (CD), turnover ratio (TURN), and gross equity issuance (SR). Based on Baker and Wurgler

12) All data from the Korea Exchange include the KOSPI and the KOSDAQ. KONEX data are excluded due to its insufficient daily trading volumes.

13) Kim and Byun (2010) use fund NAV data from a source that we cannot access. Accordingly, we employ a fund flow measure from the work of Chuang and Park (2010).

(2006), we adjust variables of Kim and Byun by regressing each to business, durable, semi-durable, non-durable, service, and a coincident composite index for controlling the economic status. Residuals from the regressions are business status-controlled proxies, and six proxies are mixed in PCA to form the principal components. The sentiment index is the first principal component that is standardized to have zero mean and unit variance.

$$\begin{aligned} \text{SENT} = {} & 0.1570\ \text{BSI} + 0.2458\ \text{FUND} + 0.2755\ \text{CSI} + 0.6579\ \text{CD} \\ & + 0.5968\ \text{TURN} + 0.2238\ \text{SR} \end{aligned} \tag{12}$$

Baker and Wurgler (2006, 2007) and Neely et al. (2014) show that investor sentiment is correlated with the stock returns. It turns out that our index also shows a significant correlation with the market risk premium (see <Table 6>).[14] The changes in the investor

<Table 6> Sentiment and Market Risk Premium, 2006.07~2018.12

This table shows the OLS estimation results of investor sentiment on market risk premium for the KOSPI and KOSDAQ markets. The sample period is from July 2006 to December 2018. The regression model is as follows. $r_t = \alpha + \beta \Delta SENT_t + \epsilon_t$. and $r_t = \alpha + \beta SENT_t + \epsilon_t$. t-statistics are reported in the parentheses. *, **, *** describe the p-value significance level 10%, 5%, 1% respectively.

Panel A: KOSPI 200

Variable	Full sample	Recessions	Expansions
ΔSENT	0.99**	1.70***	0.70*
	(2.28)	(3.14)	(1.85)
R-squared	0.0277	0.0568	0.0161
SENT	0.73**	1.24***	0.51*
	(2.33)	(3.08)	(1.86)
R-squared	0.036	0.061	0.023

Panel B: KOSDAQ

Variable	Full sample	Recessions	Expansions
ΔSENT	1.78***	2.87***	1.34***
	(3.23)	(3.71)	(3.14)
R-squared	0.0603	0.08	0.057
SENT	0.76*	2.26***	0.20
	(1.87)	(3.96)	(0.62)
R-squared	0.023	0.097	0.003

14) Prior to the predictive test, we need to verify our index with a unit root test. We run the Augmented Dickey-Fuller test, and a null hypothesis indicating the existence of a unit root is rejected.

sentiment index provide a significant explanatory power for the market risk premium, especially during the recession. In the case of KOSPI, the adjusted R-squared is 5.68%, and KOSDAQ has a value of 8%. Now we are left with two questions; (1) Is it possible to predict investor sentiment? (2) What variables among economic and technical indicators well predict investor sentiment?

2. Investor Sentiment and Technical Indicators

In section 4.2 and 4.3, we analyze whether the economic variables and technical indicators can predict investor sentiment. We focus on the coefficient and R-squared that emphasize the goodness of fit of the model. <Table 7> and <Table 8> display the predictive regression results on investor sentiment. Variables with an adjusted R-squared value of more than 0.5% and significant coefficient estimates are identified and reported as having predictive power (Campbell and Thompson, 2007; Neely et al., 2014).

One of the astonishing findings is that some fundamental variables do predict investor sentiment, which is a different result from the findings of Neely et al. (2014), that none of the economic variables have significant power in predicting investor sentiment. Dividends- and earnings-related variables, term premium, default spread, and book-to-market ratio significantly predict investor sentiment, with R-squared ranging from 2.92% to 7.34% in the KOSPI market and from 1.94% to 6.50% in the KOSDAQ market. Moving average variables, momentum variables, and volume variables all significantly predict investor sentiment. R-squared values are ranged from 0.72% to 6.26% in the KOSPI market and from 0.81% to 22.6% in the KOSDAQ market. <Table 7> tells us that investors in the KOSPI market regard on all three types of technical indicators for investor sentiment forecasting, but <Table 8> demonstrates that investor sentiment predictability is heavily concentrated on moving average and momentum variables in the KOSDAQ market. In particular, the KOSDAQ market that is known to have a higher fraction of retail investors, price-related variables rather than volume-related variables cause a change in the sentiment. Unprofessional investors rely mostly on price movements. Overall, the results from <Table 7> and <Table 8> show that the technical indicators pose stronger predictive power in predicting investor sentiment than economic variables, especially in the KOSDAQ market, where the proportion of individual investors is high.

<Table 7> Predictive Regression on Sentiment Index, KOSPI 200, 2006.07～2018.12

This table reports the bivariate predictive regression results for investor sentiment index from July 2006 to Dec. 2018. The sentiment index is formed by the first principal component of *BSI, FUND, CSI, CD, TURN* and *SR* as in equation (12). All measures are controlled for the business cycle by regressing each measure on a set of macroeconomic indicators; Growth in industrial production index, durable sales index, semi-durable sales index, non-durable sales index, service production index, and a coincident composite index. Residuals obtained from the regressions become the proxies for six measures in forming the investor sentiment. Dependent variable, y_{t+1} is the *SENT* at the time t+1 and the independent variables, $x_{i,t}$ are economic or technical variables at the time t. The regression model is as follows: $y_{t+1} = \alpha_i + \beta_i x_{i,t} + \epsilon_{i,t+1}$. t-statistics are reported in the parentheses. *, **, *** describe the p-value significance level 10%, 5%, 1% respectively.

Economic Variables	Coefficients	t-value	R-squared
DP	1.29***	(2.70)	4.80%
DY	1.62***	(3.57)	7.34%
EP	1.42***	(3.04)	5.27%
TMS	0.68***	(3.36)	6.50%
DFY	0.19**	(2.33)	2.92%
Technical Indicators	Coefficients	t-value	R-squared
MA 1-3	0.63***	(2.99)	5.08%
MA 1-6	0.70***	(3.30)	6.26%
MA 1-9	0.56***	(2.61)	3.79%
MA 1-12	0.41**	(1.84)	1.59%
MA 2-3	0.45**	(2.14)	2.36%
MA 2-6	0.69***	(3.25)	6.06%
MA 2-9	0.60***	(2.80)	4.40%
MA 2-12	0.33*	(1.51)	0.85%
MA 3-6	0.66***	(3.02)	5.21%
MA 3-9	0.52***	(2.41)	3.15%
MA 3-12	0.31*	(1.42)	0.69%
MOM 1-3	0.63***	(2.96)	4.98%
MOM 1-6	0.56***	(2.61)	3.79%
MOM 2-6	0.45**	(2.10)	2.26%
MOM 2-9	0.31*	(1.44)	0.72%
MOM 3-9	0.50***	(2.32)	2.88%
OBV 1-9	0.40**	(1.88)	1.69%
OBV 1-12	0.35*	(1.66)	1.16%
OBV 2-9	0.39**	(1.82)	1.53%
OBV 2-12	0.50**	(2.37)	3.03%
OBV 3-6	0.34*	(1.57)	0.98%
OBV 3-9	0.46**	(2.15)	2.39%
OBV 3-12	0.50***	(2.34)	2.95%

<Table 8> Predictive Regression on Sentiment Index, KOSDAQ, 2006.07~2018.12

This table reports the bivariate predictive regression results for investor sentiment index in the KOSDAQ market from July 2006 to Dec. 2018. The sentiment index is formed by the first principal component of *BSI, FUND, CSI, CD, TURN* and *SR* as in equation (12). All measures are controlled for the business cycle by regressing each measure on a set of macroeconomic indicators; Growth in industrial production index, durable sales index, semi-durable sales index, non-durable sales index, service production index and a coincident composite index. Residuals obtained from the regressions become the proxies for six measures in forming the investor sentiment. Dependent variable, y_{t+1} is the *SENT* at the time t+1 and the independent variables, $x_{i,t}$ are economic or technical variables at the time t. The regression model is as follows: $y_{t+1} = \alpha_i + \beta_i x_{i,t} + \epsilon_{i,t+1}$. t-statistics are reported in the parentheses. *, **, *** describe the p-value significance level 10%, 5%, 1% respectively.

Economic Variables	Coefficients	t-value	R-squared
EP	9.81***	(3.08)	5.44%
DE	0.09**	(3.02)	5.19%
BM	-1.68**	(-1.98)	1.94%
TMS	0.68***	(3.36)	6.50%
DFY	0.19**	(2.33)	2.92%
Technical Indicators	Coefficients	t-value	R-squared
MA 1-3	0.75***	(3.62)	7.55%
MA 1-6	1.22***	(6.42)	21.40%
MA 1-9	1.16***	(5.98)	19.00%
MA 1-12	1.26***	(6.65)	22.60%
MA 2-3	0.68***	(3.27)	6.14%
MA 2-6	1.15***	(5.94)	18.80%
MA 2-9	1.13***	(5.79)	18.00%
MA 2-12	1.22***	(6.27)	20.60%
MA 3-6	1.13***	(5.79)	18.00%
MA 3-9	0.96***	(4.79)	12.90%
MA 3-12	0.95***	(4.72)	12.60%
MOM 1-3	0.94***	(4.65)	12.20%
MOM 1-6	1.01***	(5.08)	14.40%
MOM 1-9	0.87***	(4.28)	10.50%
MOM 1-12	0.43**	(2.00)	2.00%
MOM 2-3	0.34*	(1.60)	1.05%
MOM 2-6	0.86***	(4.21)	10.20%
MOM 2-9	0.70***	(3.34)	6.44%
MOM 2-12	0.32*	(1.49)	0.81%
MOM 3-6	0.58***	(2.74)	4.23%
MOM 3-9	0.59***	(2.81)	4.46%
OBV 2-12	0.55***	(2.62)	3.80%
OBV 3-9	0.53***	(2.54)	3.55%
OBV 3-12	0.71***	(3.41)	6.71%

3. Investor Sentiment Prediction by Business Cycle Stages

In this section, we divide the full sample into two subsamples by economic conditions and test the predictability of economic and technical variables on investor sentiment.

<Tables 9> and <Table 10> show the estimation results for the KOSPI and KOSDAQ markets. The results reveal that predictors' effects on investor sentiment can dramatically change by economic conditions. In <Table 9>, the dividend-price ratio and dividend yield lose their predictive power. Bond yield-related variables (STY, LTY, and CDS) have a negative relationship with investor sentiment during the recession. However, technical indicators have positive signs but not significant enough. Among them, MA 2-12, MOM 1-9, and MOM 3-9 are the most significant in recessions. In expansion periods, three economic variables, RVOL, TMS, and CDS, are highly significant at the 1% level. Sixteen out of twenty-two moving average and trading volume variables now gain statistical power. During the recession periods, RVOL, TMS, CDS predict negative sentiment but predict positive sentiment in the expansions. Overall, Investor sentiment in the KOSPI is subject to bond yields, price averages, close prices, and trading volumes during the business expansions.

<Table 10> reports regression results on investor sentiment for the KOSDAQ market. Bond yield variables with an acceptable R-squared throughout expansions and recessions in the KOSPI also have the R-squared above 0.5% in the KOSDAQ market. Explanatory powers of the economic variables range from 2.54% to 26.8% in the recession periods and 0.83% to 7.85% in the expansion periods. The explanatory powers of technical indicators range from 3.25% to 13.2% in the recessions and range from 0.70% to 14.1% in the expansions. In the KOSDAQ market, the number of variables with significant explanatory power increased, and the explanatory power also increased. Since there are fewer significant volume indicators, prices encourage investors and appear to be more significant in the KOSDAQ. Investor sentiment that has a positive and significant correlation with the stock returns is shown to be predicted by the technical indicators, mainly in the expansion stages and in the KOSDAQ market.

<Table 9> Predictive Regression on Sentiment Index by Business Cycles: KOSPI 200, 2006.07~2018.12

This table shows the bivariate predictive regression results on investor sentiment index by business cycle stages from July 2006 to Dec. 2018. Recession periods are from Feb. 2008 to Feb. 2009, Sep. 2011 to Mar. 2013, Oct. 2017 to Dec. 2018 and expansion periods are from Jul. 2006 to Jan. 2008, Mar. 2009 to Aug. 2011, Apr. 2013 to Sep. 2017. Business cycle stages are classified and announced by Statistics Korea. The dependent variable, y_{t+1} is the *SENT* at the time t+1 and the independent variables, $x_{i,t}$ are economic or technical variables at the time t. The regression model is as follows: $y_{t+1} = \alpha_i + \beta_i x_{i,t} + \epsilon_{i,t+1}$. t-statistics are reported in the parentheses. *, **, *** describe the p-value significance level 10%, 5%, 1% respectively.

Panel A: Predictive Regression in Recessions

Economic Variables	Coefficients	t-value	R-squared	Technical Indicators	Coefficients	t-value	R-squared
EP	0.12*	(2.61)	3.78%	MA 2-12	0.43*	(2.45)	3.28%
RVOL	-3.52*	(-2.38)	3.05%	MOM 1-9	0.39*	(2.21)	2.57%
TBL	-0.13**	(-4.03)	9.32%	MOM 3-9	0.46**	(2.83)	4.51%
LTY	-0.11**	(-3.63)	7.58%				
ΔLTY	0.04*	(2.44)	3.23%				
CDS	-0.23**	(-2.96)	5.00%				

Panel B: Predictive Regression in Expansions

Economic Variables	Coefficients	t-value	R-squared	Technical Indicators	Coefficients	t-value	R-squared
RVOL	9.12***	(2.61)	3.79%	MA 1-3	0.42**	(2.29)	2.79%
LTY	0.07*	(1.50)	5.94%	MA 1-6	0.46***	(2.56)	3.60%
TMS	0.56***	(3.22)	5.94%	MA 1-9	0.32**	(1.76)	1.40%
CDS	0.77***	(3.62)	7.58%	MA 2-3	0.30*	(1.63)	1.10%
				MA 2-6	0.52***	(2.90)	4.78%
				MA 2-9	0.37**	(2.03)	2.06%
				MA 3-6	0.48***	(2.66)	3.95%
				MA 3-9	0.28*	(1.56)	0.95%
				MOM 1-3	0.46***	(2.57)	3.65%
				MOM 1-6	0.35**	(1.92)	1.78%
				MOM 2-6	0.36**	(1.97)	1.90%
				MOM 2-12	-0.33**	(-1.81)	1.53%
				MOM 3-12	-0.32**	(-1.75)	1.38%
				OBV 1-9	0.37*	(1.92)	1.78%
				OBV 1-12	0.33*	(1.71)	1.29%
				OBV 2-6	0.30*	(1.60)	1.04%
				OBV 2-9	0.31*	(1.63)	1.11%
				OBV 2-12	0.41**	(2.18)	2.48%
				OBV 3-6	0.31*	(1.65)	1.15%
				OBV 3-9	0.47**	(2.56)	3.60%
				OBV 3-12	0.48***	(2.62)	3.80%

<Table 10> Predictive Regression on Sentiment Index by Business Cycles, KOSDAQ, 2006.07~2018.12

This table shows the bivariate predictive regression results on investor sentiment index by business cycle stages from July 2006 to Dec. 2018. Recession periods are from Feb. 2008 to Feb. 2009, Sep. 2011 to Mar. 2013, Oct. 2017 to Dec. 2018 and expansion periods are from Jul. 2006 to Jan. 2008, Mar. 2009 to Aug. 2011, Apr. 2013 to Sep. 2017. Business cycle stages are classified and announced by Statistics Korea. The dependent variable, y_{t+1} is the *SENT* at the time t+1 and the independent variables, $x_{i,t}$ are economic or technical variables at the time t. The regression model is as follows: $y_{t+1} = \alpha_i + \beta_i x_{i,t} + \epsilon_{i,t+1}$. t-statistics are reported in the parentheses. *, **, *** describe the p-value significance level 10%, 5%, 1% respectively.

Panel A: Predictive Regressions in Recessions

Economic Variables	Coefficients	t-value	R-squared	Technical Indicators	Coefficients	t-value	R-squared
EP	12.43***	(7.42)	26.80%	MA 1-3	0.44**	(3.06)	5.35%
BM	-0.37*	(-2.20)	2.54%	MA 1-6	0.87***	(6.11)	19.70%
TBL	-0.13**	(-4.03)	9.32%	MA 1-9	0.63***	(4.11)	9.71%
LTY	-0.11**	(-3.63)	7.58%	MA 1-12	0.73***	(4.84)	13.20%
ΔLTY	0.04*	(2.44)	3.23%	MA 2-6	0.77***	(5.03)	14.10%
CDS	-0.23**	(-2.96)	5.00%	MA 2-9	0.52**	(3.38)	6.60%
				MA 2-12	0.59**	(3.61)	7.53%
				MA 3-6	0.72***	(4.84)	13.20%
				MA 3-9	0.54**	(3.46)	6.90%
				MA 3-12	0.50**	(3.04)	5.28%
				MOM 1-3	0.56**	(3.56)	7.30%
				MOM 1-6	0.51**	(3.28)	6.17%
				MOM 1-9	0.48**	(3.13)	5.62%
				MOM 2-6	0.39*	(2.44)	3.25%
				MOM 2-9	0.45**	(2.86)	4.64%
				MOM 3-9	0.35*	(2.26)	2.70%
				OBV 3-12	0.41**	(2.75)	4.26%

Panel B: Predictive Regressions in Expansions

Economic Variables	Coefficients	t-value	R-squared	Technical Indicators	Coefficients	t-value	R-squared
DE	0.09**	(3.69)	7.85%	MA 1-3	0.50**	(2.69)	4.03%
RVOL	7.45**	(2.50)	3.41%	MA 1-6	0.80***	(4.47)	11.40%
LTY	0.07*	(1.50)	0.83%	MA 1-9	0.82***	(4.71)	12.50%
TMS	0.56***	(3.22)	5.94%	MA 1-12	0.87***	(5.05)	14.20%
CDS	0.77***	(3.62)	7.58%	MA 2-3	0.51***	(2.77)	4.33%
				MA 2-6	0.77***	(4.36)	10.80%
				MA 2-9	0.83***	(4.80)	13.00%
				MA 2-12	0.86***	(5.03)	14.10%
				MA 3-6	0.77***	(4.33)	10.70%
				MA 3-9	0.67***	(3.74)	8.08%
				MA 3-12	0.66***	(3.73)	8.03%
				MOM 1-3	0.63***	(3.52)	7.14%
				MOM 1-6	0.73***	(4.12)	9.73%
				MOM 1-9	0.59***	(3.29)	6.23%
				MOM1-12	0.26*	(1.43)	0.70%
				MOM 2-3	0.29*	(1.56)	0.97%
				MOM 2-6	0.64***	(3.57)	7.34%
				MOM 2-9	0.42**	(2.32)	2.87%
				MOM 3-6	0.41**	(2.21)	2.57%
				MOM 3-9	0.37**	(1.99)	1.96%
				OBV 2-12	0.50***	(2.66)	3.94%
				OBV 3-9	0.38**	(1.99)	1.96%
				OBV 3-12	0.51***	(2.70)	4.07%

<Table 11> Principal Component Predictive Regression Results, 2006.07~2018.12

This table reports the predictive regression results with principal components on investor sentiment for Full sample and subsamples by business cycle stages. Recession periods, reported by Statistics Korea, are from Jan. 2001 to Jul. 2001, Jan. 2003 to Apr. 2005, Feb. 2008 to Feb. 2009, Sep. 2011 to Mar. 2013, Oct. 2017 to Dec. 2018. Expansion periods are from Aug. 2001 to Dec. 2002, May. 2005 to Jan. 2008, Mar. 2009 to Aug. 2011, Apr. 2013 to Sep. 2017. ECON is the 5-principal component of 14 economic variables, TECH is the 6-principal component for 33 technical indicators and ALL is the 10-principal component for 14 economic and 33 technical indicators altogether. After the estimation for each sample, adjusted R-squared values are reported in the table.

Panel A: Principal Component Predictive Regression in the KOSPI 200

Components	Full sample	Recessions	Expansions
ECON	9.63%	30.10%	16.30%
TECH	5.40%	16.80%	10.90%
ALL	12.20%	40.90%	28.80%

Panel B: Principal Component Predictive Regression in the KOSDAQ

Components	Full sample	Recessions	Expansions
ECON	5.81%	25.40%	17.70%
TECH	26.00%	38.00%	21.90%
ALL	29.10%	41.60%	34.20%

<Table 11> shows the principal components' forecast ability on the investor sentiment. Panel A reports the estimation results for the KOSPI. Principal components that reflect economic variables, technical indicators, and all variables show relatively high explanatory power in predicting investor sentiment with the peak in the recessions. These results are similar to the results for the KOSDAQ market in Panel B. R-squared values of all three types of the components have the largest values in the recessions, especially ALL has higher R-squared values than ECON or TECH.

4. Implication

The results on the predictability of equity premium show that economic variables have stronger predictive power than technical indicators in both the KOSPI and KOSDAQ markets, and the predictive power of the technical indicators is limited. In the case of the subsamples classified by economic conditions, the technical indicators show high predictive power during the economic expansions in the KOSPI market. The estimation results using principal component analysis show that the combination of principal components from economic variables and technical indicators has an improvement effect on predictive power in the subsamples classified by economic conditions.

Estimation results on the relationship between investor sentiment and equity premium reported in <Table 6> show that investor sentiment has a positive correlation with equity premium in both markets of KOSPI and KOSDAQ. Change of one standard deviation in sentiment increases monthly excess returns by 0.99% to 1.78% in Full samples. The impact of sentiment on equity premiums depends on the business cycle stages and the stock markets. The coefficients increase to 1.7 and 2.87 with a high significance level during the recessions in the KOSPI 200 and KOSDAQ, respectively. In the KOSPI market, where institutional investors have a relatively high share of trading, investors appear to consider all three types of technical indicators in their investment decisions. On the other hand, in the KOSDAQ market, where the proportion of individual investors is high, investors tend to rely on price indicators.

Results from <Table 7> to <Table 11> are contrary to those of Neely et al. (2014), In the Korean markets, bond yield variables show significant predictability regardless of the economic conditions. Also, technical indicators have significant explanations during economic expansions. The results using the principal components show that a considerable improvement in explanatory power is achieved by controlling the economic conditions and combining the principal components extracted from the two predictor groups.

Ⅴ. Conclusion

Predicting the equity risk premium is a topic of fierce debate in the field of finance. Contradictory arguments have emerged on whether economic variables or technical indicators are excellent tools in return forecasting. This paper gives three main results on equity risk premium and investor sentiment forecasts in the Korean stock markets: (1) Economic variables are superior predictors on equity premium forecasts over technical indicators. (2) Technical indicators are better predictors on investor sentiment forecasts than economic variables. (3) The sentiment predictability of technical indicators differs by economic conditions and markets.

Economic variables are better predictors over technical indicators in forecasting the equity premium, especially, dividend-related ratios and book-to-market ratio have the largest explanatory power. Principal components of economic and all variables provide

a stable prediction for the equity premium while the components from technical indicators do not. Also, there is a positive and significant relationship between equity premium and investor sentiment. Moving average, momentum, and volume indicators effectively predict the investor sentiment in the KOSPI while moving average and momentum predict investor sentiment in the KOSDAQ. Moreover, these technical indicators' predictive power is significant during the expansions in the KOSPI. However, in the KOSDAQ, their predictive power is significant throughout the cyclical changes.

The results of this study show that economic variables and technical indicators can have a discriminatory information effect in predicting equity premiums and that combining them can better account for changes in equity premiums in the Korean stock markets. In addition to this study, it is expected that in-depth research on the relationship between equity premium and investor sentiment and predictive power test based on a more robust research design will make a meaningful contribution to related fields.

References

Baetje, F. and L. Menkhoff, "Equity Premium Prediction: Are Economic and Technical Indicators Unstable?," *International Journal of Forecasting*, 32(4), (2016), 1193-1207.

Baker, M. and J. Wurgler, "Investor Sentiment and the Cross-section of Stock Returns," *The Journal of Finance*, 61(4), (2006), 1645-1680.

Baker, M. and J. Wurgler, "Investor Sentiment in the Stock Market," *Journal of Economic Perspectives*, 21(2), (2007), 129-152.

Brock, W., J. Lakonishok, and B. LeBaron, "Simple Technical Trading Rules and the Stochastic Properties of Stock Returns," *The Journal of Finance*, 47(5), (1992), 1731-1764.

Campbell, J. Y. and R. Shiller, "The Dividend-price Ratio and Expectations of Future Dividends and Discount Factors," *The Review of Financial Studies*, 1(3), (1988), 195-228.

Campbell, J. Y. and S. Thompson, "Predicting Excess Stock Returns Out of Sample: Can Anything Beat the Historical Average?," *The Review of Financial Studies*, 21(4), (2007), 1509-1531.

Chuang, H. and J. Park, "Fund Flow and Market Risk," *The Korean Journal of Financial Management*, 27(2), (2010), 169-204.

Chung, C. and S. Kim, "An Investigation on the Stock Return Predictability of Dividend Yield and Earning-Price Ratio," *The Korean Journal of Financial Engineering*, 9(3), (2010), 61-87.

Damodaran, A., "Equity risk premiums (ERP): Determinants, Estimation and Implications: The 2013 edition," *Managing and Measuring Risk: Emerging Global Standards and Regulations After the Financial Crisis*, (2013), 343-455.

De Bondt, W. and R. Thaler, "Does the Stock Market Overeact?," *The Journal of Finance*, 40(3), (1985), 793-805.

Eom, Y., "Momentum Profits and Firm Size," *Korean Journal of Financial Studies*, 42(5), (2013), 901-927.

Fama, E. and K. French, "Dividend Yields and Expected Stock Returns," *Journal of Financial Economics*, 22, (1988), 3 - 25.

Fama, E. and K. French, “The Equity Premium,” *The Journal of Finance*, 57, (2002), 637-659.

Gervais, S., R. Kaniel, and D. Mingelgrin, “The High-volume Return Premium,” *The Journal of Finance*, 56(3), (2001), 877-919.

Goyal, A. and I. Welch, “Predicting the Equity Premium with Dividend Ratios,” *Management Science*, 49(5), (2003), 639-654.

Goyal, A. and I. Welch, “A Comprehensive Look at The Empirical Performance of Equity Premium Prediction,” *Review of Financial Studies*, 21(4), (2008), 1455-1508.

Granville, J. E., *New Key to Stock Market Profits*, Prentice-Hall, 1963.

Hong, H. and J. Stein, “A Unified Theory of Underreaction, Momentum Trading, and Overreaction in Asset Markets,” *The Journal of Finance*, 54(6), (1999), 2143-2184.

Inoue, A. and L. Kilian, “In-sample or Out-of-sample Tests of Predictability: Which One Should We Use?,” *Econometric Reviews*, 23(4), (2005), 371-402 .

Jegadeesh, N. and S. Titman, “Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency,” *The Journal of Finance*, 48(1), (1993), 65-91.

Jegadeesh, N., “Evidence of Predictable Behavior of Security Returns,” *The Journal of Finance*, 45(3), (1990), 881-898.

Kam, H. and Y. Shin, “The impact of Economic Variables on Stock Returns in Korea,” *Korean Journal of Business Administration*, 30(1), (2017), 33-52.

Kim, H. and H. Yeo, “An Empirical Test of Stock Return Predictability in Korean Stock Market,” *Journal of Money & Finance*, 31(1), (2017), 39-73.

Kim, K. and J. Byun, “Application of Investor Sentiment Index in Financial Studies,” *The Korean Journal of Financial Management*, 30(1), (2013), 225-248.

Kim, K. and J. Byun, “Effect of Investor Sentiment on Market Response to Stock Split Announcement,” *Asia-Pacific Journal of Financial Studies*, 39(6), (2010), 687-719.

Kim, S. and T. Cho, “Simulation Studies on the Investment Performance of the Technical Trading Rules,” *The Journal of Korean Securities Association*, 33(1), (2004), 69-104.

Kim, S. and T. Jo, “Tests on the Predictive Ability of the Technical Trading Rules,” *The Korean Journal of Finance Association*, 16(2), (2003), 67-93.

Lee, H., *Predictability of Economic and Technical Indicators on Equity Premium*, Master’s Thesis, University of Seoul, 2019.

Lehmann, B. N., "Fads, Martingales, and Market Efficiency," *The Quarterly Journal of Economics*, 105(1), (1990), 1-28.

Malkiel, B. G. and E. Fama, "Efficient Capital Markets: A Review of Theory and Empirical Work," *The Journal of Finance*, 25(2), (1970), 383-417.

Neely, C. J., D. Rapach, J. Tu, and G. Zhou, "Forecasting the Equity Risk Premium: The Role of Technical Indicators," *Management Science*, 60(7), (2014), 1772-1791.

Park, J., "Business Cycles, and the Relationship between the Volatility and the Stock Market Risk Premium," *The Korean Journal of Financial Management*, 28(4), (2011), 125-146.

Ratanapakorn, O. and S. Sharma, "Dynamic Analysis between the US Stock Returns and the Economic Variables," *Applied Financial Economics*, 17(5), (2007), 369-377.

Roodman, D., M. Nielsen, J. MacKinnon, and M. Webb, "Fast and Wild: Bootstrap Inference in Stata Using Boottest," *The Stata Journal*, 19(1), (2019), 4-60.

Schwert, G. W., "The Adjustment of Stock Prices to Information about Inflation," *The Journal of Finance*, 36(1), (1981), 15-29.

Stambaugh, R. F., "Predictive Regressions," *Journal of Financial Economics*, 54(3), (1999), 375-421.

Statistics Korea, *Business Composite Index*, Statistics Korea, 2018.

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한국주식시장에서 경제 변수와 기술적 지표가 갖는 주식프리미엄 예측력*

이한빛** · 박종원***

〈요 약〉

주식프리미엄을 예측할 수 있는지는 재무금융 분야의 대표적인 연구주제로 그간 다양한 결과를 담은 많은 연구들이 발표되어 왔다. 본 연구는 한국주식시장(KOSPI 200, 코스닥 시장)에서 경제 변수와 기술적 지표를 이용하여 주식프리미엄을 예측할 수 있는지를 검증하고, 경기상황에 따라 차별적인 효과가 있는지를 분석하였다. 나아가 투자자심리지수와 주식프리미엄의 관계를 살펴보고, 경제 변수와 기술적 지표가 투자자심리지수와 갖는 관계를 검증하였다. 본 연구의 주요 결과는 다음과 같다. 첫째, 기술적 지표보다는 경제 변수가 주식프리미엄에 대해 우월한 예측력을 가지며, 주성분분석으로 축약된 주성분은 개별변수들에 비해 안정적인 예측력을 보여준다. 기술적 지표는 수축기보다는 경기확장국면에서 보다 높은 예측력을 가지며, 경기국면을 구분하고 경제 변수와 기술적 지표들의 주성분을 결합하는 경우 주식프리미엄에 대한 예측력은 유의하게 개선되는 모습을 보인다. 둘째, 투자자심리는 주식프리미엄과 유의미한 양(+)의 관계를 가지며, 기술적 지표의 투자자심리 예측력은 경기 국면에 관계없이 코스피200 시장보다는 코스닥 시장에서 더욱 강하게 나타난다. 셋째, KOSPI 200 시장의 경우 기술적 지표를 구성하는 가격, 모멘텀, 거래량의 세 변수가 모두 의미있는 영향을 미치는 것으로 나타나나, 코스닥시장의 경우 가격변수가 유의한 영향을 미치는 것으로 나타난다.

주제어 : 주식프리미엄, 예측력, 경제변수, 기술적 지표, 주성분 분석, 투자자심리지수

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