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The effect of uncertainty on the information content of term spread and its components

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Abstract

Purpose – This paper aims to investigate the impact of uncertainty on the predictive power of term spread and its components for future stock market returns and economic activity in Korea and the USA. This paper finds that the stock market's expected excess return and growth of economic activity are positively related to the risk-neutral expectation, one of the term spread's components, particularly during high uncertainty periods. These findings are consistent with the importance of the monetary policy by the central bank in a high uncertainty environment created by unexpected shocks. The results are robust to alternate definitions of high uncertainty periods.

Keywords Term structure of interest rate, Economic policy uncertainty, Monetary and interest rate policies, Stock market, Economic activity

Paper type Research paper

1. Introduction

> The Fed's Message: The Money-Printing Presses Are Fired Up and Ready to Go
>
> [. . .] It's really two distinct crises the Fed is trying to solve, with overlapping tools. One is an already-underway crisis in which financial markets are breaking down, failing in some of the same ways they did in the 2008 financial crisis – and thus threatening to make the economic crisis worse. The other is the threat of widespread business failures that could create mass bankruptcies, leaving millions of Americans jobless even once the virus is contained. The Fed's new open-ended quantitative easing – signaling it will buy Treasury bonds and mortgage-related securities in whatever quantities are needed – is aimed at the first goal, of making financial markets function more like usual. [. . .] Irwin (2020, 3.23, The New York Times)

Recently, the COVID-19 pandemic has had a negative influence on the global economy, and the uncertainty about the continued spread of the coronavirus has made people fear for their lives and economic activities. To alleviate the adverse impact of the COVID-19 pandemic, many central banks have introduced new monetary policy measures. For example, the Federal Reserve has lent to support households, employers, financial markets and state and

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local government up to $2.3tn and has cut the target for federal funds rate (Cheng *et al.*, 2020). In addition, the European Central Bank announced to buy an additional €120bn under the Asset Purchase Program on March 12, 2020 and has offered forward guidance on the future path of its key interest rate (Belz *et al.*, 2020). These represent clear examples of how the central banks establish interest rate policy, suggest forward guidance and supply the liquidity through quantitative easing based on securities purchases or asset purchases to support their respective economies.

Given that the central banks use the monetary and interest policies to reduce the impact of unexpected events on the economy, the term spread – which reflects the market expectations with regard to these monetary and interest policies – has important information about the future state of financial markets and economy, especially during high uncertainty periods. Previous literature on the term spread reveals the informativeness of the term spread on future economic state [1] or stock markets [2]. Estrella and Hardouvelis (1991) confirm that a positive slope of the yield curve is associated with a future growth in real economic activity. Plosser and Rouwenhorst (1994) find empirical evidence that the long end of the term structure has information about future growth of industrial production beyond expectations about future monetary policy. Furthermore, Chen (1991) confirms that the term spread is an important determinant of future stock market returns, and Hjalmarsson (2010) shows that the term spread is a robust predictor of stock returns in developed markets.

For the Korean economy and stock markets, Ji and Park (2002) find that the information on the term spread is useful in predicting the future business cycle. Kim *et al.* (2018) show that the term spread in the USA has predictive power for future Korean real economic activity. Yoon (2018) finds empirical evidence that the term spread predicts the growth of the industrial production index, and the predictive power of the term premium in Korea is associated with the risk-neutral expectation of the term spread in the USA. In addition, Kim and Yoon (2020) confirm the profitability of the strategy based on the term spread, the term premium and the risk-neutral expectation in Korea and the USA.

In this study, we investigate the effect of uncertainty on the predictive power of the term spread and its components (i.e. the term premium and risk-neutral expectation) for future stock market returns and economic activity in Korea and the USA. Uncertainty can gauge the reaction of the constituents in the financial markets and the economy to unexpected shocks. Baker Bloom, and Davis (2016) show that policy uncertainty is associated with stock return volatility, reduced investment and employment in policy-sensitive sectors and innovations in policy uncertainty foreshadow decrements in investment, output and employment in the USA and 12 major economies. Thus, when the level of uncertainty increases, the government and central bank execute the policies to increase investment, stabilize the financial markets and minimize any adverse effect on the unemployment rate. The monetary and interest rate policies are included in these policies of the government and central bank. As the central bank's use of the monetary and interest rate policies is intended to lessen the negative effect of unexpected shocks on the financial markets and the economy, we conjecture that the predictive power of the term spread, as well as its components, are varying depending on the level of uncertainty. Rosenberg and Maurer (2008) suggest that the risk-neutral expectation among the term spread's components is related with the monetary policy cycle, and that the role of the risk-neutral expectation in the prediction of future stock market returns and economic activity is more important with the emphasis of the central banks' monetary and interest rate policies than without urgent monetary and interest rate policies of the central banks. Thus, we expect that the predictive power of the risk-neutral expectation for future stock market returns and economic activity would be significant during high uncertainty periods.

We find that the risk-neutral expectation has a significant predictive power for future stock market returns and economic activity during high uncertainty periods in Korea and the USA. When the policy-related economic uncertainty is increasing, the risk-neutral expectation is positively and significantly related with the future stock market returns and the growth in future economic activity. On the other hand, there is no significant pattern in the predictive power of the term spread and the term premium depending on varying levels of uncertainty in Korea and the USA. These results are robust to alternate measures for the level of uncertainty.

This study contributes to the financial literature by providing evidence that uncertainty plays a key role in the usefulness of the information in the bond markets for the prediction of movements in the stock markets and economic activity. Some studies document the relation between the term spread's components and uncertainty. Rosenberg and Maurer (2008) expect the term premium to decline as investor uncertainty about long-term productivity improves and as inflation expectations become more stable. On the other hand, Bekaert *et al.* (2009) suggest that the risk-neutral expectation implies the link between uncertainty and term spread. To the best of our knowledge, this study is among the first to document the role of uncertainty in the predictive power of the term spread and its components. In this respect, it sheds an important light on the information in the term spread and its components concerning future stock market returns and economic activity based on the linkage between the monetary and interest rate policies and the term structure of interest rate.

The remainder of the paper is organized as follows. Section 2 describes the term spread, its components and uncertainty measure. Section 3 describes the data and empirical findings. Section 4 discusses our robustness check. Finally, Section 5 provides concluding remarks.

2. Term spread, its components and uncertainty

2.1 Term spread and its components

To decompose the term spread into its components, the term premium and the expectation on future short-term interest rates (risk-neutral expectation), we use the model of Adrian *et al.* (2013) (ACM model hereafter). Adrian *et al.* (2013) estimate the term premium using a three-step linear regression approach, and show that the ACM model outperforms the Cochrane and Piazzesi (2009) four-factor specification in out-of-sample exercises.

Following Adrian *et al.* (2013), we find five pricing factors as state variables to explain the term structure based on the principal component analysis. Assume the dynamics of state variables X_t (5×1 vector) below, we decompose the state variables into the predictable component and factor innovation:

$$X_{t+1} = \mu + \phi X_t + \nu_{t+1},\ \nu_{t+1}|\{X_s\}_{s=0}^{t} \sim N(0, \Sigma), \tag{1}$$

where $\{X_s\}_{s=0}^{t}$ denotes the history of state variables. $rx_{t+1}^{(n-1)}$ is the log excess holding return of a bond with maturity n, $P^{(n)}$:

$$rx_{t+1}^{(n-1)} = \ln P_{t+1}^{(n-1)} - \ln P_t^{(n)} - r_t, \tag{2}$$

where $P_t^{(n)}$ denotes the zero coupon Treasury bond price with maturity n at time t and $r_t = \ln P_t^{(1)}$ is the continuous compounded risk-free rate. To estimate the exposure of predictable component and factor innovation, we regress excess returns on a constant, contemporaneous pricing factor innovations and lagged pricing factors:

$$rx = \alpha I_T' + \beta' \hat{V} + \gamma X_- + E, \tag{3}$$

where rx is an N (number of maturity) $\times$ T (number of state variables' observations) matrix of excess bond returns, I_T is a $T \times 1$ vector of ones, $\hat{V}$ is a matrix of factor innovations ($5 \times N$ matrix), $X_- = [X_0 X_1 \cdots X_{T-1}]$, E is the $N \times T$ residual matrix and $\beta = \left[\beta^{(1)} \beta^{(2)} \cdots \beta^{(N)}\right]$ ($5 \times N$ matrix). With an estimator of the state variables variance-covariance matrix $\hat{} = \hat{V}\hat{V}'/T$, an estimator of the residuals variance $\hat{\sigma}^2 = tr\left(\hat{E}\hat{E}'\right)/NT$ and $B^* = \left[vec\left(\beta^{(1)}\beta^{(1)'}\right) \cdots vec\left(\beta^{(N)}\beta^{(N)'}\right)\right]'$ ($N \times 5^2$ matrix), we estimate the price of risk parameters λ_0 and λ_1, which are related to the expected return of log excess holding period bond returns, based on cross-sectional regression [3]. Based on the exponentially affine model, we can express the logarithm of the bond prices as the linear equation of the state variables:

$$\ln P_t^{(n)} = A_n + B_n' X_t + u_t^{(n)}, \tag{4}$$

where A_n and B_n are calculated based on λ_0 and λ_1, respectively. With the estimated λ_0 and λ_1, we can calculate the term spread. Additionally, the risk-neutral expectation of the term spread can be calculated by setting λ_0 and λ_1 to zero.

Following Rosenberg and Maurer (2008), the relation between the term spread and its components and the factors contained in each component of the term spread are as follows:

$$\text{Term Spread} = \text{Term Premium} + \text{Risk-neutral Expectation}$$

$$\text{Term Premium} = \text{Inflation Risk Premium} + \text{Real Rate Risk Premium}$$

$$\text{Risk-neutral Expectation} = \text{Inflation Expectation} + \text{Real Rate Expectation}$$

The risk-neutral expectation measures the sum of the difference in expected average inflation over long and short horizons and the difference in expected average real rates over long and short horizons. Additionally, the term premium is associated with interest rate risk and risk aversion [4].

Previous literature investigates the information on each component of the term spread. Ang *et al.* (2006) suggest that to predict gross domestic product (GDP) growth, the risk-neural expectation contained in the term spread is contaminated by the term premium, and that the term premium blurs the GDP forecasts. Rosenberg and Maurer (2008) provide empirical evidence that the risk-neutral expectation is a leading indicator of recession, while the term premium is not. In addition, Aye *et al.* (2019) find that the probit model incorporating the risk-neutral expectation and economic policy uncertainty (EPU) is the best forecasting model for recessions of South Africa in out-of-sample analysis. On the other hand, Hamilton and Kim (2002) show that the term premium and the risk-neutral expectation are relevant for predicting real GDP growth, but their respective contributions differ depending on the predictive horizon. Rudebusch *et al.* (2007) suggest that a decline in the term premium has been associated with the shock to real economic activity. Based on the term premium and risk-neutral expectation estimated by the ACM model, we analyze the predictive power of the term spread and its components for future stock market returns and economic activity depending on the level of uncertainty.

2.2 Economic policy uncertainty

To measure uncertainty induced by unexpected shocks, we use the EPU developed by Baker *et al.* (2016) [5],[6]. Previous literature on uncertainty uses EPU as the measure of policy- or economic-related uncertainty. Gulen and Ion (2016) find a strong negative relationship between firm-level capital investment and the level of EPU and Mueller *et al.* (2017) reveal that the profitability of the trading strategy using exchange rates increases with respect to the EPU as a proxy for uncertainty about monetary policy. Additionally, Sharif *et al.* (2020) analyze the connectedness between the recent spread of COVID-19, oil price volatility shock, stock market, geopolitical risk and EPU of the USA to measure the effect of COVID-19 on the US economy, and Baker *et al.* (2020) explain the unprecedented stock market reaction to the COVID-19 pandemic based on the EPU. For Korea economy and Korean stock markets, Kim and Lee (2018) analyze the effect of the Korean EPU on the macroeconomic and financial variables-based VAR model. In addition, Kim (2018) compares the predictive power of uncertainty implied by the options market and EPU for future stock market returns in Korea and the USA. Based on the EPU of the USA and Korea, we investigate the varying predictive power of the term spread and its components for future stock market returns and economic activity in the USA and Korea depending on the level of uncertainty.

3. Data and empirical analysis

We analyze the explanatory power of the term spread, term premium and risk-neutral expectation for future stock market returns and economic activity with the EPU in Korea and the USA. First, we describe the data for the term spread and its components, stock market returns, economic activity and the EPU in Korea and the USA. Second, we check the movements of the term spread, its components, stock market returns and economic activity with varying EPU. After that, we conduct the predictive regressions to evaluate the effect of the EPU on the predictive power of the term spread and its components for future stock market returns and economic activity.

3.1 Data description

Our data set consists of the interest rate variables, stock market returns, economic variables and the EPU. Our data set covers the period from January 2004 to April 2018, and the frequency of the data set is monthly. We use the difference between interest rates of 10-year and 1-year treasury bonds as the term spread [7]. Based on the ACM model, we decompose the term spread into the term premium and risk-neutral expectation. To construct the term spread, term premium and the risk-neutral expectation in Korea, the daily data of the treasury bonds' interest rate is provided by KIS Pricing [8]. For US interest rate variables, we obtain the term spread, the term premium and the risk-neutral expectation constructed based on ACM model from Federal Reserve Bank of New York [9].

We use the KOSPI200 index and the S&P500 indices to measure Korea and US stock market returns, respectively. The monthly data of the KOSPI200 and the S&P500 indices are obtained from Korea Exchange and Chicago Board Options Exchange, respectively. We use the growth of industrial production index and coincident economic activity index to measure economic activity. For the Korean economic activity, we obtain the industrial production index and coincident economic activity index from the Korean Statistical Information Service. In addition, the industrial production index and coincident economic activity index of the USA are provided by the Federal Reserve Bank of St. Louis [10]. EPU is taken from the EPU website [11].

Table 1 presents the summary statistics of the stock market returns and economic variables in Korea and the USA. The average KOSPI200 index returns is 59.94 bps and the average S&P500 index returns is 50.70 bps. As these are monthly values, they translate to an annualized return of 7.19% and 6.08%, respectively. The standard deviation of KOSPI200 index returns are larger than the standard deviation of S&P500 index returns. In addition, the differences between the maximum and minimum of KOSPI200 index returns and S&P500 index returns are 36.37% and 28.79%, respectively. These values suggest that Korean stock market has a higher expected return and volatility than the US stock market over our sample period. The S&P500 index returns are more negatively skewed than the KOSPI200 index returns, and the distributions of the two stock market returns are leptokurtic.

While the average growth of the industrial production index in Korea is larger than that of the USA, the average growth of coincident economic activity index in Korea is smaller than that of the USA. As the coincident economic activity index is constructed based on production, consumption and employment and, as the industrial production index only takes into account of the production side, the two proxies for economic activity reveal different aspects of the economic activity, which may, in turn, account for such patterns between the two countries. The differences between the maximum and minimum of the growth of industrial production index and coincident economic activity index and the standard deviations of two economic variables in Korea are larger than those in the USA. These patterns indicate that the economic activity in the USA is more stable than that in Korea. The Jarque-Bera statistics of all variables in Table 1 are very high and significant at the 1% level, indicating non-normality in the distributions of all variables. In addition, the statistics of the Augmented Dickey-Fuller test for all variables in Table 1 confirm the rejection for the null hypothesis that a unit root is present in a time-series of the variable.

Table 2 reports the summary statistics of the term spread, its components and EPU in Korea and the USA. The averages of the term spread and its components in the USA are larger than those in Korea. In addition, the term spread and its components in the USA are more volatile than those in Korea. However, the EPU in Korea has a larger average and standard deviation than the EPU in the USA, Korea is more uncertain by political and financial events than the USA [12].

The correlations among stock market returns, proxies for economic activity, term spread and its components and EPU in Korea and the USA are reported in Table 3, respectively. As the growth of the industrial production index and the growth of coincident economic activity index are different but related measures of economic activity, it is not surprising that the correlations between two variables in both Korea and the USA are positive and significant at the 1% level.

Furthermore, in Korea, the stock market returns are significantly positively correlated with the growth of industrial production index, term spread and risk-neutral expectation. While the EPU is significantly positively correlated with the term premium, the EPU is significantly negatively correlated with the risk-neutral expectation. In the USA, the stock market returns are significantly positively related with the growth of the coincident economic activity index and significantly negatively related with the term premium. Interestingly, EPU is significantly positively correlated with the term spread and risk-neutral expectation. Thus, while the risk-neutral expectation is significantly negatively

Table 1.
Summary statistics of stock market returns and economic variables

	KOSPI200 index returns	KOR growth of industrial production index	KOR growth of coincident economic activity index	S&P500 index returns	US growth of industrial production index	US growth of coincident economic activity index
Mean (%)	0.5994	0.2469	−0.0070	0.5070	0.0705	0.1845
Median (%)	0.7208	0.2114	0.0000	1.0527	0.1565	0.2267
Max	0.1285	0.0496	0.0110	0.1023	0.0151	0.0051
Min	−0.2352	−0.0455	−0.0121	−0.1856	−0.0443	−0.0054
SD	0.0514	0.0138	0.0028	0.0390	0.0073	0.0018
Skewness	−0.6684	0.0779	−0.2207	−1.0420	−2.1001	−2.0522
Kurtosis	5.4986	4.6120	5.9827	6.2937	12.5416	7.5751
Jarque-Bera Statistic	57.5494***	18.7968***	65.1541***	108.8728***	778.8994***	270.7439***
ADF test	−12.5932***	−17.5178***	−8.6327***	−10.9864***	−10.0142***	−2.5666**

Notes: The table reports summary statistics of monthly stock market returns and economic variables of Korea and the USA. KOSPI200 index returns and S&P500 index returns are log change in stock market index of Korea and the USA, respectively. Growth of industrial production index is log change in seasonally adjusted industrial production index. Growth of coincident economic activity index is log change in seasonally adjusted coincident economic activity index. Jarque-Bera Statistic verifies nonnormality and ADF (Augmented Dickey-Fuller) test is a t-statistic on β in the regression of each variable x_t, $x_t = \alpha + \beta x_{t-1} + \delta_1 \Delta x_{t-1} + \ldots + \delta_{p-1} \Delta x_{t-p+1} + \varepsilon_t$. Lag order p is selected by using Ng and Perron (1995)'s procedure. ** and *** represent significance at the 5 and 1% levels, respectively. All variables are monthlized. The sample period covers February 2004 to May 2018

Table 2. Summary statistics of term spread, its components and economic policy uncertainty

	KOR term spread (10y−1y)	KOR ACM term premium (10y−1y)	KOR ACM risk-neutral expectation (10y−1y)	KOR EPU	US term spread (10y−1y)	US ACM term premium (10y−1y)	US ACM risk-neutral expectation (10y−1y)	US EPU
Mean	0.8680	0.8024	0.0657	130.0449	1.7873	0.8208	0.9665	119.8335
Median	0.7601	0.8975	0.1775	119.7630	1.8141	0.5881	1.2700	108.8932
Max	2.8231	2.0799	0.9327	391.7984	3.7168	2.9497	1.6291	283.6656
Min	−0.0911	−0.6458	−1.1447	37.3066	−0.3259	−0.3305	−0.5622	44.7828
SD	0.6221	0.6510	0.5892	59.8400	1.0864	0.7263	0.6307	46.2130
Skewness	1.2977	−0.3122	−0.4459	1.7354	−0.1559	0.4487	−1.2967	0.9112
Kurtosis	4.2727	1.9930	2.0725	7.5267	2.1069	2.0698	3.3377	3.5897
Jarque-Bera Statistic	59.8873***	10.0619***	11.8661***	233.1793***	6.4127**	11.9722***	49.0150***	26.2931***
ADF test	−1.2794	−1.4946	−0.9815	−2.1970**	−1.4766	−1.8971*	−0.8646	−1.8728*

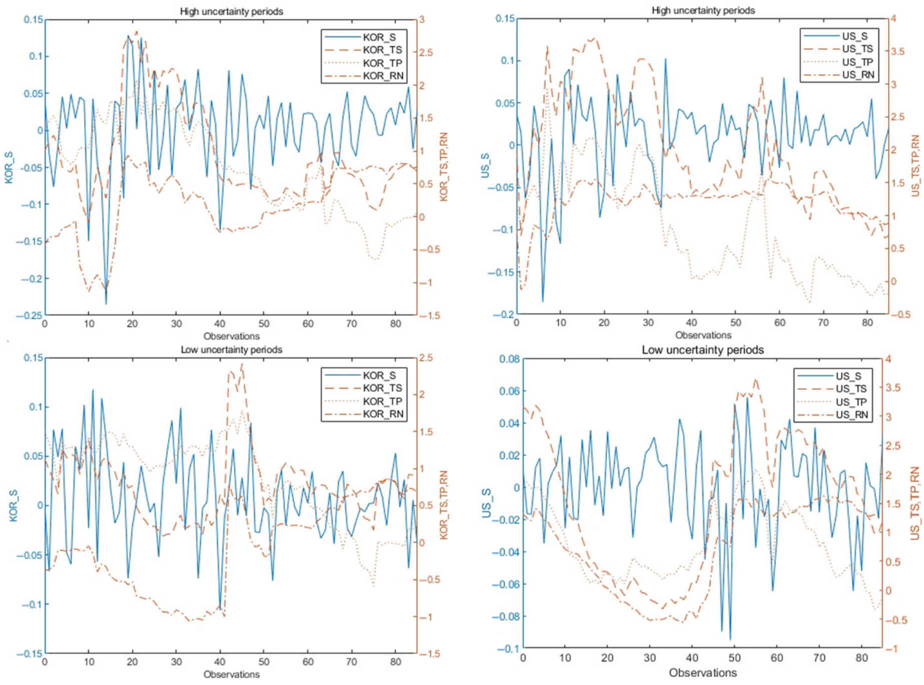
Notes: The table reports summary statistics of monthly term spread, its components and economic policy uncertainty (EPU) of Korea and the USA. The 10 year−1year term spreads, the term premiums and the expectation on future short-term interest rates (Risk-neutral expectation) are calculated using ACM method. Economic policy uncertainty is economic policy uncertainty index proposed by Baker *et al.* (2016). Jarque-Bera statistic verifies nonnormality and ADF (Augmented Dickey-Fuller) test is a t-statistic on β in the regression of each variable x_t, $x_t = \alpha + \beta x_{t-1} + \delta_1 \Delta x_{t-1} + \ldots + \delta_{p-1} \Delta x_{t-p+1} + \varepsilon_t$. Lag order p is selected by using Ng and Perron (1995)'s procedure. *, ** and *** represent significance at the 10, 5 and 1% levels, respectively. The sample period covers January 2004 to April 2018

Table 3.
Correlation of stock market returns, economic variables, term spread, its components and uncertainty

	KOR_S	KOR_I	KOR_C	KOR_TS	KOR_TP	KOR_RN		US_S	US_I	US_C	US_TS	US_TP	US_RN
KOR_I	0.1597**						US_I	0.0870					
	(2.110)							(1.138)					
KOR_C	0.1106	0.4452***					US_C	0.1531**	0.4087***				
	(1.451)	(6.482)						(2.019)	(5.839)				
KOR_TS	0.1599**	0.0905	0.1139				US_TS	−0.0510	−0.0245	−0.3201***			
	(2.113)	(1.185)	(1.495)					(−0.666)	(−0.320)	(−4.406)			
KOR_TP	0.0318	0.0243	0.0309	0.5724***			US_TP	−0.1329*	−0.0433	−0.4711***	0.8301***		
	(0.415)	(0.316)	(0.403)	(9.103)				(−1.748)	(−0.565)	(−6.963)	(19.412)		
KOR_RN	0.1337*	0.0688	0.0861	0.4234***	−0.5005***		US_RN	0.0652	0.0076	−0.0090	0.7666***	0.2784***	
	(1.760)	(0.899)	(1.127)	(6.094)	(−7.537)			(0.852)	(0.100)	(−0.117)	(15.568)	(3.779)	
KOR_EPU	0.0030	−0.0667	−0.0350	0.0322	−0.2094***	0.2653***	US_EPU	−0.0180	−0.0541	−0.178**	0.3023***	0.0749	0.4344***
	(0.039)	(−0.872)	(−0.456)	(0.420)	(−2.792)	(3.588)		(−0.235)	(−0.706)	(−2.365)	(4.135)	(0.980)	(6.289)

Notes: The table reports correlations between stock market returns, economic variables, term spread, its components and uncertainty in Korea and the USA, respectively. KOR and US indicate Korea and the USA, respectively. S, I and C indicate stock market returns, growth of industrial production index and growth of coincident economic activity index, respectively. TS, TP and RN indicate term spread, term premium and risk-neutral expectation. EPU indicates economic policy uncertainty. The *t*-statistics of correlation are reported in parentheses. *, ** and *** represent significance at the 10, 5 and 1% levels, respectively correlated with the term premium in Korea, the risk-neutral expectation is significantly positively correlated with the term premium in the USA.

Figure 1 displays the time-series of the term spread, its components and stock market returns. Panel A reveals the time-series movements of the term spread, its components and stock market returns during high and low uncertainty periods in Korea. During high uncertainty periods, the risk-neutral expectation tends to co-move with the stock market returns. The correlation between them during high uncertainty periods is 0.3626 (t-statistics = 3.5658), while the correlation between the term premium and stock market returns during high uncertainty periods is −0.0050 (t-statistics = −0.4591). On the other hand, during low uncertainty periods, the risk-neutral expectation does not exhibit any strong pattern of co-movement with the stock market returns. The correlation between them during low uncertainty periods is −0.0869 (t-statistics = −0.7998). Analogously, Panel B reveals the time-series movements of the term spread, its components and stock market returns during high and low uncertainty periods in the USA. During high uncertainty periods, the co-movement of the



(a) **(b)**

Notes: This figure plots the time-series of 12-month growth of industrial production index,term spread, and its components during high (i.e., above the median value of the economic policy uncertainty index) and low (i.e., below the median value of the economic policy uncertainty index) uncertainty periods. All variable definitions are identical to those in Table 3. The left scale presents growth of industrial production index, and the right scale presents term spread and its components. (a) and (b) plot the time-series in Korea and the USA, respectively. The sample period covers January 2004 to April 2018, for a total of 172 monthly observations

Figure 1. Time-series of stock market returns, term spread and its components with uncertainty in Korea and the USA

risk-neutral expectation and stock market returns is consistent with the positive correlation (0.2620 with the *t*-statistics of 2.4885) between them [13].

Figures 2 and 3 illustrate the time-series of the term spread, its components and two proxies for economic activity in Korea and the USA. Panel A of Figures 2 and 3 show the time-series movements of the term spread, its components and 12-month growth of industrial production index and coincident economic activity index during high and low uncertainty periods in Korea, respectively[14]. Similar to the pattern in Korean stock market returns, the 12-month growth of the industrial production index and coincident economic activity index have a tendency to move more closely together with the risk-neutral expectation during high uncertainty periods than during low uncertainty periods. Panel B of Figures 2 and 3 plot the time-series movements of the term spread, its components and 12-month growth of industrial production index and coincident economic activity index during high and low uncertainty periods in the USA, respectively. The patterns of co movement between the risk-neutral expectation and the two proxies for economic activity are more

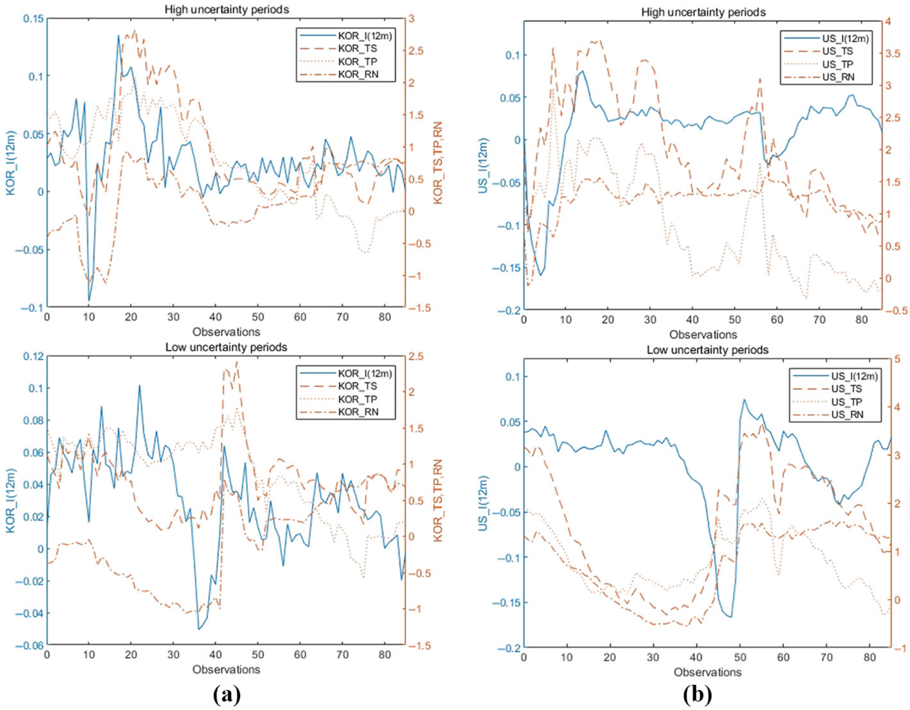


Figure 2.
Time-series of growth of industrial production index, term spread and its components with uncertainty in Korea and the USA

Notes: This figure plots the time-series of 12-month growth of industrial production index,term spread, and its components during high (i.e., above the median value of the economic policy uncertainty index) and low (i.e., below the median value of the economic policy uncertainty index) uncertainty periods. All variable definitions are identical to those in Table 3. The left scale presents growth of industrial production index, and the right scale presents term spread and its components. (a) and (b) plot the time-series in Korea and the USA, respectively. The sample period covers January 2004 to April 2018, for a total of 172 monthly observations

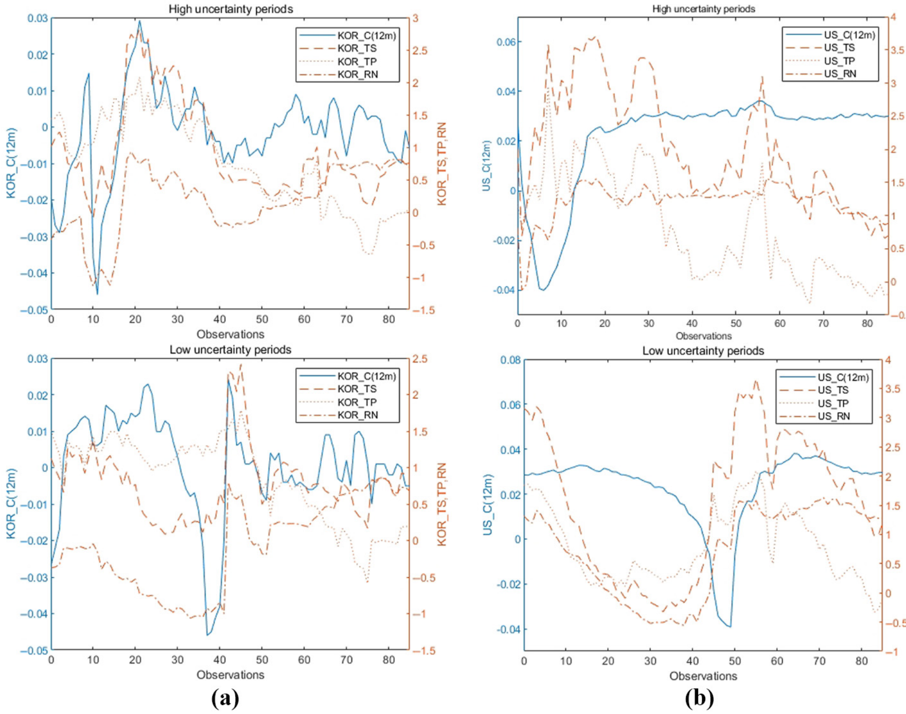


Figure 3.
Time-series of growth of coincident economic activity index, term spread and its components with uncertainty in Korea and the USA

Notes: This figure plots the time-series of 12-month growth of industrial production index,term spread, and its components during high (i.e., above the median value of the economic policy uncertainty index) and low (i.e., below the median value of the economic policy uncertainty index) uncertainty periods. All variable definitions are identical to those in Table 3. The left scale presents growth of industrial production index, and the right scale presents term spread and its components. (a) and (b) plot the time-series in Korea and the USA, respectively. The sample period covers January 2004 to April 2018, for a total of 172 monthly observations

prominent during high uncertainty periods than during low uncertainty periods. For both Korea and the USA, the different patterns of the correlations during high and low uncertainty periods suggest that the predictive power of the risk-neutral expectation for future stock market returns and economic activity bears a close relation with the level of uncertainty as measured through the EPU.

3.2 Predictive regressions

In this section, we engage in predictive regressions to examine whether the EPU influences the information on the term spread and its components. As conjectured earlier, we expect the informativeness of the term spread and its components on future stock market returns and economic activity to vary strongly with the level of EPU.

We conduct the following regression models to check whether the EPU affects the relationships between the future stock market returns and the term spread and its components and between the economic activity and the term spread and its components:

$$R_{t,t+k}(or\,EA_{t,t+k}) = \alpha_1 + \beta_1 TS_t + \varepsilon_{t,t+k}, \tag{5}$$

$$R_{t,t+k}(or\,EA_{t,t+k}) = \alpha_1 + \alpha_2 \times D_t + \beta_1 TS_t + \beta_2 TS_t \times D_t + \varepsilon_{t,t+k}, \tag{6}$$

$$R_{t,t+k}(or\,EA_{t,t+k}) = \alpha_1 + \beta_1 TP_t + \varepsilon_{t,t+k}, \tag{7}$$

$$R_{t,t+k}(or\,EA_{t,t+k}) = \alpha_1 + \alpha_2 \times D_t + \beta_1 TP_t + \beta_2 TP_t \times D_t + \varepsilon_{t,t+k}, \tag{8}$$

$$R_{t,t+k}(or\,EA_{t,t+k}) = \alpha_1 + \beta_1 RN_t + \varepsilon_{t,t+k}, \tag{9}$$

$$R_{t,t+k}(or\,EA_{t,t+k}) = \alpha_1 + \alpha_2 \times D_t + \beta_1 RN_t + \beta_2 RN_t \times D_t + \varepsilon_{t,t+k}, \tag{10}$$

$$R_{t,t+k}(or\,EA_{t,t+k}) = \alpha_1 + \beta_1 TP_t + \beta_2 RN_t + \varepsilon_{t,t+k}, \tag{11}$$

$$R_{t,t+k}(or\,EA_{t,t+k}) = \alpha_1 + \alpha_2 \times D_t + \beta_1 TP_t + \beta_2 TP_t \times D_t + \gamma_1 RN_t + \gamma_2 RN_t \times D_t + \varepsilon_{t,t+k}, \tag{12}$$

where $R_{t,t+k}$ is the k-month log stock market return and $EA_{t,t+k}$ is the k-month growth in industrial production index or coincident economic activity index. TS_t is the term spread, TP_t is the term premium, RN_t is the risk-neutral expectation and D_t is an EPU dummy variable, the value of which equals 1 if month t is included in high uncertainty periods. A high uncertainty month is defined as a month in which EPU is higher than the median of the monthly EPU during the whole sample period. We estimate all regression models using ordinary least squares with the Newey and West (1987) t-statistics. In this paper, we analyze the regression results of one-, three-, six- and 12-month stock market returns or growth of industrial production index and coincident economic activity index in Korea and the USA.

3.3 Predictive power of the term spread and its components in Korea

In this subsection, we analyze the predictive power of the term spread and its components in Korea based on the Models (1) ~ (8) (i.e. equations (5) ~ (12)).

Table 4 reports the regression results for Korean stock market returns. In Panel A of Table 4, the coefficient estimate on the term spread is positive and significant at the 5% level across all predictive horizons. The significant predictive power of the term spread in the Korean stock market is consistent with Chen (1991) and Hjalmarsson (2010). In addition, the longer the predictive horizon is, the stronger the explanatory power (adjusted R^2) of the term spread for future stock market returns is. Similarly, the magnitude of the coefficient estimates on the term spread becomes bigger as the predictive horizon increases. However, in Model (2), the coefficient estimate on the term spread loses its significance, and the interaction term between the term spread and EPU dummy variable is also insignificant for all predictive horizons. In addition, the addition of D_t does not improve the adjusted R^2 for one-, three-, six- and 12-month stock market returns. Thus, EPU cannot improve the predictive power of the term spread for future stock market returns in Korea.

Table 4. Information of term spread and its components with uncertainty in Korean stock market

Horizon	Const	D_{K_E}	KOR_TS	KOR_TS $\times D_{K\_E}$	Adj. R^2	Horizon	Const	D_{K_E}	KOR_TS	KOR_TS $\times D_{K\_E}$	Adj. R^2
Panel A: Term spread											
$n=1$	−0.0055		0.0132**		0.0198	$n=6$	−0.0212		0.0640**		0.0775
	(−0.739)		(2.126)				(−0.614)		(2.275)		
	0.0023	−0.0139	0.0068	0.0100	0.0142		−0.0249	0.0135	0.0557	0.0088	0.0726
	(0.255)	(−1.028)	(0.790)	(0.847)			(−0.471)	(0.297)	(1.166)	(0.191)	
$n=3$	−0.0141		0.0358**		0.0540	$n=12$	−0.0154		0.0957**		0.0931
	(−0.684)		(2.104)				(−0.285)		(2.484)		
	−0.0060	−0.0094	0.0204	0.0209	0.0491		−0.0493	0.0640	0.1186	−0.0379	0.0929
	(−0.196)	(−0.310)	(0.730)	(0.788)			(−0.575)	(0.912)	(1.619)	(−0.583)	

Horizon	Const	D_{K_E}	KOR_TP	KOR_TP $\times D_{K\_E}$	KOR_RN	KOR_RN $\times D_{K\_E}$	Adj. R^2	Horizon	Const	D_{K_E}	KOR_TP	KOR_TP $\times D_{K\_E}$	KOR_RN	KOR_RN $\times D_{K\_E}$	Adj. R^2
Panel B: Term premium and risk-neutral expectation															
$n=1$	0.0040		0.0025				−0.0049	$n=6$	0.0204		0.0175				0.0009
	(1.089)		(0.400)						(1.075)		(0.590)				
	−0.0024	0.0098	0.0119*	−0.0159			−0.0061		5.44×10^{-4}	0.0360	0.0217	−0.0041			0.0033
	(−0.467)	(1.515)	(1.820)	(−1.555)					(0.027)	(1.473)	(0.601)	(−0.109)			
	0.0052				0.0117		0.0121		0.0311				0.0500		0.0398
	(1.162)				(1.233)				(1.475)				(1.195)		
	7.26×10^{-4}*	−0.0105			−0.0063	0.0456***	0.0689		0.0198	0.0126			0.0147	0.0757*	0.0576
	(1.685)	(−1.394)			(−0.896)	(3.045)			(0.785)	(0.512)			(0.319)	(1.948)	
	−0.0035		0.0104*		0.0174*		0.0194		−0.0138		0.0536**		0.0796*		0.0823
	(−0.611)		(1.920)		(1.690)				(−0.496)		(2.101)		(1.745)		
	−0.0037	−0.0052	0.0135*	−0.0068	0.0023	0.0401**	0.0681		−0.0286	0.0224	0.0599	−0.0141	0.0529	0.0586	0.0892
	(−0.516)	(−0.479)	(1.689)	(−0.666)	(0.252)	(2.354)			(−0.733)	(0.640)	(1.466)	(−0.328)	(0.890)	(1.176)	
$n=3$	0.0119		0.0063				−0.0038	$n=12$	0.0313		0.0454				0.0185
	(1.154)		(0.366)						(0.851)		(1.090)				
	−0.0035	0.0265*	0.0160	−0.0148			−0.0067		−0.0077	0.0691*	0.0611	−0.0216			0.0269
	(−0.271)	(1.730)	(0.804)	(−0.679)					(−0.186)	(1.841)	(1.114)	(−0.418)			
	0.0149				0.0322		0.0375		0.0643**				0.0513		0.0197
	(1.211)				(1.252)				(2.015)				(0.811)		
	0.0100	-7.42×10^{-4}			−0.0017	0.0780***	0.0870		0.0451	0.0305			0.0182	0.0632	0.0258
	(0.729)	(−0.046)			(−0.065)	(2.707)			(1.171)	(0.809)			(0.242)	(1.058)	
	−0.0085		0.0279*		0.0476*		0.0618		−0.0125		0.0916***		0.1020		0.0886
	(−0.526)		(1.892)		(1.688)				(−0.265)		(2.637)		(1.558)		
	−0.0122	0.0018	0.0274	−0.0042	0.0158	0.0712**	0.0992		−0.0662	0.0843	0.1380**	−0.0696	0.1059	0.0068	0.0930
	(−0.528)	(0.073)	(1.143)	(−0.182)	(0.464)	(2.013)			(−0.928)	(1.484)	(2.212)	(−1.179)	(1.134)	(0.093)	

Notes: The table reports estimates from predictive regressions of Korean stock market returns on term spread and its components with dummy variables of Korean EPU. All variable definitions are identical to those in Table 3, except for D_{K_E}. D_{K_E} is the dummy variable for high uncertainty periods. Horizon indicates predictive months of future stock market returns. Panels A and B report the results of term spread and its components, respectively. Newey and West (1987) corrected t-statistics are reported in parentheses. *, ** and *** represent significance at the 10, 5 and 1% levels, respectively

On the other hand, in Panel B of Table 4, EPU has a significant effect on the predictive power of the risk-neural expectation for future stock market returns. In Models (4) and (8), the coefficient estimates on the interaction term between the term premium and EPU dummy variable are insignificant for all predictive horizons, which indicates that the predictive power of the term premium on future stock market returns is not significantly affected by the prevailing levels of the EPU. However, in Models (6) and (8), while the coefficient estimates on the standalone term for the risk-neutral expectation are not significant, the coefficient estimates on the interaction term between the risk-neutral expectation and EPU dummy variable are positive and significant for the prediction of one-, three- and six-month stock market returns. These results point out that the risk-neutral expectation has the significant return predictive power only during high uncertainty periods. In addition, compared to the increment in the adjusted R^2 by incorporating the EPU in the regression with the term premium, there is a noticeable increase in the adjusted R^2 by interacting the EPU dummy variable with the risk-neutral expectation in the regression. For example, in the prediction of one-month stock market returns, while the addition of D_t reduces the adjusted R^2 in the comparison between Models (3) and (4), it increases the adjusted R^2 from 1.21% to 6.89% in the comparison between Models (5) and (6) and the improvement in the adjusted R^2 is sustained in the comparison between Models (7) and (8). These results are consistent with our conjecture that the predictive power of the risk-neutral expectation varies with the level of EPU because the risk-neutral expectation of the term spread is related with the monetary policy cycle (Rosenberg and Maurer (2008) due to the linkage between the inflation expectation included in the risk-neutral expectation and the monetary and interest rate policies of the central bank.

Furthermore, while the adjusted R^2 in Model (1) is larger than that in Model (7) for one-month stock market returns, the adjusted R^2s in Models (6) and (8) are larger than those in Models (1) and (2) for one- and three-months stock market returns. Therefore, although the decomposition of the term spread does not enhance the explanatory power, considering the EPU nevertheless improves the explanatory power for short-term future stock market returns.

Table 5 presents the regression results of the growth of industrial production index to evaluate the predictive power of the term spread and its components varied with the EPU for the Korean economy. In Panel A of Table 5, the coefficient estimate on the term spread is positive and significant except for the one-month growth of the industrial production index. Similar to the results in Panel A of Table 4, the magnitudes of the coefficient estimate on the term spread and the adjusted R^2 increase with the predictive horizons. Although the coefficient estimate on the interaction term between the term spread and D_t is positively significant at the 5% level for the three-month growth of industrial production index, the coefficient estimates on the interaction term between the term spread and D_t for other predictive horizons are not significant. In Panel B of Table 5, the results for the growth of the industrial production index are somewhat different from the results for the stock market returns. While the predictive power of the risk-neutral expectation for short-term stock market returns is significant during high uncertainty periods, the predictive power of the risk-neutral expectation for the growth of the industrial production index is significant in long-term predictive horizons during high uncertainty periods. The coefficient estimates on the interaction term between the risk-neural expectation and D_t are significant in explaining the three-, six- and 12-month growths of the industrial production index. Furthermore, when the interaction term between the risk-neutral expectation and D_t is added to the regression models, the changes in the adjusted R^2 are larger than the changes in the adjusted R^2 affected by the addition of the interaction term between the term premium and D_t. For

Table 5. Information of term spread and its components with uncertainty in Korean economy: Industrial production index

Horizon	Const	D_{K_E}	KOR_TS	KOR_TS $\times D_{K\_E}$	Adj. R^2	Horizon	Const	D_{K_E}	KOR_TS	KOR_TS $\times D_{K\_E}$	Adj. R^2
Panel A: Term spread											
$n=1$	7.28×10^{-4}		0.0020		0.0024	$n=6$	0.0062		0.0098**		0.0662
	(0.532)		(1.459)				(1.153)		(1.979)		
	0.0030	−0.0034	−0.0011	0.0045	−0.0006		0.0144*	−0.0144*	0.0024	0.0115	0.0868
	(1.150)	(−0.935)	(−0.388)	(1.108)			(1.962)	(−1.959)	(0.367)	(1.553)	
$n=3$	0.0016		0.0066*		0.0446	$n=12$	0.0148*		0.0167**		0.1118
	(0.440)		(1.958)				(1.764)		(2.292)		
	0.0100**	−0.0141**	−0.0020	0.0129***	0.0821		0.0238**	−0.0153	0.0078	0.0135	0.1218
	(2.194)	(−2.550)	(−0.524)	(2.678)			(2.051)	(−1.631)	(0.808)	(1.494)	

Horizon	Const	D_{K_E}	KOR_TP	KOR_TP $\times D_{K\_E}$	KOR_RN	KOR_RN $\times D_{K\_E}$	Adj. R^2	Horizon	Const	D_{K_E}	KOR_TP	KOR_TP $\times D_{K\_E}$	KOR_RN	KOR_RN $\times D_{K\_E}$	Adj. R^2
Panel B: Term premium and risk-neutral expectation															
$n=1$	0.0021**		5.14×10^{-4}				−0.0053	$n=6$	0.0116***		0.0039				0.0068
	(2.572)		(0.354)						(5.546)		(0.822)				
	0.0017	6.25×10^{-4}	4.71×10^{-4}	1.37×10^{-4}			−0.0165		0.0116***	-2.75×10^{-4}	0.0056	−0.0031			0.0005
	(1.451)	(0.333)	(0.298)	(0.044)					(3.838)	(−0.087)	(1.196)	(−0.517)			
	0.0024***				0.0016		−0.0011		0.0144***				0.0062		0.0194
	(2.949)				(0.853)				(4.337)				(0.862)		
	0.0021*	-2.52×10^{-4}			−0.0011	0.0064	0.0045		0.0161***	−0.0070*			−0.0035	0.0251***	0.1181
	(1.871)	(−0.110)			(−0.609)	(1.356)			(5.019)	(−1.691)			(−0.562)	(3.522)	
	9.73×10^{-4}		0.0016		0.0025		−0.0024		0.0068*		0.0090**		0.0111		0.0632
	(0.831)		(1.183)		(1.237)				(1.678)		(2.026)		(1.406)		
	0.0026	−0.0026	-6.17×10^{-4}	0.0028	−0.0015	0.0078	−0.0015		0.0115**	−0.0101*	0.0057	0.0034	1.41×10^{-4}	0.0256***	0.1497
	(1.063)	(−0.763)	(−0.207)	(0.677)	(−0.479)	(1.396)			(2.209)	(−1.740)	(1.097)	(0.519)	(0.018)	(2.960)	
$n=3$	0.0057***		0.0021				−0.0005	$n=12$	0.0193***		0.0124**				0.0655
	(3.895)		(0.665)						(5.344)		(2.252)				
	0.0070***	−0.0023	0.0018	3.05×10^{-4}			−0.0094		0.0203***	−0.0016	0.0114*	0.0018			0.0547
	(3.516)	(−0.941)	(0.648)	(0.071)					(4.009)	(−0.328)	(1.727)	(0.228)			
	0.0071***				0.0049		0.0186		0.0291***				0.0034		
	−0.0014	(3.457)				(0.970)				(6.015)				(0.341)	
	0.0083***	−0.0053*			−0.0028	0.0197***	0.1109		0.0296***	−0.0041			−0.0053	0.0218*	0.0301
	(4.452)	(−1.765)			(−0.713)	(2.761)			(5.910)	(−0.640)			(−0.523)	(1.953)	
	0.0023		0.0057**		0.0080		0.0436		0.0134**		0.0187***		0.0138		0.1140
	(0.820)		(2.024)		(1.433)				(1.990)		(3.092)		(1.211)		
	0.0086***	−0.0117**	-4.31×10^{-4}	0.0076**	−0.0030	0.0233***	0.1356		0.0183**	−0.0093	0.0140**	0.0056	0.0036	0.0218**	0.1337
	(2.641)	(−2.550)	(−0.153)	(1.984)	(−0.635)	(2.949)	(2.111)		(−1.325)	(2.022)	(0.715)	(0.289)	(2.064)		

The table reports estimates from predictive regressions of growth in Korean industrial production index on term spread and its components with dummy variables of Korean EPU. All variable definitions are identical to those in Table 3, except for D_{K_E}. D_{K_E} is the dummy variable for high uncertainty periods. Horizon indicates predictive months of growth in industrial production index. Panels A and B report the results of term spread and its components, respectively. Newey and West (1987) corrected t-statistics are reported in parentheses. *, ** and *** represent significance at the 10, 5 and 1% levels, respectively instance, in the prediction of the three-month growth of industrial production index, the adjusted R^2 decreases from −0.05% in Model (1) to −0.94% in Model (2). However, considering the effect of EPU on the risk-neutral expectation improves the adjusted R^2 by 9.23% in the comparison between the Models (3) and (4).

Table 6 reports the regression results using the growth of coincident economic activity index as the dependent variable instead. In Panel A of Table 6, the coefficient estimate on the term spread in Model (1) is positive and significant except for one-month growth of the coincident economic activity index. Although the size of the coefficient estimates on the term spread and the adjusted R^2 in Model (1) is smaller than those in Panel A of Table 5, the pattern of those across the predictive horizons is very similar to those in Panel A of Table 5. In addition, incorporating EPU does not have an effect on the predictive power of the term spread. In Panel B of Table 6, the coefficient estimates on the risk-neutral expectation are positive and significant at the 5% or 1% levels only during high uncertainty periods in all predictive horizons. These results are consistent with the results of the stock market returns and the growth of the industrial production index. Analogous to the results in Panel B of Tables 4 and 5, the improvements in the adjusted R^2 by incorporating EPU are sizable. Taken together with Tables 4–6, the empirical evidence in Korea confirms the significant predictive power of the risk-neutral expectation in the Korean stock market and the Korean economy during high uncertainty periods.

3.4 Predictive power of the term spread and its components in the USA

Similar to Section 3.3, we assess the predictability of the term spread and its components for the US stock markets and the economy in an analogous manner.

In Table 7, the results using the US stock returns as the dependent variable are presented. As opposed to the results in Panel A of Table 4, the coefficient estimates on the term spread are not significant in Panel A of Table 7. In addition, the coefficient estimates on the term spread and the interaction term between the term spread and D_t are also insignificant in Model (2), which are similar to the results in Panel A of Table 4. Thus, the term spread does not have significant explanatory power for future stock market returns, and the EPU does not exhibit any strong association with the predictive power of the term spread.

In Panel B of Table 7, with the decomposition of the term spread into the term premium and risk-neutral expectation, we find that the information contents on the term spread components for US future stock market returns do indeed vary with the level of EPU. The coefficient estimates on the interaction term between the risk-neutral expectation and D_t are significant at the 1% or 5% levels in Models (6) and (8) for all predictive horizons, which are consistent with the results in Panel B of Table 4. In addition, the increases in the adjusted R^2 through the addition of the interaction term between the risk-neutral expectation and D_t in the US stock market are comparable to those in the Korean stock market. However, during high uncertainty periods, while the predictive power of the risk-neutral expectation lacks significance at the 12-month horizon in the Korean stock market, it remains significant at all predictive horizons in the US stock market.

In Table 8, we report the results using the growth of the US industrial production index as the dependent variable. In Panel A, there is no significant coefficient estimate on the term spread in Model (1) for the growth of the US industrial production index, while the predictive power of the term spread is positively significant in Model (1) for the growth of Korean industrial production index except for the one-month predictive horizon. In addition, the adjusted R^2s in Model (2) are negative and decrease compared to the adjusted R^2s in Model

Table 6. Information of term spread and its components with uncertainty in Korean economy: Coincident economic activity index

Horizon	Const	D_{K_E}	KOR_TS	KOR_TS $\times D_{K\_E}$	Adj. R^2	Horizon	Const	D_{K_E}	KOR_TS	KOR_TS $\times D_{K\_E}$	Adj. R^2
Panel A: Term spread											
$n=1$	-5.08×10^{-4}		5.05×10^{-4}		0.0072	$n=6$	−0.0036		0.0038**		0.0607
	(−1.221)		(1.228)				(−1.569)		(2.154)		
	1.86×10^{-5}	-8.83×10^{-4}	-3.76×10^{-5}	8.14×10^{-4}	0.0039		-4.40×10^{-4}	−0.0060**	0.0017	0.0036	0.0889
	(0.032)	(−1.369)	(−0.065)	(1.439)			(−0.147)	(−2.039)	(0.652)	(1.462)	
$n=3$	−0.0018		0.0019*		0.0285	$n=12$	−0.0071*		0.0077***		0.1247
	(−1.426)		(1.800)				(−1.870)		(2.718)		
	1.46×10^{-4}	−0.0034	1.30×10^{-4}	0.0027	0.0402		−0.0048	−0.0048	0.0070	0.0016	0.1326
	(0.076)	(−1.633)	(0.070)	(1.575)			(−0.829)	(−1.019)	(1.471)	(0.416)	

Horizon	Const	D_{K_E}	KOR_TP	KOR_TP $\times D_{K\_E}$	KOR_RN	KOR_RN $\times D_{K\_E}$	Adj. R^2	Horizon	Const	D_{K_E}	KOR_TP	KOR_TP $\times D_{K\_E}$	KOR_RN	KOR_RN $\times D_{K\_E}$	Adj. R^2
Panel B: Term premium and risk-neutral expectation															
$n=1$	-1.75×10^{-4}		1.31×10^{-4}				−0.0049	$n=6$	-1.37×10^{-4}		-2.04×10^{-4}				−0.0057
	(−0.624)		(0.285)						(−0.122)		(−0.093)				
	-4.93×10^{-4}	4.95×10^{-4}	5.69×10^{-4}	-7.41×10^{-4}			−0.0091		3.48×10^{-4}	−0.0011	6.34×10^{-4}	−0.0016			0.0026
	(−1.389)	(0.917)	(1.341)	(−0.957)					(0.228)	(−0.670)	(0.295)	(−0.643)			
	-9.60×10^{-5}				4.03×10^{-4}		0.0016		-5.97×10^{-4}				0.0045		0.0773
	(−0.320)				(0.799)				(−0.403)				(1.466)		
	-4.28×10^{-5}	-4.28×10^{-4}			-5.24×10^{-4}	0.0023***	0.0489		9.13×10^{-4}	−0.0046***			4.64×10^{-4}	0.0113***	0.2264
	(−0.155)	(−0.857)			(−1.172)	(2.773)			(0.653)	(−2.954)			(0.169)	(3.805)	
	-4.47×10^{-4}		4.19×10^{-4}		6.35×10^{-4}		0.0031		−0.0027		0.0025		0.005*		0.0945
	(−1.178)		(0.899)		(1.159)				(−1.501)		(1.483)		(1.831)		
	-3.28×10^{-4}	-4.10×10^{-4}	3.52×10^{-4}	-3.59×10^{-5}	-3.00×10^{-4}	0.0022***	0.0420		-5.39×10^{-4}	−0.0051**	0.0018	4.50×10^{-4}	0.0016	0.0111***	0.2341
	(−0.627)	(−0.695)	(0.609)	(−0.052)	(−0.492)	(2.817)			(−0.236)	(−2.176)	(0.817)	(0.203)	(0.485)	(3.284)	
$n=3$	-1.87×10^{-4}		3.18×10^{-5}				−0.0059	$n=12$	-8.89×10^{-4}	6.24×10^{-4}					−0.0049
	(−0.249)		(0.025)						(−0.626)	(0.202)					
	-4.17×10^{-4}	2.60×10^{-4}	7.84×10^{-4}	−0.0013			−0.0089		5.84×10^{-4}	−0.0026	1.29×10^{-4}	6.38×10^{-4}			−0.0103
	(−0.404)	(0.186)	(0.613)	(−0.693)					(0.347)	(−1.458)	(0.035)	(0.179)			
	-2.96×10^{-4}				0.0020		0.0311		-9.03×10^{-4}				0.007*		0.1151
	(−0.345)				(1.219)				(−0.412)				(1.728)		
	2.10×10^{-4}	−0.0020			-6.12×10^{-4}	0.0069***	0.1315		9.43×10^{-4}	−0.0053**			0.0041	0.0108**	0.1841
	(0.260)	(−1.554)			(−0.401)	(2.756)			(0.383)	(−2.391)			(0.825)	(2.543)	
	−0.0014		0.0013		0.0028		0.0386		−0.005**		0.0056**		0.010**		0.1661
	(−1.306)		(1.165)		(1.584)				(−2.002)		(2.459)		(2.274)		
	-3.01×10^{-4}	−0.0025	6.33×10^{-4}	5.63×10^{-4}	-2.09×10^{-4}	0.0071***	0.1303		−0.0037	−0.0050	0.0058	-6.21×10^{-4}	0.0078	0.0095**	0.2258
	(−0.183)	(−1.368)	(0.359)	(0.304)	(−0.099)	(2.672)			(−0.910)	(−1.422)	(1.570)	(−0.189)	(1.264)	(2.048)	

Notes: The table reports estimates from predictive regressions of growth in Korean coincident economic activity index on term spread and its components with dummy variables of Korean EPU. All variable definitions are identical to those in Table 3, except for D_{K_E}. D_{K_E} is the dummy variable for high uncertainty periods. Horizon indicates predictive months of growth in coincident economic activity index. Panels A and B report the results of term spread and its components, respectively. Newey and West (1987) corrected t-statistics are reported in parentheses. *, ** and *** represent significance at the 10, 5 and 1% levels, respectively

Table 7. Information of term spread and its components with uncertainty in US stock market

Horizon	Const	D_{U_E}	US_TS	US_TS $\times D_{U\_E}$	Adj. R^2	Horizon	Const	D_{U_E}	US_TS	US_TS $\times D_{U\_E}$	Adj. R^2
Panel A: Term spread											
$n=1$	0.0075**		−0.0026		−0.0039	$n=6$	0.0348**		−0.0018		−0.0056
	(2.284)		(−0.673)				(1.950)		(−0.171)		
	0.0026	0.0131	−0.0030	−0.0026	0.0031		0.0238	0.0346	−0.0093	0.0070	0.0254
	(0.749)	(1.499)	(−0.889)	(−0.269)			(1.304)	(1.160)	(−0.848)	(0.419)	
$n=3$	0.0209**		−0.0031		−0.0038	$n=12$	0.0306		0.0178		0.0086
	(2.132)		(−0.427)				(0.755)		(1.138)		
	0.0129	0.0268	−0.0024	−0.0065	−0.0041		0.0184	0.0373	0.0057	0.0149	0.0385
	(1.352)	(1.238)	(−0.446)	(−0.517)			(0.426)	(0.694)	(0.311)	(0.621)	

Horizon	Const	D_{U_E}	US_TP	US_TP $\times D_{U\_E}$	US_RN	US_RN $\times D_{U\_E}$	Adj. R^2	Horizon	Const	D_{U_E}	US_TP	US_TP $\times D_{U\_E}$	US_RN	US_RN $\times D_{U\_E}$	Adj-R^2
Panel B: Term premium and risk-neutral expectation															
$n=1$	0.0109***		−0.0071				0.0119	$n=6$	0.0511***		−0.0237				0.0169
	(4.104)		(−1.299)						(4.808)		(−1.236)				
	-4.31×10^{-5}	0.0200***	2.07×10^{-4}	−0.0121			0.0296		0.0318**	0.0409**	−0.0278	0.0052			0.0452
	(−0.010)	(3.172)	(0.046)	(−1.551)					(2.170)	(2.468)	(−1.132)	(0.227)			
	0.0012				0.0040		−0.0016		0.0064				0.0261		0.0149
	(0.223)				(1.073)				(0.233)				(1.404)		
	0.0034	−0.0435*			−0.0044	0.0462**	0.0521		0.0128	−0.1432**			−0.0045	0.1580***	0.0986
	(1.062)	(−1.789)			(−1.325)	(2.467)			(0.579)	(−2.340)			(−0.289)	(2.868)	
	0.0057		−0.0088		0.0069		0.0175		0.0230		−0.0325		0.036*		0.0488
	(1.357)		(−1.550)		(1.645)				(1.045)		(−1.631)		(1.854)		
	0.0015	−0.0330	0.0037	−0.0163**	−0.0059	0.0493***	0.0775		0.029*	−0.1429**	−0.0327	0.0074	0.0083	0.1486***	0.1171
	(0.409)	(−1.602)	(0.698)	(−2.267)	(−1.524)	(2.881)			(1.712)	(−2.504)	(−1.193)	(0.285)	(0.472)	(3.329)	
$n=3$	0.0288***		−0.0164				0.0205	$n=12$	0.079***		−0.0211				0.0032
	(4.367)		(−1.180)						(3.624)		(−0.778)				
	0.014*	0.0256**	−0.0070	−0.0154			0.0224		0.051*	0.0617*	−0.0297	0.0118			0.0422
	(1.891)	(2.293)	(−0.637)	(−1.034)					(1.735)	(1.865)	(−0.776)	(0.347)			
	0.0032				0.0126		0.0060		−0.0157				0.0808*		0.0947
	(0.208)				(1.192)				(−0.273)				(1.959)		
	0.0102	−0.1002*			−0.0013	0.0943**	0.0591		0.0025	−0.2930***			0.0336	0.2900***	0.2191
	(0.975)	(−1.735)			(−0.152)	(2.043)			(0.053)	(−2.827)			(1.020)	(3.328)	
	0.0140		−0.0210		0.019*		0.0406		0.0068		−0.0440		0.0949**		0.1261
	(1.155)		(−1.457)		(1.667)				(0.140)		(−1.456)		(2.115)		
	0.0144	−0.0881*	−0.0081	−0.0160	0.0019	0.0944**	0.0860		0.0357	−0.3102***	−0.0644	0.0408	0.0588	0.2680***	0.2421
	(1.583)	(−1.805)	(−0.654)	(−1.120)	(0.205)	(2.342)			(0.948)	(−2.854)	(−1.376)	(0.903)	(1.425)	(3.470)	

Notes: The table reports estimates from predictive regressions of US stock market returns on term spread and its components with dummy variables of US EPU. All variable definitions are identical to those in Table 3, except for D_{U_E}. D_{U_E} is the dummy variable for high uncertainty periods. Horizon indicates predictive months of future stock market returns. Panels A and B report the results of term spread and its components, respectively. Newey and West (1987) corrected t-statistics are reported in parentheses. *, ** and *** represent significance at the 10, 5 and 1% levels, respectively

Table 8. Information of term spread and its components with uncertainty in US economy: Industrial production index

Horizon	Const	D_{U_E}	US_TS	US_TS $\times \bar{D}_{U\_E}$	Adj-R^2	Horizon	Const	D_{U_E}	US_TS	US_TS $\times \bar{D}_{U\_E}$	Adj-R^2
Panel A: Term spread											
$n = 1$	9.98×10^{-4} (1.204)		-1.64×10^{-4} (−0.251)		−0.0053	$n = 6$	0.0053 (1.244)		-4.27×10^{-4} (−0.131)		−0.0056
	0.0010 (1.202)	4.60×10^{-5} (0.020)	2.13×10^{-4} (0.420)	-7.03×10^{-4} (−0.537)	−0.0075		0.0040 (0.947)	0.0047 (0.479)	8.37×10^{-4} (0.291)	−0.0033 (−0.544)	−0.0134
$n = 3$	0.0030 (1.280)		-4.55×10^{-4} (−0.234)		−0.0048	$n = 12$	0.0027 (0.275)		0.0034 (0.713)		0.0005
	0.0027 (1.272)	0.0012 (0.183)	4.20×10^{-4} (0.322)	−0.0018 (−0.461)	−0.0078		0.0020 (0.211)	0.0018 (0.107)	0.0020 (0.345)	0.0023 (0.294)	−0.0066

Horizon	Const	D_{U_E}	US_TP	US_TP $\times \bar{D}_{U\_E}$	US_RN	US_RN $\times \bar{D}_{U\_E}$	Adj-R^2	Horizon	Const	D_{U_E}	US_TP	US_TP $\times \bar{D}_{U\_E}$	US_RN	US_RN $\times \bar{D}_{U\_E}$	Adj-R^2
Panel B: Term premium and risk-neutral expectation															
$n = 1$	0.0011 (1.576)		-4.34×10^{-4} (−0.344)				−0.0040	$n = 6$	0.0073** (2.117)		−0.0033 (−0.483)				0.0019
	4.57×10^{-4} (0.527)	7.25×10^{-4} (0.596)	0.0011 (0.997)	−0.0024 (−1.512)			0.0059		0.0020 (0.475)	0.0083* (1.694)	0.0041 (0.639)	−0.0119 (−1.448)			0.0141
	6.19×10^{-4} (0.609)				8.82×10^{-5} (0.125)		−0.0058		0.0015 (0.231)				0.0031 (0.765)		−0.0007
	0.0015* (1.827)	−0.0085** (−2.416)			-2.13×10^{-4} (−0.311)	0.0061** (2.297)	0.0184		0.0058 (1.338)	−0.0478* (−1.738)			-6.56×10^{-4} (−0.186)	0.0388* (1.847)	0.0666
	8.72×10^{-4} (1.021)		-4.94×10^{-4} (−0.370)		2.47×10^{-4} (0.305)		−0.0095		0.0038 (0.764)		−0.0044 (−0.601)		0.0046 (0.900)		0.0062
	6.75×10^{-4} (0.860)	−0.0067** (−2.081)	0.0016 (1.222)	−0.0030* (−1.816)	-8.39×10^{-4} (−1.124)	0.0069*** (2.631)	0.0273		0.0028 (0.688)	−0.0390 (−1.630)	0.0058 (0.784)	−0.0142* (−1.776)	−0.0029 (−0.769)	0.0422** (2.138)	0.0943
$n = 3$	0.0036* (1.775)		−0.0017 (−0.432)				0.0010	$n = 12$	0.0111* (1.863)		−0.0028 (−0.289)				−0.0040
	0.0016 (0.703)	0.0029 (0.973)	0.0023 (0.785)	−0.0064 (−1.226)			0.0165		0.0021 (0.242)	0.0164* (1.800)	0.0038 (0.283)	−0.0107 (−0.919)			−0.0027
	0.0013 (0.3930				9.68×10^{-4} (0.469)		−0.0043		−0.0046 (−0.316)				0.0139 (1.375)		0.0292
	0.0037* (1.793)	−0.0254 (−1.600)			-4.66×10^{-4} (−0.272)	0.0194 (1.628)	0.0543		0.0033 (0.320)	−0.1015*** (−3.362)			0.0024 (0.296)	0.0900*** (3.608)	0.1571
	0.0023 (0.957)		−0.0021 (−0.496)		0.0017 (0.636)		−0.0006		−0.0012 (−0.099)		−0.0066 (−0.649)		0.0160 (1.400)		0.0333
	0.0020 (0.982)	−0.0207 (−1.503)	0.0033 (0.965)	−0.0077 (−1.558)	−0.0018 (−0.910)	0.0213* (1.823)	0.0783		0.0018 (0.192)	−0.0942*** (−3.061)	0.0031 (0.192)	−0.0116 (−0.825)	0.0012 (0.120)	0.0923*** (4.463)	0.1588

Notes: The table reports estimates from predictive regressions of growth in US industrial production index on term spread and its components with dummy variables of US EPU. All variable definitions are identical to those in Table 3, except for D_{U_E}. D_{U_E} is the dummy variable for high uncertainty periods. Horizon indicates predictive months of growth in industrial production index. Panels A and B report the results of term spread and its components, respectively. Newey and West (1987) corrected t-statistics are reported in parentheses. *, ** and *** represent significance at the 10, 5 and 1% levels, respectively

(1), as opposed to the case of Korea. In Panel B of Table 8, the predictive power of the risk-neutral expectation for the growth of the industrial production index is significantly positive across all predictive horizons except for the three-month horizon in Model (6) during high uncertainty periods. These results are similar to those obtained for the US stock returns as the dependent variable. Furthermore, the improvement in the adjusted R^2 using the interaction of the EPU ranges from 2.42% to 12.79%.

Table 9 reports the regression results with the growth of the US coincident economic activity index as the dependent variable. In Panel A, the coefficient estimates on the term spread are negatively significant in Model (1) except for the 12-month horizon. In addition, the coefficient estimates on the interaction term between the term spread and D_t are negatively significant at the 10% level in Model (2) except for the three-month horizon. However, the shorter the predictive horizon is, the stronger the explanatory power of the term spread for the growth of the coincident economic activity index is. These patterns are different from the case of Korea, and also from other US forecast variables. According to the results in Panel A of Table 9, although the pattern is somewhat different, the EPU can improve the predictive power of the term spread for the growth of the US coincident economic activity index.

In Panel B of Table 9, the coefficient estimates on the term premium in Models (3), (4), (7) and (8) are negatively significant at the 1% or 5% levels, except for the 12-month growth of US coincident economic activity index in Model (4). However, the coefficient estimates on the interaction term between the term premium and D_t are not significant in Models (4) and (8) for all predictive horizons. These results suggest that the information on the term premium for the growth of the US coincident economic activity index does not vary strongly depending on the level of EPU. The coefficient estimates on the risk-neutral expectation during high uncertainty periods are significantly positive for the six- and 12-month growths of the US coincident economic activity index. Furthermore, the explanatory power of the models with the interaction term between the risk-neutral expectation and $D_t$becomes larger as the predictive horizon increases. As the adjusted R^2s in the Model (8) are the largest across all predictive horizons and the coefficient estimates on the risk-neutral expectation during high uncertainty periods are significantly positive for six- and 12-month predictive horizons, the results strongly suggest that the information content of the risk-neutral expectation for the growth of the US coincident economic activity index varies significantly with the level of EPU.

In sum, the empirical evidence in Korea and the USA confirms that the predictive power of the risk-neutral expectation becomes noticeable stronger during high uncertainty periods. Moreover, allowing for the interaction between the risk-neutral expectation and EPU significantly improves the explanatory power of the future stock market returns and economic activity in Korea and the USA. However, our results also reveal some differences in between Korea and the USA. For example, the predictive power of the risk-neutral expectation during high uncertainty periods in Korea is less significant than that in the USA for longer predictive horizons (e.g. six- or and 12-month stock returns or 12-month growth in the industrial production index). These differences in empirical results may be attributable to a plethora of different factors, including the differences in the degree of development of the long-term government bond market [15].

4. Robustness check

To check the robustness of our definition of a “high uncertainty period,” we analyze the predictive power of the risk-neutral expectation during the first quartile (top 25%) of EPU rather than the top 50% in this section.

Table 9. Information of term spread and its components with uncertainty in US economy: Coincident economic activity index

Horizon	Const	D_{U_E}	US_TS	US_TS $\times D_{U\_E}$	Adj. R^2	Horizon	Const	D_{U_E}	US_TS	US_TS $\times D_{U\_E}$	Adj. R^2
Panel A: Term spread											
$n = 1$	0.0028***		-5.22×10^{-4}**		0.0972	$n = 6$	0.0152***		−0.0023*		0.0605
	(10.321)		(−2.161)				(10.115)		(−1.800)		
	0.0024***	0.0013**	-2.45×10^{-4}	-7.60×10^{-4}*	0.1355		0.0133***	0.0070**	-7.16×10^{-4}	−0.0043*	0.1021
	(11.629)	(2.164)	(−1.381)	(−1.773)			(10.624)	(2.150)	(−0.807)	(−1.822)	
$n = 3$	0.0080***		−0.0014**		0.0870	$n = 12$	0.0261***		−0.0022		0.0109
	(10.320)		(−2.010)				(7.959)		(−1.031)		
	0.0071***	0.0034*	-5.96×10^{-4}	−0.0022	0.1274		0.0226***	0.0123**	2.26×10^{-4}	−0.0069*	0.0348
	(11.415)	(1.924)	(−1.173)	(−1.652)			(7.179)	(2.148)	(0.127)	(−1.778)	

Horizon	Const	D_{U_E}	US_TP	US_TP $\times D_{U\_E}$	US_RN	US_RN $\times D_{U\_E}$	Adj. R^2	Horizon	Const	D_{U_E}	US_TP	US_TP $\times D_{U\_E}$	US_RN	US_RN $\times D_{U\_E}$	Adj. R^2
Panel B: Term premium and risk-neutral expectation															
$n = 1$	0.0028***		−0.0011***				0.2173	$n = 6$	0.0161***		−0.0061***				0.2023
	(18.591)		(−2.939)						(18.965)		(−2.683)				
	0.0027***	1.98×10^{-5}	-8.46×10^{-4}**	-4.75×10^{-4}			0.2281		0.0152***	9.81×10^{-4}	−0.0038**	−0.0036			0.2203
	(15.101)	(0.093)	(−2.467)	(−0.950)					(15.924)	(0.824)	(−2.098)	(−1.255)			
	0.0019***				-2.52×10^{-5}		−0.0058		0.0098***				0.0013		0.0008
	(6.773)				(−0.098)				(4.719)				(0.877)		
	0.0021***	−0.0018			-3.78×10^{-5}	0.0012	0.0150		0.0116***	−0.0163*			7.90×10^{-4}	0.0115	0.0654
	(10.631)	(−1.225)			(−0.158)	(1.129)			(8.323)	(−1.684)			(0.665)	(1.623)	
	0.0025***		−0.0012***		3.72×10^{-4}**		0.2291		0.0134***		−0.0070***		0.0035***		0.2451
	(12.361)		(−3.187)		(2.178)				(10.011)		(−3.012)		(2.814)		
	0.0026***	−0.0015	−0.0011***	-2.75×10^{-4}	3.80×10^{-4}**	9.69×10^{-4}	0.2552		0.0145***	−0.0140**	−0.0056***	−0.0021	0.0030***	0.0103*	0.3141
	(13.431)	(−1.316)	(−2.966)	(−0.576)	(2.255)	(1.027)			(13.431)	(−2.021)	(−2.802)	(−0.811)	(3.045)	(1.764)	
$n = 3$	0.0082***		−0.0033***				0.2225	$n = 12$	0.0300***		−0.0096**				0.1368
	(18.623)		(−2.795)						(18.322)		(−2.459)				
	0.0080***	9.74×10^{-5}	−0.0023**	−0.0016			0.2391		0.0276***	0.0037	−0.0058	−0.0061			0.1415
	(15.600)	(0.152)	(−2.325)	(−0.994)					(12.051)	(1.446)	(−1.453)	(−1.216)			
	0.0053***				2.00×10^{-4}		−0.0052		0.0161***				0.0062**		0.0390
	(5.830)				(0.271)				(3.296)				(1.988)		
	0.0061***	−0.0072			6.84×10^{-5}	0.0049	0.0415		0.0198***	−0.0366**			0.0044*	0.0274**	0.1286
	(10.159)	(−1.555)			(0.101)	(1.477)			(5.404)	(−2.322)			(1.792)	(2.299)	
	0.0072***		−0.0036***		0.0014**		0.2452		0.0223***		−0.0120***		0.0101***		0.2414
	(11.552)		(−3.063)		(2.474)				(6.574)		(−3.078)		(3.382)		
	0.0077***	−0.0061*	−0.0030***	-9.04×10^{-4}	0.0013***	0.0042	0.2972		0.0254***	−0.0337***	−0.0109**	−0.0016	0.0086***	0.0248***	0.3251
	(13.796)	(−1.788)	(−2.934)	(−0.639)	(2.692)	(1.492)			(9.653)	(−3.009)	(−2.399)	(−0.344)	(3.434)	(2.677)	

Notes: The table reports estimates from predictive regressions of growth in US coincident economic activity index on term spread and its components with dummy variables of US EPU. All variable definitions are identical to those in Table 3, except for D_{U_E}. D_{U_E} is the dummy variable for high uncertainty periods. Horizon indicates predictive months of growth in coincident economic activity index. Panels A and B report the results of term spread and its components, respectively. Newey and West (1987) corrected t-statistics are reported in parentheses. *, ** and *** represent significance at the 10, 5 and 1% levels, respectively

Table 10 reports the empirical results with the redefined uncertainty dummy variable ($D^Q{}_t$). Owing to the limitations of space, we only report the results of Models (6) and (8) in the Korean and the US stock markets; other results are broadly consistent with those in Tables 4 to 9. In Panel A, the coefficient estimates on the interaction term between the risk-neutral expectation and $D^Q{}_t$ are positive and significant at the 1% or 5% levels for one- and three-month predictive horizons in the Korean stock market. In addition, the increase in the adjusted R^2 is also comparable to that in Table 4. For instance, the adjusted R^2s in Models (6) and (8) with $D^Q{}_t$ are 9.03% and 11.27%, respectively, which are slightly larger than those in Table 4. Thus, in the Korean stock market, the results with $D^Q{}_t$ are similar to the results in Table 4. In Panel B, the coefficient estimates on the risk-neutral expectation during high uncertainty periods are positively significant except for Model (8) for the six-month predictive horizon. Although the significance of the coefficient estimate on the interaction term between the risk-neutral expectation and $D^Q{}_t$ is somewhat weaker than that in Table 7, the sign of the coefficient is still positive. Furthermore, the addition of $D^Q{}_t$ improves the adjusted R^2 in the US stock market.

In summary, the predictive power of the risk-neutral expectation for future stock market returns and economic activity during the top quartile of the EPU is still significantly stronger than the other three quartiles both in Korea and the USA. These findings lend further support to the hypothesis that uncertainty has an important role in the information on the term spread's components, especially the risk-neutral expectation.

5. Conclusion

This study investigates how the predictive power of the term spread and its components on the stock market and economic activity vary with the level of economic or policy-related uncertainty. The central bank exploits the monetary policy and interest rate policy to alleviate the adverse impact of unexpected events such as the COVID-19 pandemic, financial crisis and major political elections. Thus, we expect that the risk-neutral expectation of the term spread to have significantly stronger predictive power for future stock market returns and economic activity during high uncertainty periods, as this component captures the movement of monetary business cycle and the inflation expectation pertaining to the monetary and interest rate policies.

The empirical results confirm that the risk-neutral expectation significantly and positively predicts future stock market returns and economic activity during high uncertainty periods. This relation is robust to the alternate definition of high uncertainty period based on the first quartile of the uncertainty measure. However, we do not observe a similar increase in the predictive power of the term spread and term premium with regard to the EPU.

Our paper contributes to the literature on the information of the term spread. We consider the impact of the monetary and interest rate policies' significance on the information on the term spread and its components. Furthermore, this paper provides indirect empirical evidence that the monetary and interest rate policies of the central bank play an important role on the response to uncertainty created by unexpected shocks. When viewed this way, our results highlight that the policymakers ought to recognize and carefully monitor the effectiveness of the monetary and interest rate policies, particularly during periods of high uncertainty. Finally, our results suggest that uncertainty plays an important role when using the information in the bond markets to anticipate future movements in the stock markets and economic activity. In this respect, our research provides important insights on the conditional trading strategy in the stock markets or economic policymaking.

Table 10. Information of term spread and its components with uncertainty in Korean and US stock markets: top 25% uncertainty dummy variable

Horizon	Const	$D^Q_{K\_E}$	KOR_TP	KOR_TP × $D^Q_{K\_E}$	KOR_RN	KOR_RN × $D^Q_{K\_E}$	Adj. R^2
Panel A: Term premium and risk-neutral expectation (Korean stock market)							
$n = 1$	0.0041	−0.0069			6.44×10^{-4}	0.0571***	0.0646
	(0.929)	(−0.648)			(0.081)	(2.742)	
	−0.0068	−0.0019	0.0127**	−0.0054	0.0075	0.0544**	0.0684
	(−1.072)	(−0.134)	(2.062)	(−0.493)	(0.816)	(2.268)	
$n = 3$	0.0078	0.0116			0.0126	0.0860***	0.0903
	(0.581)	(0.686)			(0.470)	(2.914)	
	−0.0170	0.0130	0.0291*	1.13×10^{-4}	0.0284	0.0866**	0.1127
	(−0.947)	(0.524)	(1.809)	(0.006)	(0.962)	(2.548)	
$n = 6$	0.0202	0.0323			0.0323	0.0638	0.0593
	(0.841)	(0.968)			(0.673)	(1.159)	
	−0.0218	0.0215	0.0492*	0.0167	0.0589	0.0741	0.1013
	(−0.688)	(0.588)	(1.827)	(0.470)	(1.138)	(1.289)	
$n = 12$	0.0513	0.0537			0.0439	6.94×10^{-4}	0.0229
	(1.394)	(0.987)			(0.595)	(0.008)	
	−0.0469	0.1075*	0.1153***	−0.0598	0.1064	−0.0307	0.0978
	(−0.814)	(1.859)	(2.955)	(−1.144)	(1.362)	(−0.327)	
Horizon	Const	$D^Q_{U\_E}$	US_TP	US_TP × $D^Q_{U\_E}$	US_RN	US_RN × $D^Q_{U\_E}$	Adj. R^2
Panel B: Term premium and risk-neutral expectation (US stock market)							
$n = 1$	0.0045	−0.1398***			0.0015	0.1123***	0.0777
	(1.233)	(−2.793)			(0.455)	(2.873)	
	0.0051	−0.1073**	−0.0014	−0.0125	0.0020	0.0938***	0.0852
	(1.401)	(−2.386)	(−0.338)	(−1.491)	(0.556)	(2.675)	
$n = 3$	0.0070	−0.2372*			0.0040	0.2103**	0.0913
	(0.544)	(−1.802)			(0.407)	(2.064)	
	0.0137	−0.2141*	−0.0140	0.0015	0.0095	0.1886**	0.0964
	(1.203)	(−1.901)	(−1.105)	(0.094)	(0.889)	(2.134)	
$n = 6$	0.0066	−0.1859			0.0129	0.1940*	0.0661
	(0.257)	(−1.361)			(0.749)	(1.745)	
	0.0225	−0.1845	−0.0330	0.0258	0.0257	0.1719	0.0822
	(1.066)	(−1.292)	(−1.525)	(0.885)	(1.327)	(1.548)	
$n = 12$	−0.0146	−0.3081			0.0608	0.3136*	0.1590
	(−0.265)	(−1.496)			(1.565)	(1.906)	
	0.0104	−0.3670*	−0.0521	0.0663	0.0809*	0.3118*	0.1837
	(0.231)	(−1.697)	(−1.401)	(1.229)	(1.768)	(1.954)	

Note: The table reports estimates from predictive regressions of growth in Korean and US stock market returns on term spread and its components with top 25% dummy variables of Korean and US EPUs, respectively. All variable definitions are identical to those in Table 3, except for $D^Q_{K\_E}$ and $D^Q_{U\_E}$. $D^Q_{K\_E}$($D^Q_{U\_E}$) is the dummy variable for Korean (US) top 25% high uncertainty periods. Horizon indicates predictive months of stock market returns. Panels A and B report the results of Korean and US stock markets, respectively. Newey and West (1987) corrected t-statistics are reported in parentheses. *, ** and *** represent significance at the 10, 5 and 1% levels, respectively

Notes

1. Davis and Fagan (1997), Brunetti and Torricelli (2009).
2. Campbell and Yogo (2006), Chen (2009).
3. Details of the price of risk parameters are explained in Adrian *et al.* (2013).
4. Engle *et al.* (1987), Longstaff and Schwartz (1992), Wachter (2006).
5. Baker *et al.* (2016) construct the US EPU based on news. EPU of the USA reflects the search results in 10 large newspapers containing at least one of the terms such as "uncertainty" or "uncertain," "economic" or "economy," "congress," "legislation," "white house," "regulation," "federal reserve" and "deficit." Similar to the EPU of the USA, the EPU of Korea is also derived from the search results in newspapers. The 10 newspapers included in their analysis are USA Today, the Miami Herald, the Chicago Tribune, the Washington Post, the Los Angeles Times, the Boston Globe, the San Francisco Chronicle, the Dallas Morning News, the Houston Chronicle and the WSJ. EPU of Korea reflects the search results containing one or more of the following terms such as "economy" or "economic," "commerce," "government," "Blue House," "Congress," "authorities," "legislation," "tax," "regulation," "Bank of Korea," "central bank," "deficit," "WTO," "law/bill," "ministry of finance," "uncertainty" or "uncertain" in the newspaper with the native language including Donga Ilbo, Kyunghyang, Maeil Economic, Hankyoreh, Hankook Ilbo and Korea Economic Daily. After September 2016, EPU of Korea is constructed based on the set of newspapers excluding Donga Ilbo due to archiving issues.
6. For the USA, the EPU is constructed based on three components. The first component based on news is similar to EPU of the USA used in this paper. The second component includes the information on uncertainty about expiration of tax code provisions in the future reported by the Congressional Budget Office. The third component captures uncertainty monetary policy and government spending. However, for Korea, the EPU is only constructed based on news. To eliminate the influence of the difference in the components of the EPU's construction on our results, we use the EPU of the USA based on news only.
7. The results with the term spread defined as the difference between interest rates of five-year and one-year treasury bonds are qualitatively similar and available upon request.
8. The maturities of the treasury bonds range from one month to 10 years.
9. www.newyorkfed.org/research/data_indicators/term_premia.html.
10. All indexes in Korea and the USA are seasonally adjusted.
11. www.policyuncertainty.com/.
12. EPUs of Korea and the USA are standardized and normalized, respectively.
13. During low uncertainty periods, although the correlation between the risk-neutral expectation and stock market returns is negative (−0.1189), that is statistically insignificant (*t*-statistics = −1.0978).
14. Harvey (1989), Estrella and Hardouvelis (1991), Haubrich and Dombrosky (1996) and Estrella and Mishkin (1998) show that the term spread has the predictive power for 12-month (i.e. four-quarters) growth of economic activity.
15. While the long-term interest rate generally refers to the 10-year Treasury bond in the USA (Stock and Watson, 1989), the corresponding measure in economic analysis is usually three- or five-year Treasury bonds for the case of Korea, as is the case when constructing the composite economic index, for example. Thus, the market for long-term bonds appears to be thinner and less developed in Korea compared to the USA.

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