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ORIGINAL RESEARCH

The effects of high uncertainty risk on international stock markets

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Abstract
We conduct an international analysis of the cross-sectional risk premiums of uncertainty risk factors in addition to traditional risk factors. We consider international stock markets in five regions separately. We measure uncertainty by the local and US economic policy uncertainty indices. Economic policy uncertainty risk has negative risk premiums. This implies that investors get lower returns for assets with high uncertainty betas. We further analyze a nonlinear relationship between excess returns and uncertainty risk by adding the downside economic policy uncertainty risk factor which captures high levels of uncertainty, similar to downside market risk. The downside uncertainty risk factor has negative risk premiums.

Keywords International stock returns · Economic policy uncertainty · Factor models · Downside risk

JEL Classification G12 · G15

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1 Introduction

There is a great deal of interest in the link between economic uncertainty and financial markets, cf. e.g. (Pastor & Veronesi, 2012, 2013; Bali et al., 2014; Brogaard & Detzel, 2015), and Bali et al. (2017). Bali et al. (2017) and Brogaard and Detzel (2015) show that economic uncertainty is priced in the cross-section of US stock returns with a negative risk premium. The economic uncertainty risk premiums are negative because an increase in uncertainty is unfavorable for investors. This is opposite the positive risk premiums of the market portfolio where increases in the market return is favorable for investors.

In this paper we contribute to this literature by testing whether economic policy uncertainty is priced in the cross-section of international stock returns. We conduct our international analysis by assessing the cross-sectional risk premiums of economic uncertainty in addition to the traditional regional risk factors of Fama and French (2012). To measure economic uncertainty we use the (Baker et al., 2016) economic policy uncertainty (EPU) index because it is available for many other countries than the US. Further, this allows us to investigate if US or local economic policy uncertainty is an important determinant of international stock returns.

Another important contribution of our paper is to use a nonlinear model to describe the relationship between excess returns and economic policy uncertainty risk by allowing the uncertainty risk premiums to differ for low and high levels of the economic policy uncertainty. The reasoning behind analyzing high economic policy uncertainty as a risk factor is linked to the literature on downside risk asset pricing models, cf. Kraus and Litzenberger (1976) who consider market downside risk which covers the risk from when the market return is below its average value. Ang et al. (2006) find that the downside risk has a significant risk premium in the cross-section of stock returns, both for individual stocks and for portfolios of stocks. Similarly, Lettau et al. (2014) show that there is a downside risk premium in the cross-section of currencies. Farago and Tedongap (2018) provide a theoretical model that includes downside risk in the cross-section of asset returns. In the present paper, we are interested in the uncertainty risk (not the market risk) and investigate the situation when the uncertainty is above its average as this economic environment is the critical situation for investors similar to small market returns. Therefore, we define the new risk variable (high economic policy uncertainty) to be equal to the economic policy uncertainty index itself when uncertainty is above its average value and zero otherwise, similar to the definition of the market downside risk. We estimate the high uncertainty betas and risk premiums in a similar fashion as for the downside market risk factor.

Our paper is closely related to (Bali et al., 2017) who show that macroeconomic uncertainty as measured by the (Jurado et al., 2015) index has a negative risk premium. Using (Fama & MacBeth, 1973) regressions, Bali et al. (2017) show evidence of significantly negative economic policy uncertainty risk premiums in the cross-section of US stock returns. Moreover, they find that the results also hold for stock portfolios. Bali et al. (2014) investigate the exposure of hedge funds to economic uncertainty. Their findings reveal that the economic uncertainty beta is significant in the cross-section and that there is a significant risk premium in the hedge fund returns for economic uncertainty. Brogaard and Detzel (2015) extend the (Fama & French, 1993) factor model with the economic policy uncertainty risk factor from Baker et al. (2016). They find that the (Fama & French, 1993) US test portfolios earn negative economic policy uncertainty risk premiums. In contrast, we show that while for the US stock market, the economic policy uncertainty risk premium is insignificant, the high economic policy uncertainty risk premium is significantly negative. Overall, our results for the US stock market partially confirm the findings in Bali et al. (2017).

The previous literature shows that there is a negative time series relation between excess stock returns and the economic policy uncertainty index from (Baker et al., 2016). Chiang (2019) uses time series analysis to find that international stock returns are negatively related to changes in both the local and global economic policy uncertainty. Ko and Lee (2015) use wavelet analysis to show that there is a negative relationship between international stock returns and the economic policy uncertainty. Phan et al. (2018) also consider local and global economic policy uncertainty. They find that economic policy uncertainty has predictive power for stock returns in the time series dimension. Tsai (2017) considers the effect of the economic policy uncertainty on the spillover and volatility of international stock markets. Smales (2020) considers time series causality of economic policy uncertainty on international stock market implied volatility and finds that there is a positive relationship. Brogaard et al. (2019) show that international stock returns tend to fall with higher global policy uncertainty, where policy uncertainty is measured by US election data.

Fama and French (2012) and Fama and French (2017) both use factor models of international stock market returns in the spirit of their (Fama & French, 1993) US stock market analysis. Fama and French (2012) consider stocks from 23 countries region-wise; North America, Japan, Asia Pacific, and Europe. Their test assets are 25 stock portfolios formed on size and book-to-market as well as 25 stock portfolios formed on size and momentum. They estimate the four-factor model for each region with the (Fama & French, 1993) and the Carhart (1997) risk factors (MKT, SMB, HML, and UMD). They use both global and local risk factors and they find that the local risk factors have stronger explanatory power. For this reason we also use local risk factors. Similarly, Blackburn and Cakici (2017) consider cross-sectional stock returns across regions in the same manner. They show that return reversal is a priced risk factor across regions.

In the empirical analysis, we adopt a model with local Fama and French risk factors rather than US risk factors. The use of local risk factors is in line with the previous literature. Griffin (2002) uses the Fama and French (1993) three-factor model in two versions: one with global factors and one with country-specific factors. Griffin (2002) considers Canada, Japan, the UK, and the US. The explanatory power of the local three-factor models is much stronger for all countries. This applies to both individual stocks and stock portfolios. Hou et al. (2011) consider individual stocks from 49 countries to estimate various factor models and show that local factors are more informative than global factors.

Our five-factor asset pricing model includes economic policy uncertainty (EPU) in addition to the four traditional risk factors of Fama and French (2012) (MKT, SMB, HML, and UMD), while our six-factor model is extended to include the high economic policy uncertainty ($HEPU$) risk factor. We consider stock markets in four world regions (North America, Europe, Asia Pacific and Japan) as well as the US stock market. We consider each region separately. Our results show that economic policy uncertainty generally has a negative and significant risk premium. This implies that investors get lower returns for high economic policy uncertainty beta assets because high economic policy uncertainty is unfavorable to investors. Our results further show that the high economic policy uncertainty risk factor has significantly negative risk premiums in addition to the economic policy uncertainty risk factor in itself.

Our paper fills several gaps in the literature: First by investigating if economic policy uncertainty is priced in the cross-section of international stock returns. Second, by using a non-linear model, where the uncertainty risk premium is allowed to differ for low and higher levels of economic policy uncertainty. Third, by investigating wether local and / or US economic policy uncertainty is important.

The remaining part of the paper is structured as follows. First, we introduce the data in Sect. 2 and then we present the econometric framework in Sect. 3. Subsequently, we provide our empirical results in Sect. 4 for the five-factor model and in Sect. 5 for the six-factor model. The paper ends with the conclusion in Sect. 6. The Appendix contains additional results.

2 Data

We consider monthly observations during the period 1990M11-2019M04.

2.1 Test portfolios

We follow (Fama & French, 2012) and Fama and French (2017) and consider test portfolios for various regions using the test portfolios from French's data library.[1] We consider portfolios made up of stocks from the following regions: Asia Pacific (Australia, New Zealand, Hong Kong, and Singapore), Europe (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the UK), Japan, and North America (Canada and the US).[2] In addition, we analyze the US stock market so that we can compare our results to previous research that is mainly concerned with the US market. For each region, our test assets are 25 equally-weighted portfolios formed on size and book-to-market. We denote these 25 portfolios with $\{S1B1, \ldots, S5B5\}$ where S denotes size and B denotes book-to-market.[3]

2.2 Risk factors

For each of the regions, we use traditional regional risk factors in combination with the uncertainty risk factors. The traditional risk factors are the regional (Fama & French, 1993) factors; regional excess market return (MKT), regional small-minus-big factor (SMB), regional high-minus-low factor (HML), as well as the regional momentum factor (UMD) from Carhart (1997).[4]

We consider the economic policy uncertainty indices from Baker et al. (2016) because it is readily available for several countries.[5] We use the log of the EPU indices as the first uncertainty risk factor (EPU). There are readily available local EPU indices for Europe, Japan, and the US. For North America we use the US EPU index as there is no specific EPU index covering North America. For Asia Pacific there is no specific local EPU index available covering the entire region, so we use the Australian EPU index. However, this index only begins in 1998M01, so here we consider a shortened sample period.

1 The test portfolios are available from French's homepage.

2 The classification of regions follow the data structure of French's data library.

3 The portfolios are equally weighted across the individual stocks in the portfolio.

4 Equally weighted country portfolios are constructed. We form value and growth portfolios in each country using four ratios: book-to-market (B/M); earnings-price (E/P); cash earnings to price (CE/P); and dividend yield (D/P). Firms in the country portfolios are value-weighted. To construct index returns, we weight each country in proportion to its EAFE weight. The raw data are from Morgan Stanley Capital International for 1975 to 2006 and from Bloomberg for 2007 to present.

5 Bekaert et al. (2017) note that various uncertainty indices for the US are positively correlated.

Table 1 Summary statistics for the uncertainty risk factors

		Mean	*Std.dev.*	*Min*	Max	Skewness	Kurtosis
US	EPU	114.28	43.62	44.78	284.14	1.22	4.63
	HEPU	62.24	80.30	0.00	284.14	0.73	2.04
Europe	EPU	134.01	61.79	47.69	433.28	1.38	5.85
	HEPU	77.61	101.16	0.00	433.28	0.83	2.51
Asia Pacific	EPU	99.47	57.46	25.66	337.04	1.51	5.49
	HEPU	59.91	82.51	0.00	337.04	1.08	3.16
Japan	EPU	104.60	34.01	48.37	240.23	1.44	5.52
	HEPU	55.12	69.67	0.00	240.23	0.68	1.97

The table shows the summary statistics for the EPU and HEPU uncertainty risk factors for each region

In addition, we consider a new risk factor, namely risk from high levels of the EPU indices. The high EPU risk factor is equal to the log of the EPU index itself when the EPU index is high and zero otherwise. For simplicity we define EPU to be high when the EPU index is above its average. Thus, the high EPU risk factor is defined as $HEPU_t = EPU_t \times 1[EPU_t > \overline{EPU}]$. The high EPU risk factor is similar in spirit to the downside market betas, cf. the discussion in the Introduction.

For Europe, Japan, and Asia Pacific we also compare with the results from using the US EPU index in place of the local EPU index. In this way, we can further investigate if the dominance of the local risk factors over the US risk factors also applies to the uncertainty risk factors.

Table 1 shows summary statistics for the EPU and $HEPU$ risk factors. The EPU risk factor has higher means and lower standard deviations than the $HEPU$ risk factor. Both risk factors are positively skewed, strongest for EPU. EPU is leptokurtic while $HEPU$ is platykurtic. Table A1 in the Appendix shows the correlation between the risk factors for each region. The EPU risk factors are very weakly correlated with the traditional risk factors. For instance, for the US EPU risk factor, the correlation with the traditional risk factors ranges between −0.10 and 0.01. The correlations between the US and local EPU risk factors are positive but not so strong; for Europe and Asia Pacific it is 0.67, while it is 0.44 for Japan.

3 Econometric method

We analyze each region separately. To keep notation simple, we do not use explicit notation to keep track of the region under investigation.

We examine the cross-sectional relation between the risk factors and expected stock returns using two-step (Fama & MacBeth, 1973) regressions. In the first step, we use time series regressions to estimate factor betas and in the second step, we use cross-sectional regressions to estimate risk premiums. In practice, we use a 60-month rolling window estimation. The first set of betas are obtained using the sample 1990M11-1995M10. Then, these betas are used to predict the cross-sectional stock returns in the following month (1995M11), and so on. The cross-sectional return predictability results are thereby reported for the period 1995M11-2019M04.

The first-step regression for a given region is given in Eq. (1). The first step amounts to a time series regression for each of the test portfolios. Here i denotes is the ith portfolio of that region, where $i = \{S1B1, \ldots, S5B5\}$ and t denotes month t. The excess return for the test portfolio is denoted R_{it} and it is regressed on the traditional risk factors, MKT_t, SMB_t, HML_t, UMD_t, and of particular interest to us, the uncertainty risk factors EPU_t and $HEPU_t$.

$$R_{it} = \alpha_{it} + \beta_{it}^{MKT} MKT_t + \beta_{it}^{SMB} SMB_t + \beta_{it}^{HML} HML_t + \beta_{it}^{UMD} UMD_t + \beta_{it}^{EPU} EPU_t + \beta_{it}^{HEPU} HEPU_t + \varepsilon_{it} \tag{1}$$

In the second step, we use cross-sectional regressions to estimate the risk premiums for the traditional risk factors as well as for the EPU and $HEPU$ risk factors. We regress the excess returns of the test portfolios on the one-period lagged estimated beta coefficients from the first-step regressions, e.g. $\widehat{\beta_{it}^{EPU}}$. From Eq. (2) we obtain the risk premiums for the six-factor model for period $t + 1$.

$$R_{it+1} = \lambda_{0t} + \lambda_t^{MKT} \widehat{\beta_{it}^{MKT}} + \lambda_t^{SMB} \widehat{\beta_{it}^{SMB}} + \lambda_t^{HML} \widehat{\beta_{it}^{HML}} + \lambda_t^{UMD} \widehat{\beta_{it}^{UMD}} + \lambda_t^{EPU} \widehat{\beta_{it}^{EPU}} + \lambda_t^{HEPU} \widehat{\beta_{it}^{HEPU}} + \epsilon_{it} \tag{2}$$

The risk premiums for the entire sample period are the averages of the lambda estimates from the second step regression. In particular, the economic policy uncertainty risk premium is the average of the λ_t^{EPU} estimates and the high economic policy risk premium is the average of the λ_t^{HEPU} estimates. We use the time series of the lambda estimates to investigate if the lambdas are statistically significant based on (Newey & West, 1987) standard errors.

We consider two sets of analysis, namely the five-factor and the six-factor model. The five-factor model arrises when we leave out the $HEPU$ risk factor, i.e. in the first-step regression we let $\beta_{it}^{HEPU} = 0$. This then translates into $\lambda_t^{HEPU} = 0$ in the second-step regression. The six-factor model simply contains all the risk factors.

4 Empirical results from five-factor model

In this section we show the empirical results based on the five-factor model which only includes the EPU risk factor.[6] The analysis in this section is an international extension of previous US studies. Although we consider all five risk factors, we do not look further into the traditional risk factors.

4.1 EPU beta estimates

Table A3 in the Appendix shows the averages and standard deviations of the time series of the estimated EPU betas, β_{it}^{EPU}, for each of the 25 portfolios for each of the regions. The standard deviations are large relative to the averages which implies that the EPU betas are highly volatile over time. Figure 1 shows the average EPU beta for the 25 test portfolios for the various regions. From the figure it is also evident that the average EPU betas differ across portfolios for a given region. Moreover, it is clear that the EPU betas differ across regions and across local and US EPU.

We look further into the time series behavior of the EPU betas. As an example we focus on the local EPU betas for Japan. Figure 2 shows the time series of the EPU betas for each of the portfolios. We see that the betas are highly time varying. The ordering of the betas

[6] In the text, we adopt a 5% level of significance.

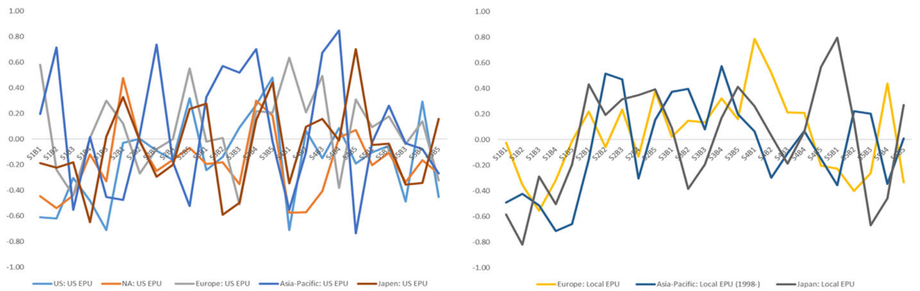

Fig. 1 Average EPU betas from five-factor model. The figure shows the average EPU betas from the five-factor model for each of the 25 test portfolios for various regions using US EPU (left) and local EPU (right). S denotes size and B book-to-market. Sample: 1990M11-2019M04, except for Asia Pacific where it is 1998M01-2019M04.

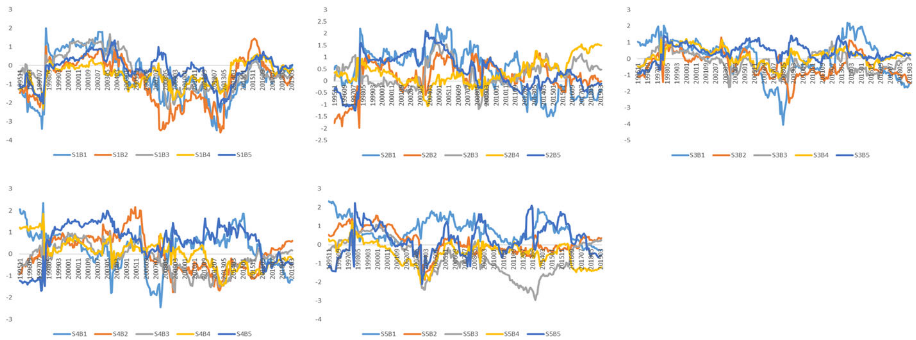

Fig. 2 Japan local EPU betas from five-factor model. The figure shows the time series of the local EPU betas for Japan from the five-factor model for the 25 portfolios where S denotes size and B book-to-market. Sample: 1990M11-2019M04.

for the different portfolios is changing over time, so it is not the same portfolio which has the largest EPU beta at all points in time. The betas also vary between being positive and negative. During the period 1998–2002, the betas are less spread out and are similar across portfolios, while they are highly volatile in the period 2011–2014.

4.2 Risk premiums

Table 2 shows the average risk premiums and associated t-values. The average R-squared values are high (all above 0.43) which document that the five risk factors in combination have strong power in explaining the cross-sectional variation in the regional stock returns.

Generally the EPU risk premiums are negative. This implies that investors get lower returns for assets with high uncertainty betas because high uncertainty is unfavorable for investors. This is similar to the findings for the US in Bali et al. (2017) and Brogaard and Detzel (2015).

For the US and North America, the risk premiums of the US EPU risk factor are both negative, but they are insignificant. For Europe, both risk premiums of the US and the local EPU risk factors are about zero and insignificant.

For Asia Pacific, all the EPU risk premiums are significantly negative. For the local EPU risk factor we use the Australian EPU which is only available for a shorter time period. Still,

Table 2 Risk premiums in five-factor model

	US		NA		Europe				Asia Pacific						Japan			
Cons	1.33	*3.17*	1.63	*4.04*	0.94	*2.54*	1.23	*3.37*	1.70	*2.75*	1.27	*1.84*	1.04	*1.54*	0.39	*0.79*	0.07	*0.11*
MKT	−0.35	*−0.96*	−0.73	*−2.05*	−0.10	*−0.22*	−0.37	*−0.83*	−0.92	*−1.68*	−0.29	*−0.50*	−0.03	*−0.05*	−0.16	*−0.28*	0.25	*0.36*
SMB	0.11	*0.56*	0.14	*0.68*	−0.10	*−0.76*	−0.12	*−0.96*	0.19	*0.80*	0.16	*0.61*	0.09	*0.37*	0.22	*1.19*	0.16	*0.85*
HML	0.10	*0.42*	0.03	*0.13*	0.26	*1.24*	0.28	*1.30*	0.59	*2.97*	0.50	*2.70*	0.47	*2.40*	0.45	*1.81*	0.38	*1.54*
UMD	0.40	*0.76*	0.07	*0.14*	−0.17	*−0.47*	−0.12	*−0.34*	0.29	*0.67*	0.11	*0.22*	0.22	*0.46*	−0.31	*−0.84*	−0.38	*−0.98*
US EPU	−0.06	*−1.33*	−0.11	*−1.94*	0.00	*0.07*			−0.11	*−2.64*	−0.16	*−3.22*			−0.07	*−1.46*		
Local EPU							0.03	*0.65*					−0.28	*−3.90*			−0.12	*−2.46*
R^2	0.59		0.60		0.53		0.53		0.45		0.43		0.44		0.60		0.60	

The table reports the average risk premiums (lambdas) from the five-factor model with the associated t-stats in *italic* based on Newey and West (1987) standard errors. Sample: 1990M11-2019M04, except for Asia Pacific second and third specification where it is 1998M01-2019M04. The test assets are the excess returns on the Fama-French 25 portfolios formed on size and book-to-market. The list of factors consist of the Fama-French three factors (MKT, SMB, HML), the Carhart momentum factor (UMD), and the US or local economic policy uncertainty risk factor

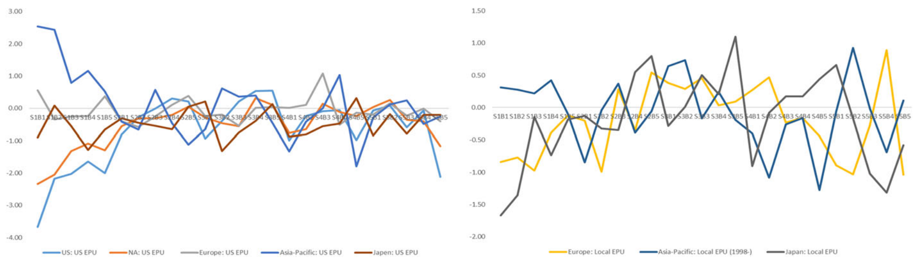

Fig. 3 Average EPU betas from six-factor model. The figure shows the average EPU betas from the six-factor model for each of the 25 test portfolios for various regions using US EPU (left) and local EPU (right). S denotes size and B book-to-market. Sample: 1990M11–2019M04, except for Asia Pacific where it is 1998M01–2019M04.

the local EPU risk premium is significantly negative. Using the US EPU, the uncertainty risk premium for Asia Pacific is significant both for the entire sample period as well as for the shorter sample period. The size of the US EPU risk premiums are smaller (in absolute terms).

For Japan, the local EPU has a significantly negative risk premium, while the US EPU risk premium is still negative but insignificant.

Overall, for Asia Pacific and Japan our results show that local uncertainty risk factors are more important than US uncertainty risk factors. These findings are in line with previous research about the importance of local versus US traditional risk factors, cf. Fama and French (2012), Fama and French (2017), and Blackburn and Cakici (2017) as discussed in the Introduction. Further, we see that the US uncertainty risk factor is significant outside the US (in Asia Pacific). We also see that the cross-sectional risk premiums of the uncertainty risk factor vary across regions. Economic policy uncertainty is an important risk factor in international cross-sectional asset pricing. Thus, the international findings are similar to the previous findings for the US.

5 Empirical results from six-factor model

In this section we show the empirical results from the six-factor model that includes both the EPU risk factor as well as the new high EPU ($HEPU$) risk factor. The analysis in this section extends the previous literature on the US stock market with the new risk factor ($HEPU$) and in addition it extends the US analysis into an international context.

5.1 EPU and HEPU beta estimates

Table A2 in the Appendix shows the averages and standard deviations of the time series of the estimated EPU betas (β_{it}^{EPU}) and $HEPU$ betas (β_{it}^{HEPU}) for each of the 25 portfolios for each of the regions as they are estimated in the six-factor model. The standard deviations are relatively smaller than the averages compared to the EPU betas from the five-factor model. Figures 3 and 4 show the average EPU and $HEPU$ betas for the 25 test portfolios for the various regions. We see that the average betas vary across regions and across local and US EPU risk measures. The span of variation in the $HEPU$ betas is larger than for the EPU betas.

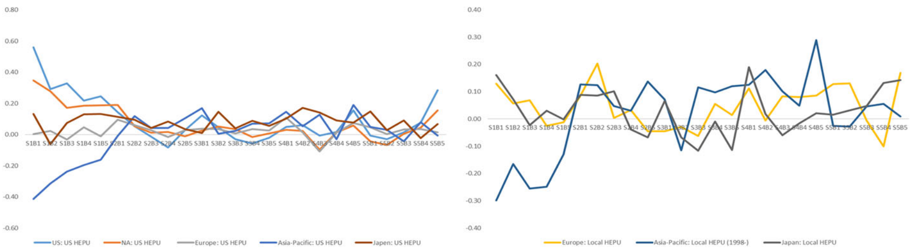

Fig. 4 Average HEPU betas from six-factor model. The figure shows the average HEPU betas from the six-factor model for each of the 25 test portfolios for various regions using US EPU (left) and local EPU (right). S denotes size and B book-to-market. Sample: 1990M11–2019M04, except for Asia Pacific where it is 1998M01–2019M04.

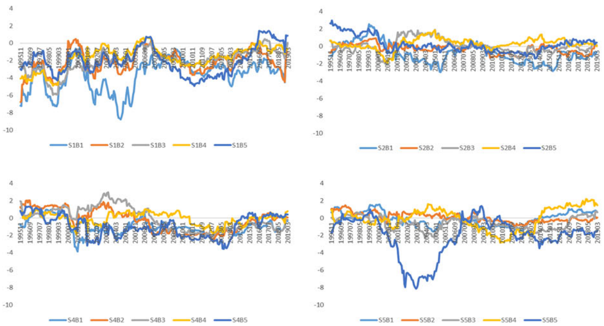

Fig. 5 US EPU betas from six-factor model. The figure shows the time series of the US EPU betas for US from the 6-factor model for the 25 portfolios where S denotes size and B book-to-market. Sample: 1990M11–2019M04.

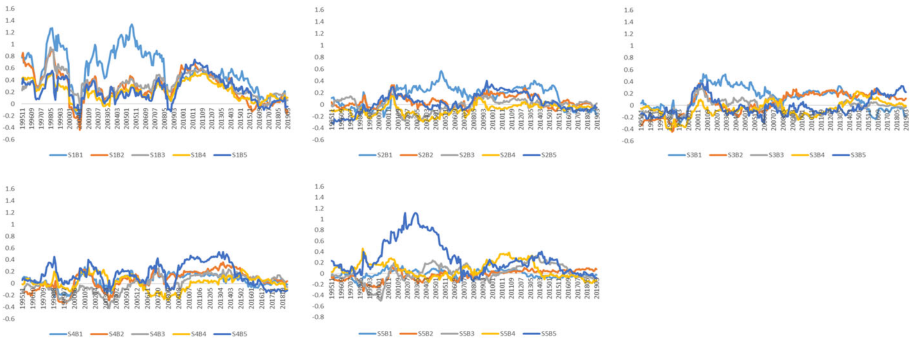

Fig. 6 US HEPU betas from six-factor model. The figure shows the time series of the US HEPU betas for US from the 6-factor model for the 25 portfolios where S denotes size and B book-to-market. Sample: 1990M11–2019M04.

We look further into the time series behavior of the EPU and $HEPU$ betas. We illustrate the US betas as the $HEPU$ risk factor is new to the literature. Figures 5 and 6 show the time series of the EPU and $HEPU$ betas for the US for each of the 25 test portfolios. The estimated betas vary both over time and across portfolios. The span of the variation in the EPU betas is larger than for the $HEPU$ betas.

5.2 Risk premiums

Table 3 shows the average risk premiums and associated t-values for the six-factor model. The average R-squared values are all high (all above 0.48) and they are all individually higher than the corresponding R-squared values from the five-factor model. This documents that adding the $HEPU$ risk factor is important for explaining the cross-sectional variation in the regional stock returns.

In general, the EPU risk premiums are negative as in the five-factor model. Again, this implies that investors get lower returns for assets with high uncertainty betas because high uncertainty is unfavorable for investors. This is similar to the findings for the US by Bali et al. (2017) and Brogaard and Detzel (2015). In general, the $HEPU$ risk premiums are also negative. This implies that the risk premiums for uncertainty increases when uncertainty is high. So, there is a non-linear relationship between excess stock returns and uncertainty risk.

For the US and North America, the risk premiums of the US EPU risk factor are both negative and small and only significant for North America. In contrast the risk premiums for $HEPU$ are large and significant for both the US and North America.

The results for Asia Pacific resemble those for North America with significant risk premiums for both the US and the local EPU and $HEPU$ risk factors. Thereby, both the five-factor model and the six-factor model show the importance of both local and US uncertainty risk factors for Asia Pacific stock markets. For Europe and Japan none of the EPU or $HEPU$ risk premiums are significant. For Europe this is in accordance with the findings of the five-factor model, while for Japan, we see that the risk premium of the local EPU risk factor turns insignificant once we also account for the risk premium from $HEPU$.

We contribute to the literature by investigating the risk premiums of the high economic policy uncertainty risk factor. Overall, we see that for high levels of uncertainty the risk premiums are even larger than what applies for the traditional economic policy uncertainty risk premiums. We find variations across regions and we find differences between the estimated uncertainty risk premiums when we do and do not take into account the risk from high uncertainty. Another way of thinking about the new high uncertainty risk factor is to define different states of the world or regimes, and allow for a non-linear utility function in uncertainty, where uncertainty has to be above of certain size before investors start caring, cf. Cochrane (2005).

6 Conclusion

We conduct an international study of the cross-sectional risk premiums of economic policy uncertainty risk factors in addition to traditional risk factors. We consider the stock markets in five regions separately. We find that economic policy uncertainty has a negative risk premium for both local and US economic policy uncertainty risk measures. This implies that investors get lower returns for assets with high economic policy uncertainty betas because high economic policy uncertainty is unfavorable to investors. We further consider a nonlinear relationship between expected returns and economic policy uncertainty by considering the downside risk factor for higher uncertainty. We find that high economic policy uncertainty has negative risk premiums.

This present article offers useful insights for academics, practitioners, and policy makers. Our research has important implications for fund management, as we show that it is important to take the non-linearity in the risk premium for policy uncertainty into account when

Table 3 Risk premiums in six-factor model

	US		NA		Europe		Asia Pacific						Japan					
Cons	1.46	*4.13*	1.57	*4.23*	1.05	*2.82*	1.60	*4.28*	1.87	*3.18*	1.21	*1.76*	1.47	*2.20*	0.29	*0.61*	0.28	*0.47*
MKT	−0.53	*−1.66*	−0.66	*−2.04*	−0.21	*−0.50*	−0.70	*−1.54*	−1.06	*−2.01*	−0.18	*−0.28*	−0.42	*−0.73*	−0.08	*−0.14*	0.06	*0.08*
SMB	0.08	*0.41*	0.12	*0.62*	−0.09	*−0.75*	−0.15	*−1.18*	0.11	*0.47*	0.04	*0.18*	0.06	*0.26*	0.19	*1.03*	0.17	*0.89*
HML	0.08	*0.35*	0.04	*0.16*	0.27	*1.25*	0.26	*1.18*	0.66	*3.52*	0.55	*2.88*	0.59	*3.19*	0.45	*1.83*	0.38	*1.54*
UMD	−0.27	*−0.61*	0.05	*0.11*	−0.29	*−0.76*	−0.08	*−0.23*	0.21	*0.46*	0.16	*0.33*	0.05	*0.10*	−0.32	*−0.88*	−0.16	*−0.43*
US EPU	−0.08	*−1.75*	−0.11	*−2.07*	0.00	*0.00*			−0.09	*−2.05*	−0.28	*−3.95*			−0.04	*−0.88*		
High US EPU	−1.04	*−3.87*	−0.68	*−2.08*	0.02	*0.06*			−0.91	*−3.01*	−1.59	*−4.40*			−0.01	*−0.02*		
Local EPU							0.04	*1.00*					−0.15	*−2.70*			−0.08	*−1.59*
High local EPU							−0.08	*−0.33*					−1.24	*−3.31*			−0.37	*−0.91*
R^2	0.64		0.65		0.56		0.57		0.50		0.48		0.48		0.62		0.63	

The table reports the average risk premiums (lambdas) from the six-factor model with the associated t-stats in *italic* based on Newey and West (1987) standard errors. Sample: 1990M11-2019M04, except for Asia Pacific second and third specification where it is 1998M01-2019M04. The test assets are the excess returns on the Fama-French 25 portfolios formed on size and book-to-market. The list of factors consist of the Fama-French three factors (MKT, SMB, HML), the Carhart momentum factor (UMD), and the US and high US or local and high local economic policy uncertainty risk factor managing portfolios. Our research also provides important implications for policy makers, in that it shows that policy makers should care about periods with high economic policy uncertainty, as its risk premium is priced in the cross-section of bonds. Further, for policy makers it is of interest that also external uncertainty (US economic policy uncertainty) is of importance, so local policy makers also need to be updated on external risk factors. (Tables 4, 5 and 6).

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A Additional Tables

Table 4 Correlation of risk factors

US		MKT	SMB	HML	UMD	
	SMB	0.22				
	HML	−0.17	−0.27			
	UMD	−0.25	0.06	−0.19		
	US EPU	−0.10	0.01	−0.09	−0.09	
NA		MKT	SMB	HML	UMD	
	SMB	0.26				
	HML	−0.25	−0.34			
	UMD	−0.14	0.19	−0.26		
	US EPU	−0.12	0.00	−0.05	−0.11	
Europe		MKT	SMB	HML	UMD	US EPU
	SMB	−0.16				
	HML	0.19	−0.06			
	UMD	−0.32	0.09	−0.28		
	US EPU	−0.19	−0.07	−0.06	−0.01	
	Local EPU	−0.09	−0.03	−0.13	0.01	0.67
Asia Pacific		MKT	SMB	HML	UMD	US EPU
	SMB	0.11				
	HML	0.09	−0.06			
	UMD	−0.29	0.09	−0.37		
	US EPU	−0.11	−0.17	0.00	−0.04	
	Local EPU	−0.20	−0.10	−0.03	−0.01	0.67
Japan		MKT	SMB	HML	UMD	US EPU
	SMB	0.13				
	HML	−0.18	−0.05			
	UMD	−0.17	−0.06	−0.27		
	US EPU	−0.10	0.10	0.04	−0.06	
	Local EPU	−0.12	0.05	−0.01	0.01	0.44

The table shows the correlation coefficients between the risk factors for each region. Sample: 1990M11-2019M04, except for Asia Pacific where it is 1998M01-2019M04

Table 5 Descriptive statistics for EPU betas from five-factor model

Panel A: Means	US	NA	Europe		Asia Pacific			Japan	
	US EPU	US EPU	US EPU	Local EPU	US EPU	US EPU*	Local EPU*	USEPU	Local EPU
S1B1	−0.61	−0.45	0.58	−0.02	0.20	−0.23	−0.49	−0.19	−0.58
S1B2	−0.62	−0.54	−0.24	−0.35	0.72	0.35	−0.42	−0.22	−0.82
S1B3	−0.30	−0.44	−0.44	−0.56	−0.55	−0.17	−0.51	−0.18	−0.29
S1B4	−0.48	−0.12	0.01	−0.32	0.02	−0.11	−0.71	−0.65	−0.50
S1B5	−0.71	−0.33	0.30	−0.01	−0.45	−0.71	−0.66	0.02	−0.19
S2B1	−0.03	0.48	0.12	0.22	−0.47	−0.24	−0.15	0.33	0.43
S2B2	0.00	−0.02	−0.27	−0.06	0.04	0.42	0.52	−0.01	0.19
S2B3	−0.09	−0.25	−0.08	0.24	0.74	0.63	0.47	−0.29	0.32
S2B4	−0.16	−0.16	0.00	−0.13	−0.18	−0.18	−0.30	−0.20	0.35
S2B5	0.32	−0.07	0.55	0.38	−0.52	−0.05	0.15	0.24	0.39
S3B1	−0.24	−0.20	−0.02	0.02	0.33	−0.28	0.37	0.28	0.09
S3B2	−0.14	−0.18	0.01	0.15	0.57	0.53	0.40	−0.59	−0.38
S3B3	0.09	−0.35	−0.51	0.14	0.52	0.94	0.08	−0.50	−0.20
S3B4	0.27	0.30	0.22	0.32	0.70	0.71	0.58	0.15	0.17
S3B5	0.48	0.18	0.21	0.16	−0.02	0.18	0.20	0.44	0.41
S4B1	−0.71	−0.58	0.63	0.79	−0.55	−0.57	0.06	−0.35	0.26
S4B2	0.06	−0.57	0.21	0.52	−0.10	−0.04	−0.30	0.10	0.03
S4B3	−0.15	−0.41	0.49	0.21	0.67	0.09	−0.11	0.16	−0.19
S4B4	0.09	0.01	−0.38	0.21	0.85	0.59	0.07	−0.01	0.06
S4B5	−0.19	0.07	0.31	−0.20	−0.74	−0.59	−0.15	0.71	0.57
S5B1	−0.10	−0.20	0.09	−0.23	−0.02	−0.40	−0.35	−0.05	0.80
S5B2	−0.05	−0.11	0.18	−0.40	0.26	0.12	0.22	−0.03	0.14
S5B3	−0.49	−0.34	−0.04	−0.26	−0.03	0.21	0.20	−0.36	−0.67
S5B4	0.30	−0.17	0.14	0.44	−0.08	−0.37	−0.35	−0.34	−0.46
S5B5	−0.45	−0.27	−0.32	−0.33	−0.27	−0.13	0.01	0.16	0.27

Table 5 continued

Panel B: Standard deviations

	US	NA	Europe		Asia Pacific			Japan	
	US EPU	US EPU	US EPU	Local EPU	US EPU	US EPU*	Local EPU*	USEPU	Local EPU
S1B1	1.15	1.12	0.49	0.54	1.58	1.12	0.69	0.93	1.25
S1B2	0.89	0.72	0.50	0.65	1.37	0.94	0.78	0.58	1.21
S1B3	0.90	0.68	0.44	0.71	0.96	0.80	0.89	0.71	0.95
S1B4	0.97	0.55	0.49	0.49	0.92	0.86	0.78	0.45	0.61
S1B5	0.98	0.83	0.66	0.63	1.10	0.97	1.05	0.43	0.75
S2B1	0.92	1.22	0.56	0.62	1.37	1.03	0.59	0.83	0.91
S2B2	0.56	0.49	0.53	0.57	1.41	0.60	0.59	0.48	0.65
S2B3	0.52	0.34	0.67	0.76	1.11	0.67	0.47	0.60	0.54
S2B4	0.56	0.45	0.31	0.38	0.80	0.81	0.62	0.38	0.53
S2B5	0.54	0.34	0.34	0.54	1.07	0.41	0.26	0.33	0.73
S3B1	0.73	0.52	0.86	0.77	1.59	1.08	0.75	0.69	1.18
S3B2	0.74	0.78	0.57	0.81	0.70	0.55	0.77	0.80	0.72
S3B3	0.43	0.73	0.83	0.44	1.00	0.65	0.47	0.66	0.57
S3B4	0.53	0.67	0.43	0.47	0.90	0.95	0.63	0.90	0.48
S3B5	0.77	0.43	0.58	0.70	1.02	0.89	0.68	0.48	0.50
S4B1	0.77	0.81	0.70	0.56	0.77	0.52	0.37	0.75	0.84
S4B2	0.77	0.93	0.49	0.63	0.96	0.90	0.41	0.84	0.82
S4B3	0.83	0.48	0.71	0.66	1.91	1.54	0.70	0.93	0.64
S4B4	0.67	0.51	0.74	0.93	1.03	1.00	0.53	0.46	0.62
S4B5	0.81	0.55	0.68	0.68	0.77	0.73	0.46	0.52	0.85

Table 5 continued

Panel B: Standard deviations

	US	NA	Europe		Asia Pacific			Japan	
	US EPU	US EPU	US EPU	Local EPU	US EPU	US EPU*	Local EPU*	USEPU	Local EPU
S5B1	0.62	0.82	0.41	0.39	1.37	1.26	0.63	0.60	0.61
S5B2	0.42	0.62	0.59	0.37	0.79	0.75	0.23	0.59	0.63
S5B3	0.59	0.49	0.43	0.53	0.96	0.38	0.22	0.35	0.98
S5B4	0.66	0.31	0.53	0.53	0.73	0.52	0.40	0.63	0.60
S5B5	0.97	0.56	0.57	0.67	1.32	0.95	0.73	1.33	0.81

The table shows the means and standard deviations of the EPU betas from the five-factor model for the 25 portfolios where S denotes the size of B the book-to-market. Sample: 1990M11-2019M04, except for Asia Pacific second and third column where it is 1998M01-2019M04 (marked by *)

Table 6 Descriptive statistics for EPU and High EPU betas from six-factor model

Panel A: Means

	US		NA		Europe				Asia Pacific						Japan			
	US EPU	US HEPU	US EPU	US HEPU	US EPU	US HEPU	Local EPU	Local HEPU	US EPU	US HEPU	US EPU	US HEPU*	Local EPU*	Local HEPU*	US EPU	US HEPU	Local EPU	Local HEPU
S1B1	−3.67	0.56	−2.34	0.35	0.56	0.00	−0.84	0.13	2.54	−0.41	2.01	−0.40	0.31	−0.30	−0.90	0.13	−1.67	0.16
S1B2	−2.18	0.29	−2.05	0.28	−0.35	0.02	−0.77	0.06	2.44	−0.31	2.24	−0.36	0.28	−0.17	0.08	−0.06	−1.36	0.07
S1B3	−2.02	0.33	−1.32	0.17	−0.25	−0.03	−0.98	0.07	0.79	−0.24	1.61	−0.33	0.22	−0.26	−0.55	0.08	−0.14	−0.02
S1B4	−1.64	0.22	−1.09	0.19	−0.24	0.05	−0.39	−0.03	1.16	−0.20	1.07	−0.22	0.42	−0.25	−1.28	0.13	−0.74	0.03
S1B5	−2.01	0.25	−1.30	0.19	0.38	−0.01	−0.12	−0.01	0.52	−0.16	0.07	−0.14	−0.10	−0.13	−0.66	0.13	−0.19	0.00
S2B1	−0.80	0.14	−0.56	0.19	−0.40	0.10	−0.20	0.09	−0.41	−0.01	−0.07	−0.02	−0.85	0.13	−0.31	0.11	−0.13	0.09
S2B2	−0.28	0.05	−0.31	0.05	−0.58	0.06	−0.99	0.20	−0.65	0.12	−0.34	0.13	−0.04	0.12	−0.45	0.10	−0.32	0.09
S2B3	0.00	−0.01	−0.31	0.01	−0.25	0.03	0.28	0.00	0.57	0.04	0.43	0.05	0.37	0.05	−0.54	0.04	−0.35	0.10
S2B4	0.31	−0.08	−0.21	0.02	0.11	−0.02	−0.35	0.03	−0.47	0.04	−0.62	0.07	−0.39	0.03	−0.65	0.08	0.55	−0.04
S2B5	0.21	0.03	0.04	−0.01	0.39	0.03	0.55	−0.04	−1.12	0.10	−1.41	0.24	−0.06	0.14	0.04	0.03	0.80	−0.07
S3B1	−0.94	0.12	−0.28	0.03	−0.24	0.04	0.38	−0.05	−0.64	0.17	−1.39	0.20	0.65	0.07	0.21	0.01	−0.28	0.07
S3B2	−0.39	0.05	−0.46	0.05	−0.20	0.04	0.29	−0.03	0.61	0.00	0.41	0.04	0.73	−0.11	−1.32	0.15	0.01	−0.07
S3B3	0.21	−0.03	−0.56	0.04	−0.55	0.01	0.46	−0.06	0.36	0.02	1.17	−0.06	−0.17	0.12	−0.75	0.04	0.50	−0.12
S3B4	0.54	−0.06	0.32	−0.02	0.01	0.04	0.04	0.06	0.39	0.07	−0.42	0.23	0.24	0.10	−0.39	0.09	0.21	−0.01
S3B5	0.54	−0.02	0.10	0.01	0.04	0.03	0.09	0.01	−0.46	0.07	−1.21	0.25	−0.19	0.12	0.13	0.06	1.10	−0.11
S4B1	−0.99	0.05	−0.76	0.03	0.01	0.11	0.27	0.11	−1.33	0.15	−1.79	0.23	−0.40	0.12	−0.88	0.10	−0.90	0.19
S4B2	−0.24	0.06	−0.65	0.02	0.11	0.02	0.47	−0.01	−0.42	0.05	−0.68	0.12	−1.08	0.18	−0.81	0.17	−0.08	0.02
S4B3	−0.10	−0.01	0.14	−0.10	1.08	−0.11	−0.23	0.08	0.01	0.13	−0.73	0.16	−0.26	0.10	−0.55	0.14	0.17	−0.06
S4B4	−0.06	0.02	−0.11	0.02	−0.50	0.01	−0.16	0.08	1.03	−0.03	0.62	0.00	−0.17	0.05	−0.48	0.09	0.17	−0.02

Table 6 continued

Panel A: Means

	US		NA		Europe				Asia Pacific						Japan			
	US EPU	US HEPU	US EPU	US HEPU	US EPU	US HEPU	Local EPU	Local HEPU	US EPU	US HEPU	US EPU	US HEPU*	Local EPU*	Local HEPU*	US EPU	US HEPU	Local EPU	Local HEPU
S4B5	−0.99	0.16	−0.24	0.06	−0.13	0.07	−0.44	0.09	−1.79	0.19	−2.12	0.28	−1.27	0.29	0.31	0.08	0.44	0.02
S5B1	−0.07	−0.01	0.04	−0.04	−0.19	0.05	−0.89	0.13	−0.29	0.05	−1.15	0.14	−0.06	−0.03	−0.85	0.15	0.66	0.02
S5B2	0.08	−0.03	0.26	−0.07	0.15	0.00	−1.03	0.13	0.12	0.03	−0.61	0.14	0.93	−0.03	−0.18	0.03	−0.17	0.03
S5B3	−0.59	0.01	−0.36	0.00	−0.23	0.03	−0.28	−0.01	0.24	−0.04	−0.26	0.09	−0.01	0.05	−0.78	0.09	−1.02	0.05
S5B4	−0.07	0.08	−0.41	0.04	−0.01	0.04	0.89	−0.10	−0.48	0.08	−0.77	0.08	−0.69	0.06	−0.21	−0.02	−1.31	0.13
S5B5	−2.12	0.28	−1.17	0.16	−0.40	0.02	−1.04	0.17	−0.25	−0.01	−0.66	0.09	0.11	0.01	−0.20	0.07	−0.58	0.14

Panel B: Standard deviations

	US		NA		Europe				Asia Pacific						Japan			
	US EPU	US HEPU	US EPU	US HEPU	US EPU	US HEPU	Local EPU	Local HEPU	US EPU	US HEPU	US EPU	US HEPU*	Local EPU*	Local HEPU*	US EPU	US HEPU	Local EPU	Local HEPU
S1B1	1.88	0.35	1.59	0.27	1.06	0.17	1.17	0.26	2.04	0.34	1.70	0.26	1.14	0.27	2.11	0.26	2.49	0.30
S1B2	1.35	0.25	1.86	0.31	0.84	0.11	1.00	0.17	1.58	0.32	1.52	0.30	0.73	0.20	1.42	0.20	1.95	0.26
S1B3	1.26	0.18	0.95	0.20	0.94	0.16	1.19	0.17	1.99	0.28	1.53	0.22	0.98	0.23	1.12	0.18	2.07	0.23
S1B4	1.31	0.16	0.80	0.18	0.63	0.09	0.97	0.20	1.15	0.21	0.69	0.15	0.78	0.17	1.03	0.15	0.90	0.11
S1B5	1.59	0.21	1.24	0.17	1.08	0.14	1.19	0.18	1.54	0.26	1.17	0.23	1.32	0.24	1.49	0.22	1.09	0.13
S2B1	1.15	0.17	1.69	0.18	0.88	0.17	0.79	0.15	1.56	0.17	1.29	0.17	1.05	0.19	1.87	0.26	1.03	0.17
S2B2	0.53	0.09	0.50	0.10	0.66	0.11	0.99	0.19	1.30	0.16	1.10	0.13	1.17	0.14	0.73	0.17	1.24	0.20
S2B3	0.83	0.11	0.63	0.10	0.97	0.08	1.45	0.19	1.53	0.20	1.23	0.22	0.71	0.19	0.88	0.08	0.62	0.08
S2B4	0.63	0.09	0.69	0.09	0.41	0.05	0.55	0.10	0.98	0.17	0.56	0.18	1.14	0.15	0.63	0.10	0.81	0.14
S2B5	0.92	0.16	0.97	0.12	0.52	0.11	0.94	0.13	1.03	0.27	0.72	0.13	0.60	0.17	0.48	0.06	0.98	0.07
S3B1	1.43	0.19	1.24	0.17	1.07	0.11	1.19	0.21	1.99	0.29	1.62	0.27	0.83	0.29	1.14	0.18	2.15	0.25
S3B2	1.49	0.18	1.65	0.21	0.84	0.13	0.86	0.12	1.32	0.28	1.36	0.29	0.63	0.22	1.24	0.20	1.37	0.18

Table 6 continued

Panel A: Means

	US		NA		Europe				Asia Pacific						Japan			
	US EPU	US HEPU	US EPU	US HEPU	US EPU	US HEPU	Local EPU	Local HEPU	US EPU	US HEPU	US EPU	US HEPU*	Local EPU*	Local HEPU*	US EPU	US HEPU	Local EPU	Local HEPU
S3B3	0.57	0.12	1.50	0.18	1.27	0.10	0.59	0.12	2.17	0.27	1.54	0.23	1.39	0.27	0.83	0.12	1.18	0.14
S3B4	0.96	0.13	0.80	0.14	0.53	0.06	0.50	0.08	2.24	0.33	1.95	0.24	1.06	0.22	1.35	0.11	1.36	0.19
S3B5	1.30	0.16	0.85	0.11	0.92	0.10	1.11	0.14	1.92	0.34	1.12	0.16	0.56	0.10	0.65	0.09	1.24	0.16
S4B1	0.92	0.10	1.07	0.13	0.78	0.17	0.72	0.12	1.69	0.22	1.33	0.19	0.82	0.19	1.08	0.13	1.07	0.16
S4B2	1.27	0.16	1.45	0.17	0.86	0.10	1.09	0.14	0.89	0.18	0.85	0.14	0.64	0.19	0.91	0.15	1.66	0.20
S4B3	1.34	0.15	1.17	0.18	1.02	0.08	0.80	0.12	2.32	0.19	2.32	0.17	0.98	0.19	1.04	0.16	1.87	0.22
S4B4	0.69	0.12	0.75	0.12	1.09	0.15	1.13	0.14	1.30	0.09	1.14	0.07	0.84	0.12	0.87	0.18	1.42	0.16
S4B5	1.23	0.18	1.09	0.14	1.17	0.15	1.18	0.19	1.23	0.20	0.87	0.12	0.58	0.12	0.70	0.11	1.98	0.24
S5B1	0.78	0.07	0.79	0.08	0.67	0.13	0.76	0.16	1.90	0.16	1.45	0.08	0.75	0.15	0.90	0.17	0.80	0.09
S5B2	0.52	0.09	0.90	0.10	1.05	0.12	0.60	0.11	1.93	0.26	1.75	0.22	1.01	0.29	0.72	0.11	1.57	0.18
S5B3	0.72	0.16	0.69	0.12	0.64	0.09	0.60	0.11	1.15	0.24	0.69	0.11	0.34	0.09	0.66	0.13	1.46	0.11
S5B4	1.23	0.14	0.68	0.09	0.83	0.12	1.13	0.15	0.98	0.12	0.89	0.11	1.13	0.17	0.84	0.09	1.24	0.12
S5B5	2.24	0.31	0.95	0.16	0.83	0.09	0.75	0.16	1.45	0.24	1.29	0.14	1.02	0.16	2.38	0.28	2.25	0.28

The table shows the means and standard deviations of the EPU betas and HEPU betas from the six-factor model for the 25 portfolios where S denotes the size of B the book-to-market. Sample: 1990M11-2019M04, except for Asia Pacific columns three to six where it is 1998M01-2019M04 (marked by *)

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