Uncertainty and Downside Risk in International Stock Returns*

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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 the stock markets in five regions separately. Internationally, uncertainty has negative risk premiums which is similar to previous findings for the US. This implies that investors get lower returns for assets with high uncertainty betas. We further contribute with an analysis of downside uncertainty risk. Here, the downside uncertainty risk factor is high uncertainty which has additional risk premiums. We measure uncertainty by the logs of the local and US economic policy uncertainty indices.

Keywords: International stock returns; economic policy uncertainty; Fama-French factor models; downside risk

JEL Classifications: G12; G15

1 Introduction

There is a great deal of interest, and a correspondingly large literature, on the link between economic uncertainty and financial markets, cf. e.g. Bali, Brown, and Caglayan (2014), Brogaard and Detzel (2015), and Bali, Brown, and Tang (2017). Prominent economic uncertainty measures are the factor-based macroeconomic uncertainty (Jurado, Ludvigson, and Ng (2015)) and the economic policy uncertainty measure based on newspaper coverage of Baker, Bloom, and Davis (2016). Bali, Brown, and Tang (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 uncertainty risk premiums are negative because an increase in uncertainty is unfavorable for investors. This is opposite the positive risk premiums on the market portfolio where increases in the market return is considered favorable for investors.

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

Another important contribution of our paper is to allow the uncertainty risk premiums to differ for low versus high levels of the economic policy uncertainty. We think of this setup as an asset pricing model and provide an explanation of the use of high economic policy uncertainty as follows. Our explanation is linked to the literature on downside risk asset pricing models, cf. Kraus and Litzenberger (1976), where the market downside risk covers the risk from when the market return is below its average value. Ang, Chen, and Xing (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, Maggiori, and Weber (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. We are hereby considering a non-linear relationship between excess returns and economic policy uncertainty risk. Therefore, we define the new risk variable (high economic policy uncertainty) as being equal to the economic policy uncertainty index itself when the uncertainty is above its average value and zero otherwise. We estimate the high uncertainty betas in a similar fashion as the downside market betas are obtained. To our best of knowledge, applying downside betas to uncertainty risk is new to the literature.

Our paper is closely related to Bali, Brown, and Tang (2017) who show that macroeconomic uncertainty as measured by the Jurado, Ludvigson, and Ng (2015) index is priced in the cross-section of US stock returns with a negative risk premium. Using Fama and MacBeth (1973) regressions, Bali, Brown, and Tang (2017) show evidence of significantly negative uncertainty risk premiums in the cross-section of US stock returns. Moreover, they find that the results also hold for stock portfolios. Bali, Brown, and Caglayan (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 and French (1993) factor model with the economic policy uncertainty risk factor from Baker, Bloom, and Davis (2016). They find that the Fama and French (1993) US test portfolios earn negative economic policy uncertainty risk premiums.

The two papers by Fama and French (2012) and Fama and French (2017) both use factor models on international stock market returns in the spirit of their Fama and French (1993) 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 4-factor model for each region with the Fama and 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 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 where the factors are global factors and one where the factors are country-specific. 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, Karolyi, and Kho (2011) consider individual stocks from 49 countries to estimate various factor models and show that local factors are more informative than global factors, too.

Our five-factor asset pricing model that we put forward includes uncertainty (EPU) in addition to the four traditional risk factors of Fama and French (2012) (MKT, SMB, HML, and UMD), while the six-factor model is extended to include the high 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 has generally a negative and significant risk premium. This implies that investors get lower returns for high uncertainty beta assets because high uncertainty is unfavorable to investors. More importantly, our results show that the high economic policy uncertainty risk factor implies a further significant risk premium in addition to the economic policy uncertainty risk factor in itself.

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

2 Data

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

2.1 Test Portfolios

We follow Fama and French (2012) and Fama and French (2017) and consider test portfolios for various regions.[1] We consider equal-weighted 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). In addition, we analyze the US stock mar-

[1] The test portfolios are available from French' homepage.

ket 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 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.

2.2 Risk Factors

Previous research documents that local risk factors are more important than the global risk factors, cf. the discussion in the Introduction. Based on this, we use regional risk factors rather than global (US) risk factors.

For each of the regions, we use traditional regional risk factors in combination with the uncertainty risk factors.[2] The traditional risk factors are the regional Fama and 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).[3]

We consider the economic policy uncertainty (EPU) indices from Baker, Bloom, and Davis (2016). We use the log of the EPU indices as the first uncertainty risk factor. There are readily available local EPU indices for Europe, Japan, and the US. For North America we use the US EPU index as the US economy is a lot larger than the Canadian. For Asia Pacific there is no specific local EPU index available, so we use the Australian EPU index. However, this index only begins in 1998M01, so here we consider a shortened sample period.

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 EPU index itself when the EPU index is high and zero otherwise (still based on log

[2] The traditonal risk factors are available from French' homepage.

[3] Bekaert, Engstrom, and Xu (2017) note that various uncertainty indices for the US are positively correlated.

values). 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.

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 consider two sets of analysis, namely the five-factor and the six-factor model.

We examine the cross-sectional relation between the risk factors and expected stock returns using two-step Fama and 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.

3.1 Six-Factor Model

The first-step regression in the six-factor model 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 i'th 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 risk factors, MKT_t, SMB_t, HML_t, UMD_t, and of particular interest to us, the EPU_t and $HEPU_t$ risk factors.

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

In the second step, we estimate cross-sectional regressions in order 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 $t+1$.

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

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. We use the time series of the lambda estimates to investigate if the lambdas are statistically significant based on Newey and West (1987) standard errors.

3.2 Five-Factor Model

The five-factor model arrises when we leave out the $HEPU$ risk factor from the six-factor model, 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.

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.[4] The analysis in this section is an international extension of previous US studies.

4.1 EPU Beta Estimates

We obtain estimates of the betas for all of the risk factors, however, in this paper our main interest is the EPU betas, and we therefore do not look further into the traditional factor betas. Table 1 shows the averages and standard deviations of the time series of the estimated EPU betas, β_{it}^{EPU}, for each of the 25 portfolios ($i = \{S1B1, \ldots, B5B5\}$) for each of the regions. The standard deviations are very large relative to the average values which implies that the time series of the EPU betas are highly volatile over time. This applies across all regions and it also applies for both US and local EPU betas. For instance for Japan, for $S1B1$ the average US EPU beta is -0.19 while its standard error is 0.93. The corresponding values for the beta for the local EPU (still for Japan) are -0.58 and 1.25, respectively. In general, the average EPU betas for the same portfolio are very different for US and local EPU. There are very large differences in the average betas across the 25 portfolios. For instance, the average beta for local EPU for Japan ranges between -0.82 ($S1B2$) and 0.80 ($S5B1$).

[Table 1]

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.

[4] We use a 5% level of significance.

[Figure 1]

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 their time series for each of the portfolios. We see that the betas are highly time varying. The ordering of the betas 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 to 2002, the betas are less spread out and are similar across portfolios, while they are highly volatile in the period 2011 to 2014.

[Figure 2]

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.

[Table 2]

Most of 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 by Bali, Brown, and Tang (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, the local EPU risk premium is significantly negative and it is estimated to be -0.28. 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 significant risk premium at -0.12, while the US EPU risk premium is still negative but insignificant.

Overall, we see that local uncertainty risk factors are more important than US risk factors for both Asia-Pacific and Japan. This is similar to the findings for traditional risk factors. Further, we see that the US uncertainty risk factor is significant outside the US (in Asia-Pacific). We also see that pricing in the cross-section of the uncertainty risk factors varies 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 the section extends the previous literature on the US stock market with the new risk factor, the $HEPU$ and in addition it extends the US analysis into an international context.

5.1 EPU and HEPU Beta Estimates

Table 3 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 ($i = \{S1B1, \ldots, B5B5\}$) 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.

[Table 3]

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 local and US EPU risk measures. The span of variation in the average $HEPU$ betas is larger than for the average EPU betas.

[Figure 3]
[Figure 4]

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 and therefore has not been investigated for the US previously. 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.

[Figure 5]
[Figure 6]

5.2 Risk Premiums

Table 4 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.

[Table 4]

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, Brown, and Tang (2017) and Brogaard and Detzel (2015). Moreover, the $HEPU$ risk premiums are also negative in general. This implies that the risk premiums for uncertainty increases when uncertainty is high.

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.

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 high levels of uncertainty, that is when the economic policy uncertainty is higher than usual, 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 risk uncertainty premiums when we do and do not take into account the risk from high uncertainty. Thus, it is important that we have added the new downside uncertainty risk factor.

6 Conclusion

We conduct an international study of the cross-sectional risk premiums of economic policy uncertainty factors in addition to traditional risk factors. We consider the stock markets in five regions separately. We find that 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 uncertainty betas because high uncertainty is unfavorable to investors. We add the new downside uncertainty risk factor which is characterized by high levels of economic policy uncertainty. We find that the downside risk factor of high economic policy uncertainty has additional risk premiums.

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Table 1: 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*	US EPU	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

Panel B: Standard deviations

	US	NA	Europe		Asia-Pacific			Japan	
	US EPU	US EPU	US EPU	Local EPU	US EPU	US EPU*	Local EPU*	US EPU	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
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, expect for * where it is 1998M01-2019M04.

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*
R2	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-West standard errors below. Sample: 1990M11-2019M04, expect for * 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.

Table 3: Descriptive statistics for EPU and High EPU betas from six-factor model

Panel A: Means

	US		NA		Europe				Asia-Pacific						Japan			
	US EPU	High US EPU	US EPU	High US EPU	US EPU	High US EPU	Local EPU	High local EPU	US EPU	High US EPU	US EPU*	High US EPU*	Local EPU*	High local EPU*	US EPU	High US EPU	Local EPU	High local EPU
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
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	High US EPU	US EPU	High US EPU	US EPU	High US EPU	Local EPU	High local EPU	US EPU	High US EPU	US EPU*	High US EPU*	Local EPU*	High local EPU*	US EPU	High US EPU	Local EPU	High local EPU
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
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

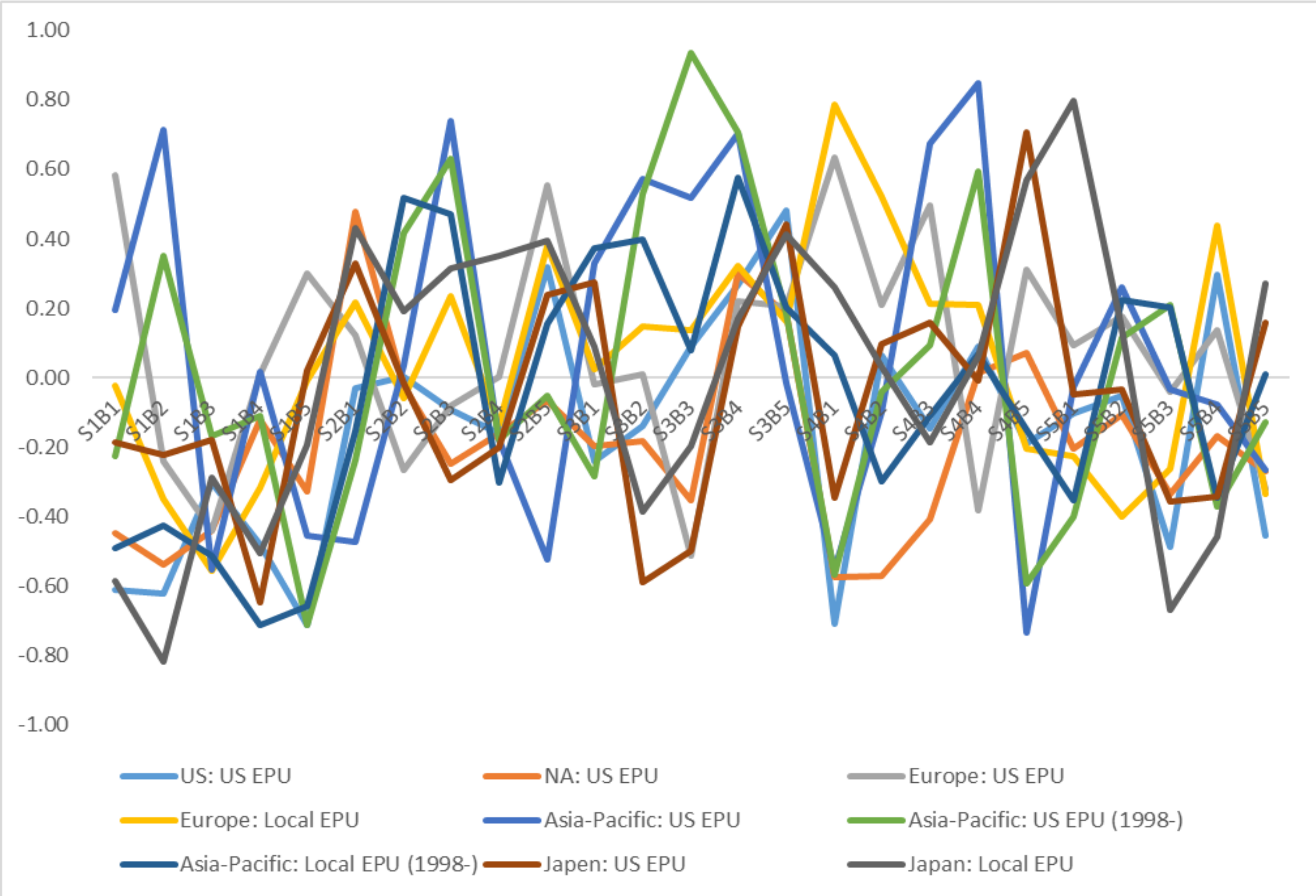
The table shows the means and standard deviations of the EPU betas and high EPU betas from the six-factor model for the 25 portfolios where S denotes the size of B the book-to-market. Sample: 1990M11-2019M04, expect for * where it is 1998M01-2019M04.

Table 4: 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
R2	0.64		0.65		0.56		0.57		0.50		*0.48		*0.48		0.62		0.63	

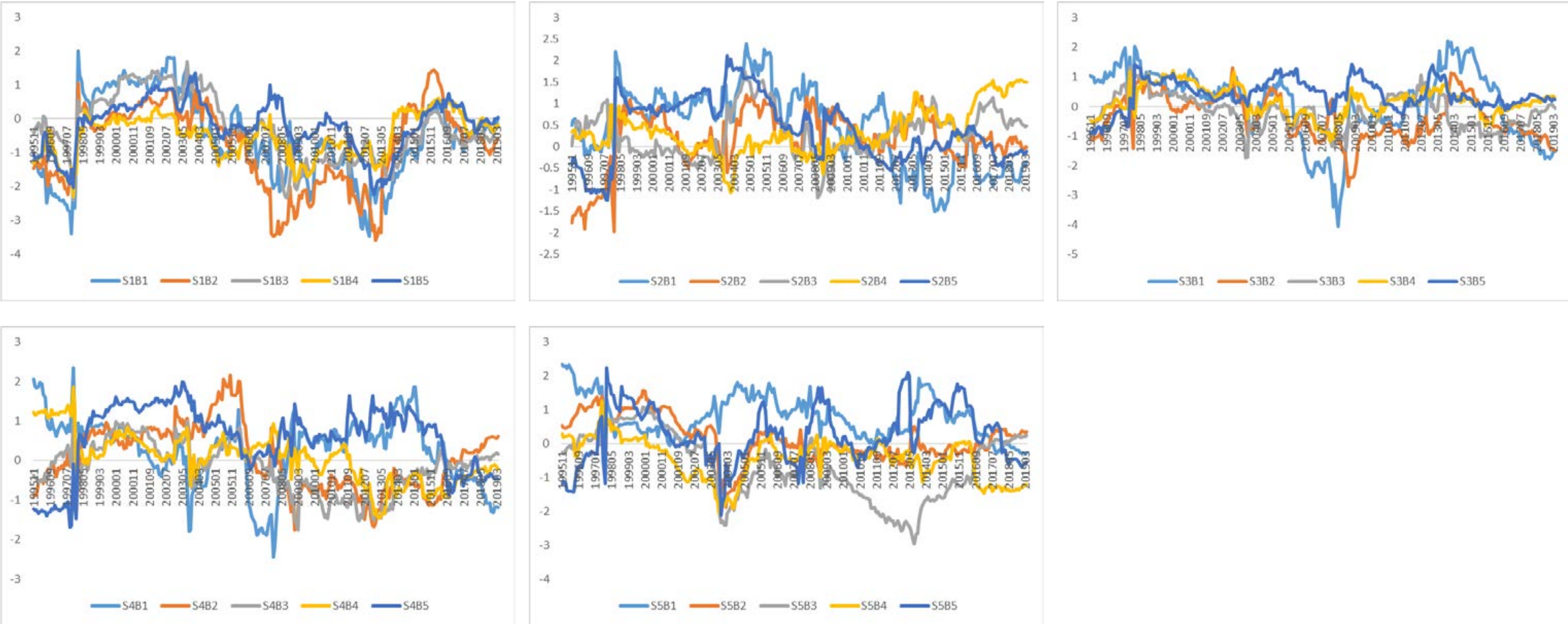
The table reports the average risk premiums (lambdas) from the six-factor model with the associated t-stats in italic based on Newey-West standard errors below. Sample: 1990M11-2019M04, expect for * where it is 1998M01-2019M04. The test assets are the excess returns on the Fama-French 25 portfolios formed 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.

Figure 1: Average EPU betas from five-factor model



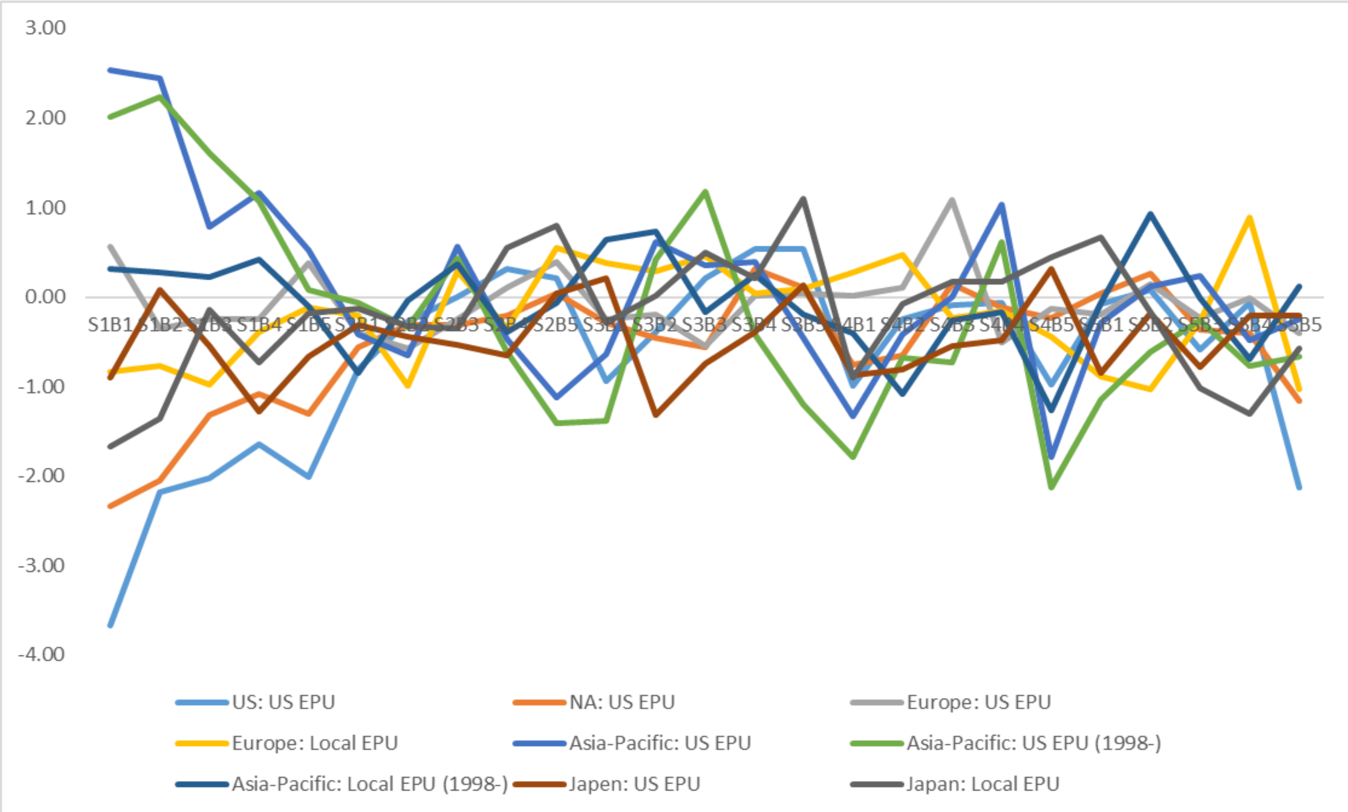
The figure shows the avarage EPU betas from the five-factor model for each of the 25 test portfolios for various regions using local and US EPU. S denotes size and B book-to-market. Sample: 1990M11-2019M04 , expect for Asia-Pacific where it is 1998M01-2019M04..

Figure 2: Japan local EPU betas from five-factor model



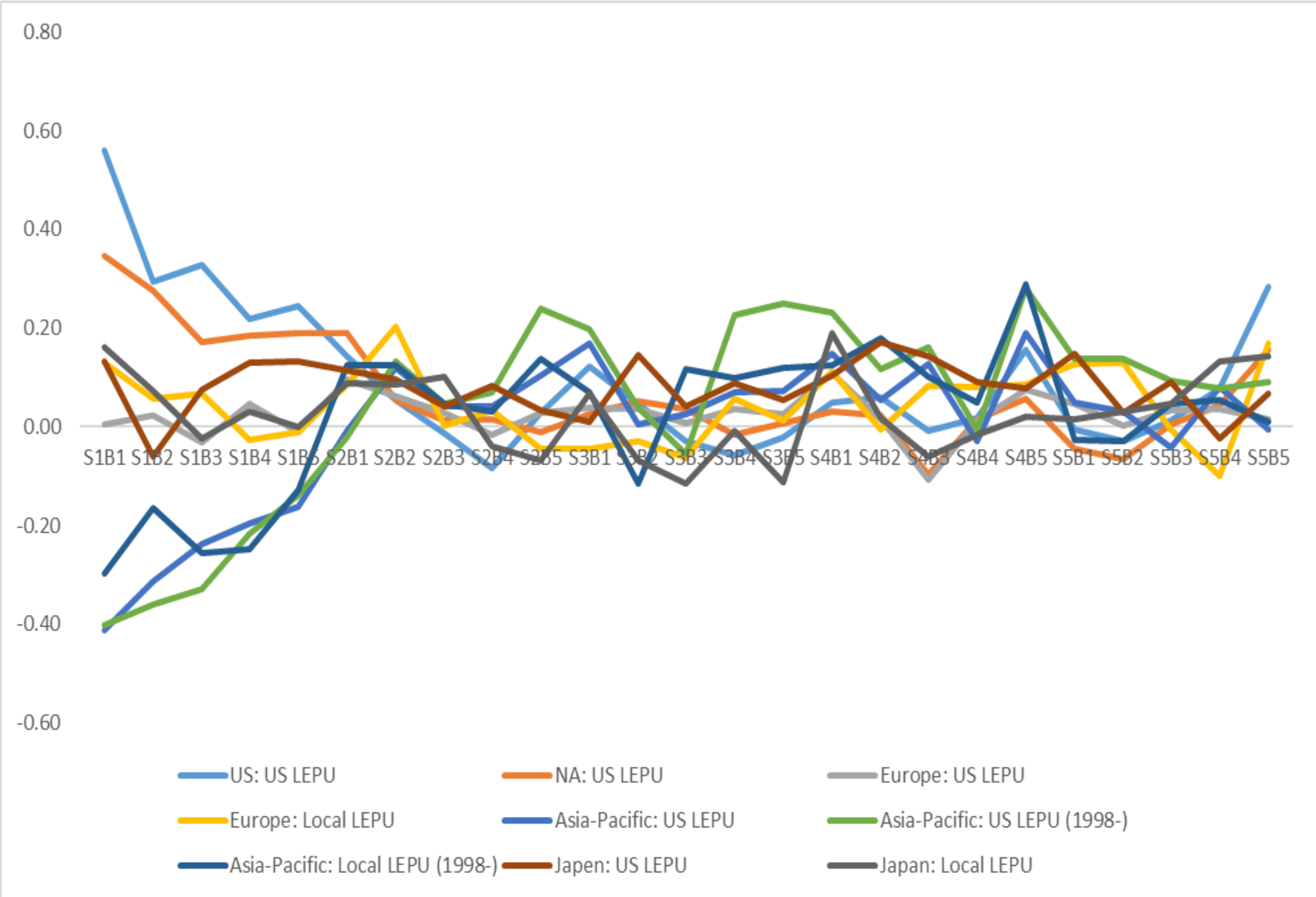
The figure shows the time series of the local EPU betas for Japan from the five-factor model for the 25 portfolios where S denotes size and B book-to-market. Sample: 1990M11-2019M04.

Figure 3: Average EPU betas from six-factor model



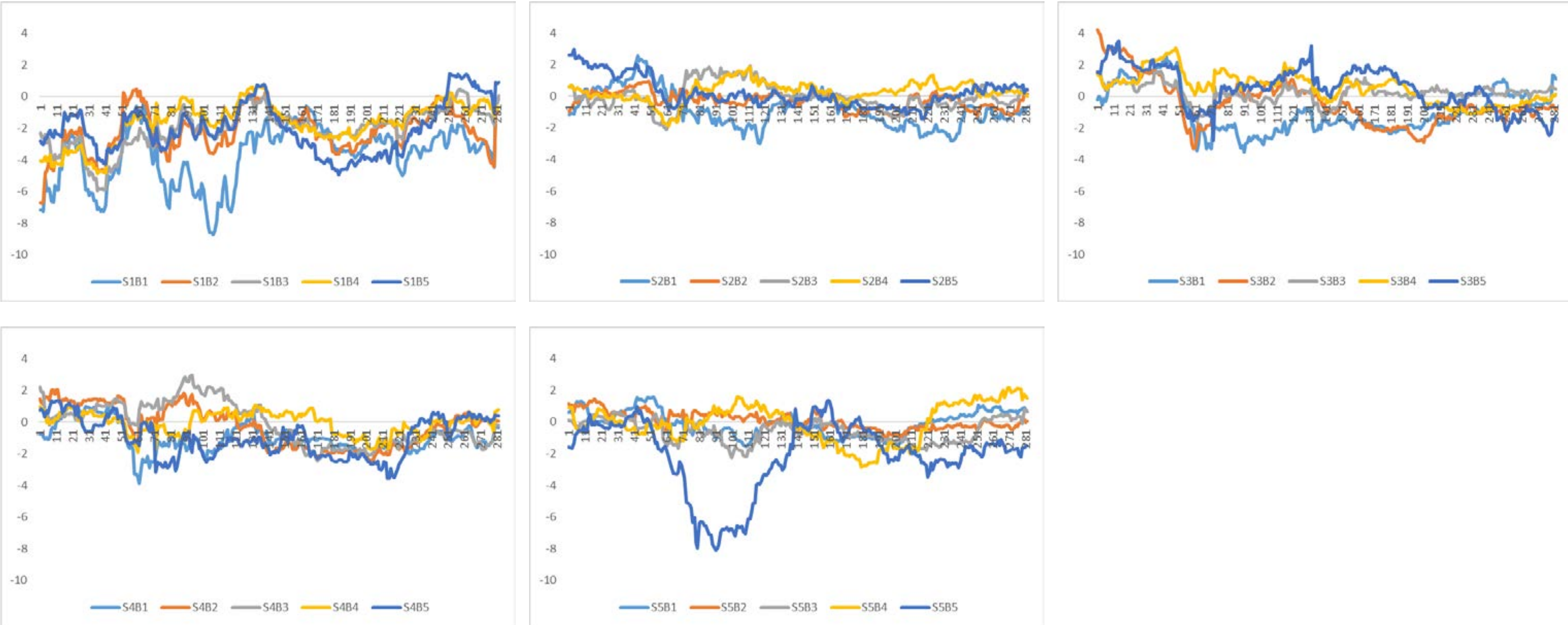
The figure shows the avarage EPU betas from the six-factor model for each of the 25 test portfolios for various regions using local and US EPU. S denotes size and B book-to-market. Sample: 1990M11-2019M04 , expect for Asia-Pacific where it is 1998M01-2019M04..

Figure 4: Average high EPU betas from six-factor model



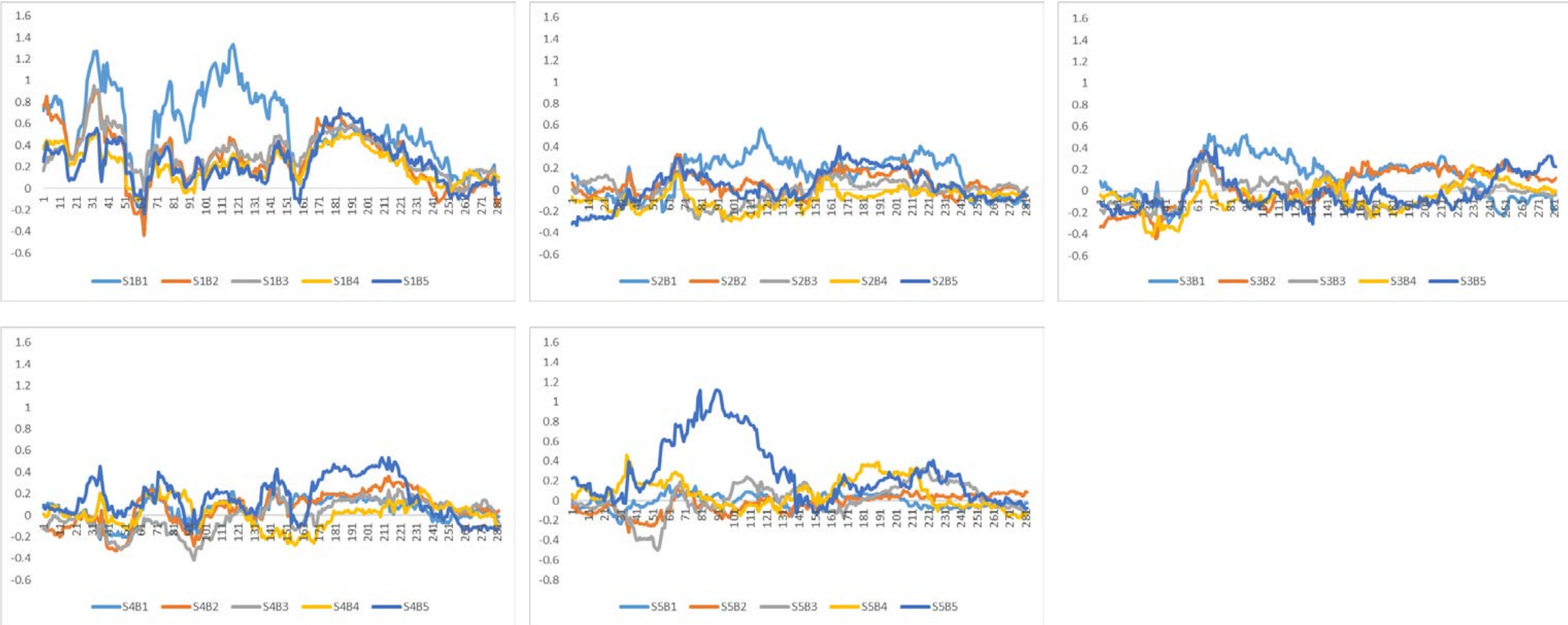
The figure shows the avarage high EPU betas from the six-factor model for each of the 25 test portfolios for various regions using local and US EPU. S denotes size and B book-to-market. Sample: 1990M11-2019M04 , expect for Asia-Pacific where it is 1998M01-2019M04..

Figure 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.

Figure 6: US high EPU betas from six-factor model



The figure shows the time series of the US high 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.