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The impact of economic policy uncertainty on stock types while considering the economic cycle. A quantile regression approach

Jessica Paule-Vianez, Carmen Orden-Cruz, Camilo Prado-Román and Raúl Gómez-Martínez
Department of Business Economics, Rey Juan Carlos University–Madrid Campus, Madrid, Spain

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Abstract

Purpose – This study aims to analyse the effects of Economic Policy Uncertainty (EPU) on the return of growth/value and small/large-cap stocks during expansionary and recessionary periods across a conditional distribution.

Design/methodology/approach – The authors selected a sample covering the period between 01/1995–05/2021. Quantile regressions were applied to the EPU and Russell indices. Business cycles were established following the NBER.

Findings – The results show that EPU has a negative effect on stocks with the intensity of the effect depending on the stock's profile. Small-cap and growth stocks were found to be most sensitive to EPU, especially during recessions. The negative effect is moderated by the economic cycle but is progressively diluted at the lower tail of the stock return distribution.

Practical implications – The findings shed more light on investment strategies for growth/value investors that pursue opportunities arising from a changing economic cycle.

Originality/value – This study makes the following contributions: (1) explores the impact of EPU on the return of different stocks across a conditional distribution, and (2) provides evidence on how the economic cycle influences EPU impact on growth/value stocks and small/large stocks.

Keywords Economic policy uncertainty, Stock market returns, Limited arbitrage, Economic cycles, Behavioural finance

Paper type Research paper

Introduction

Following Keynes' (1937) suggestion that uncertainty is a fundamental element in the economy, the literature has focused particularly on the study of Economic Policy Uncertainty (EPU) and its consequences. This interest increased with the uncertainties derived from the global financial crisis (2007–2009) that contributed to a sharp economic decline, as well as to its subsequent slow recovery (International Monetary Fund, 2013; Baker *et al.*, 2016).

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Changes in existing economic policies, or even the speed of changes agreed in these policies, can influence investors, generating a sentiment of insecurity in their expectations or judgements about the value of assets (Alcázar-Blanco *et al.*, 2021). The most recent literature confirms that EPU influences the asset pricing of many markets, including stocks (Antonakakis *et al.*, 2013; Arouri *et al.*, 2016), bonds (Ioannidis and Ka, 2021; Pham and Nguyen, 2022) and cryptocurrencies (Cheng and Yen, 2020; Paule-Vianez *et al.*, 2020), among others.

The impact of EPU on stock market returns has been well researched, with results showing strong evidence of a negative influence (Baker *et al.*, 2016; Arouri *et al.*, 2016). Increased EPU amplifies behavioural biases, with mixed results being found on the impact of EPU on individual stocks (Hu *et al.*, 2018; Luo and Zhang, 2020). Analysing investor sentiment, some authors show a stronger impact for small-cap and growth stocks (Lakonishok *et al.*, 1994; Baker and Wurgler, 2006; Waggle and Agrrawal, 2015; Wu *et al.*, 2014; Smales, 2017), while others defend the view that the impact is stronger for value stocks (Kumar and Lee, 2006; Bathia and Bredin, 2013). Under uncertainty, Hu *et al.* (2018) reveal that small and growth stocks in China's A-share market are more sensitive to US EPU shocks.

The economic cycle plays a key role in the impact of EPU on investor confidence levels (Ahmad and Sharma, 2018; Adjei *et al.*, 2022). Policymakers experience more pressure to stimulate the economy during economic downturns, and investors are more sensitive to their doubts (Adjei and Adjei, 2017). This is further evidenced in the influence of EPU in value premium (Bretschger and Lechthaler, 2018; Kirby, 2019).

However, EPU impact is not the same in the lower and the upper quantiles of stock returns (Kannadhasan and Das, 2020), nor in the nonlinear predictability US equity premium models (Bekiros *et al.*, 2016). For example, Raza *et al.* (2018) showed that the relationship between equity premium and EPU is especially negative in the extreme low and high tails.

Considering that the impact of EPU on stock market returns does not have to be uniform and given the precedents of the amplification of the behavioural biases under uncertainty, this research goes deeper into considering relationships that prior literature had researched independently. The objectives of this study are therefore: (1) to explore whether the EPU impact on different types of stocks differs depending on the most or least profitable stocks, and (2) to examine how the economic cycle moderates the influence of EPU on stock return considering the different types of stocks.

Advancing on the approaches undertaken in previous literature, we propose the use of quantile regression to evaluate EPU impact, as this methodology offers a more comprehensive dependence structure for the analysis of stock returns under diverse market conditions (Bekiros *et al.*, 2016; Kannadhasan and Das, 2020; Jiang *et al.*, 2022). Linear models based on the conditional-mean are insufficient to explain the entire conditional distribution of the value premium (Bekiros and Gupta, 2015). We apply Ordinary Least Squares (OLS) with heteroskedasticity correction to analyse the robustness of the results.

This study makes a comprehensive contribution to the EPU literature related to value/growth and small/large cap stock returns, exploring the role the economic cycle plays in this impact and the effect under different conditions of the stock market. This new evidence offers more insight for investments strategies for growth/value investors that pursue opportunities arising from the changing economic cycle.

The paper is structured as follows: Section 2 addresses the theoretical framework involved in the study, and Section 3 explains the data and variables used in the study. Section 4 explains the methodology, and in Section 5, the results are presented and discussed. Finally, Section 6 shows the conclusions.

Theoretical framework

Information uncertainty is behind several findings that contradict the theory of equilibrium in financial markets (Jiang *et al.*, 2005). Several authors have documented how uncertainty related to social, political or economic conditions has a considerable influence on investor sentiment (Beugelsdijk and Frijns, 2010; Kumar *et al.*, 2012). Brown and Cliff (2005) found that investor sentiment is due to persistent and uninformed demand shocks, which leads to a poor valuation of prices in the presence of limits to arbitrage.

In this paper, we use EPU, understanding it as the "non-zero probability of changes in existing economic policies" (Baker *et al.*, 2016). Uncertainty can increase when those responsible for economic policies fail to reach timely agreements or change policies frequently (Li *et al.*, 2015). Even media speculations can influence uncertainty (Adjei and Adjei, 2017). Since the inception of EPU, there is considerable evidence of its negative impact on the stock returns using different methodologies and stock markets (Antonakakis *et al.*, 2013; Kang and Ratti, 2013; between others).

Studies focused on the impact of investor sentiment have shown that stocks are affected by behavioural biases, especially in stocks that are more subjective to value or are faced by limits to arbitrage, such as small-cap stocks (Smales, 2017). In this sense, behavioural indicators such sentiment have a great explanatory power (Lemmon and Portniaguina, 2006) or confidence index that has a high predictive capacity for small-cap returns (Kumar and Lee, 2006). In addition, growth stocks overprice with investor overreactions (Lakonishok *et al.*, 1994), especially with bullish sentiment (Waggle and Agrrawal, 2015), making them more prone to bubbles (Baker and Wurgler, 2006). Extreme pessimism also affects growth stocks much more than value stocks (Wu *et al.*, 2014). Therefore, growth stocks are more sensitive to changes in investor confidence.

Though it is confirmed that the impact of investor sentiment is especially negative on small and growth stocks, the effect is no so clear under uncertainty. Studies first showed small-cap and value stocks as the most affected negatively by EPU (Aboura and Arisoy, 2017) and most predictable in bearish markets (Chen *et al.*, 2018). In contrast, recent research shows small-cap and growth stocks to be most affected by EPU (Hu *et al.*, 2018; Luo and Zhang, 2020). These studies highlight the need for more research on the differential factor behind these mixed results, leading us to the following hypothesis:

H1. EPU has a greater negative impact on growth and small-cap stocks.

The relationship between stock returns and EPU is not linear, being stronger and more persistent during periods of extreme volatility (Arouri *et al.*, 2016). The quantile regression methodology allows us to show different asymmetric effects. This approach significantly enhances out-of-sample stock return predictability, especially when the market is neutral (Bekiros *et al.*, 2016). Raza *et al.* (2018) demonstrate that the relationship between equity premium and EPU is especially negative in the extreme low and high tails. Given the prior literature, we test more evidence of the nonlinear relationship between uncertainty and individual stock returns, presenting the following hypothesis:

H2. EPU has a greater impact on the returns of stocks that are at the extremes of the distribution.

The economic cycle is of great importance in the financial markets as an element of systematic risk influencing stock returns (Fama and French, 1989). Generally, there are more economic policy adjustments during periods of recession, and investors respond more to these changes. When the economy contracts, investors expect governmental bodies to take greater measures than during periods of expansion. The speed at which policies are implemented also influences investment risk perception (Pastor and Veronesi, 2013). Thus, there is a high correlation between EPU and the economic cycle (Baker *et al.*, 2016; Adjei and Adjei, 2017).

Evidence shows that a stock's profile is an important element for determining the impact of the economic cycle on stock returns. In regard to value and growth stocks, Fama and French (1992) led a broad literature showing how the value premium is statistically associated with macroeconomic fundamentals (Kelly, 2003; Aretz *et al.*, 2010; among others). More recent literature reassesses that the value premium is related to current and expected economic growth (Lee and Kim, 2017; Bretschger and Lechthaler, 2018), expected business conditions (Kirby, 2019) and future growth consumption (Roh *et al.*, 2019). The role of investor sentiment is more significant in the period preceding the subprime crisis and during the crisis, outperforming value stocks compared with growth stocks (Neves *et al.*, 2021). This evidence could explain how policy makers' intervention in times of recession, while trying to prevent a depression, makes small-growth stocks outperform small-value stocks (Bianchi, 2020).

The size premium is also demonstrated by an extensive literature (Crain, 2011) revealing that small-caps on average outperform large-caps over time, especially during expansions (Kim and Burnie, 2002) and after an economic trough (Switzer, 2010). This effect reflects the firm's exposure to fundamental variables, but Van Dijk (2011) also indicated the non-rationality of valuation models.

Since investor sentiment contributes to size premium (Qadan and Aharon, 2019; Song, 2023), EPU impact is especially negative for small-cap stocks (Killins *et al.*, 2022), and given that size premium is related to the uncertainty with macroeconomic production and aggregate consumption (Scheurle and Spremann, 2010), we test the following hypothesis:

H3. EPU has a greater negative impact on stock returns in times of recession, especially for growth and small-cap stocks.

On the other hand, as noted by Bekiros *et al.* (2016), business cycle fluctuations can cause different EPU impacts on stock returns across quantiles. This may be because this uncertainty could implicitly incorporate information for some parts of the return distribution. This issue has been investigated for the return of momentum strategies but not for stocks in general or the different stock types. Paule-Vianez *et al.* (2021) found that the momentum effect is reduced in the presence of increases in EPU, especially in times of recession and in the lower quantiles of the distribution. However, in periods of expansion, EPU has a positive impact on the upper quantiles. Considering how investor sentiment impacts stock returns, Baker and Wurgler (2006) show how the moderating effect of the business cycle gradually loses its effect as the stock market becomes more bearish. Considering the above, one would expect EPU to have a greater negative impact on lowest stock returns in times of recession. In contrast, EPU impact should be smaller in times of expansion and for the best profitable stocks. Therefore, the last hypothesis we propose to test in this study is:

H4. The economic cycle moderates the influence of EPU on the best profitable stocks.

Data

In this study, we selected a sample covering the period from January 1995 to May 2021 with monthly data.

As a reference of EPU, we selected the US Monthly EPU index of Baker *et al.* (2016) (see http://www.policyuncertainty.com/). This index is based on the frequency with which articles in newspapers refer to words such as "economy" or "economic", "uncertain" or "uncertainty", "deficit", "Federal Reserve", "legislation" and "regulation".

To study the effect of uncertainty on investment returns of value and growth stocks of higher and lower capitalisation, we selected the following indices: Russell 1,000 Value, Russell 1,000 Growth, Russell 2,000 Value and Russell 2,000 Growth. Russell 1,000 Value represents large-cap value stocks, Russell 1,000 Growth represents large-cap growth stocks, Russell

2,000 Value represents small-cap value stocks and Russell 2,000 Growth represents small-cap growth stocks.

Following the proposed objectives, we also distinguish the impact of EPU on stock returns between periods of recession and expansion (Table 1).

Economic variables associated with stock markets and political uncertainty were included as control variables. The variables selected include US inflation (Arouri *et al.*, 2016; Chen *et al.*, 2018), the Industrial Production Index (Arouri *et al.*, 2016; Chen *et al.*, 2018), the term spread between the yield to maturity of a 10-year Treasury note and the 3-month Treasury bill (Brogaard and Detzel, 2015; Adjei and Adjei, 2017), the default spread between yields of BAA-rated bonds and AAA-rated bonds (Brogaard and Detzel, 2015; Arouri *et al.*, 2016; Adjei and Adjei, 2017) and the US gross domestic product index (GDP) (Kurov and Stan, 2018).

Table 2 shows the target study variables, their definition and the sources from which they were extracted.

Methodology

To test the proposed hypotheses, we use quantile regression. This is an extensive form based on traditional regression and can broadly depict a conditional distribution (Lee and Chen, 2021). We use quantile regression to evaluate EPU impact, as this approach offers a more comprehensive dependence structure to the analysis of stock returns under diverse market conditions (Bekiros *et al.*, 2016; Kannadhasan and Das, 2020; Jiang *et al.*, 2022). Additionally,

Period	Economic cycle
January 1995 to March 2001	Expansion
April 2001 to November 2001	Recession
December 2001 to December 2007	Expansion
January 2008 to June 2009	Recession
July 2009 to February 2020	Expansion
March 2020 to April 2020	Recession
May 2020 to May 2021	Expansion

Source(s): National Bureau of Economic Research (NBER)

Table 1. Periods of recession and expansion in the sample

Variable	Definition	Source
R_{Large_Value}	Return of Russell 1000 Value index	Datastream database
$R_{Large-Growth}$	Return of Russell 1000 Growth index	
$R_{Small-Value}$	Return of Russell 2000 Value index	
$R_{Small-Growth}$	Return of Russell 2000 Growth index	
EPU	Variation rate of US Economic Policy Uncertainty index	Baker *et al.* (2016)
Cycle	Recession (1) or Expansion (2)	National Bureau of Economic Research (NBER)
Default_ spread	Default spread between yields of BAAs-rated bonds and AAA-rated bonds	Federal Reserve Economic Data (FRED) Database
Inflation	Variation rate of the US Consumer Price index	
IPI	Variation rate of the Industrial Production index	
Term_ spread	Term spread between the yield to maturity of a 10-year Treasury note and the three-month Treasury bill	
GDP	Variation rate of US normalised Gross Domestic Product	

Source(s): Own elaboration

Table 2. Description of the target study variables

this method's estimates are more robust in the presence of outliers, heteroskedasticity and skewness than those of OLS models (Koenker and Hallock, 2001; Koenker, 2005).

The proposed quantile regression model is the following:

$$\mathrm{R_{i,t}} = \alpha_\tau + \beta_{1,\tau} EPU_t + \beta_{2,\tau} Cycle_t + \beta_{3,\tau} Default\_spread_t + \beta_{4,\tau} Inflation_t + \beta_{5,\tau} IPI_t + \beta_{6,\tau} Term\_spread_t + \beta_{7,\tau} GDP_t + \varepsilon_{t,\tau}, \quad (1)$$

where $\mathrm{R_{it}}$ is the dependent variable of model and represents the stock index i return in month t, α is the constant term, β_k is the regression coefficient corresponding to each explanatory variable k, τ the quantile whose value will be between 0 and 1 (the quantiles 0.25, 0.5 and 0.75 will be taken in the study), and ε_t is the error term in month t.

The previous model allows us to evaluate the impact of EPU on the stock returns analysed. However, to test the role of the economic cycle in the influence of EPU on stock returns, the inclusion of interaction term between EPU and Cycle has been implemented.

We run the regression in Eq. (1) with an additional interaction term given by:

$$\mathrm{R_{i,t}} = \alpha_\tau + \beta_{1,\tau} EPU_t + \beta_{2,\tau} EPU_t \cdot Cycle_t + \beta_{3,\tau} Cycle_t + \beta_{4,\tau} Default\_spread_t + \beta_{5,\tau} Inflation_t + \beta_{6,\tau} IPI_t + \beta_{7,\tau} Term\_spread_t + \beta_{8,\tau} GDP_t + \varepsilon_{t,\tau}, \quad (2)$$

To add further robustness to the results from quantile regression, we propose to apply linear regression with OLS. Given the possible heteroskedasticity problem typical of financial series, the OLS models are adjusted for heteroskedasticity (white cross-section standard errors) (Lee and Chen, 2021).

Results and discussion

Basic descriptive statistics

Over the total sample period, the descriptive statistics (Table A1) show how $\mathrm{R_{Large\text{-}Growth}}$ and $\mathrm{R_{Small\text{-}Value}}$ achieved a higher average return (1% versus 0.9% for $\mathrm{R_{Large\text{-}Value}}$ and $\mathrm{R_{Small\text{-}Growth}}$). However, when distinguishing by economic cycle, we find that growth stocks had lower losses than value stocks in recessions. In particular, $\mathrm{R_{Large\text{-}Growth}}$ recorded the smallest losses (average return of −0.9%). In contrast, larger cap value stocks had the worst results ($\mathrm{R_{Large\text{-}Value}}$: −1.8%). Though the average returns of the different types of stocks differ significantly in recessions, the differences recorded in expansions are minimal, with $\mathrm{R_{Small\text{-}Growth}}$ obtaining the lowest average return (1.1 versus 1.2% for the rest). These results are in line with evidence shown by Bretschger and Lechthaler (2018), Kirby (2019) and Bianchi (2020). When evaluating the existence of significant differences in the average return of these types of stocks in recessions and expansions, only $\mathrm{R_{Large\text{-}Value}}$ has substantial differences depending on the economic cycle, with a significance level of 5%.

Although in recessions the dispersion in all stocks is higher, we identify a clear pattern: the returns of the smallest capitalisation stocks show greater variability, especially those of growth stocks. These results suggest that investment in value stocks may be more advisable in expansions, while growth stocks may perform better in a recession, despite taking on higher risk. In the same vein, Kirby (2019) evidenced a procyclical relation between the expected value premium and expected business conditions.

Table A1 shows that EPU has a higher mean value in recessions than in expansions (7.3 vs. 1.3%), although this difference cannot be considered significant. In addition, the dispersion of EPU is greater in recessions than in expansions. In this sense, the literature shows how in recessions, despite the economic policies that will be implemented, uncertainty is higher than in expansions (Baker *et al.*, 2016; Adjei and Adjei, 2017).

Regarding control variables, it should be noted that Default spread and Term spread show significant differences, with a confidence greater than 99% in their mean value depending on the economic cycle. These variables have a higher mean value in recessions (1.7 and 2.2% versus 0.9 and 1.5%, respectively). However, in terms of their dispersion, Default spread has higher variability in recessions (0.9 vs. 0.2%), while Term spread has a higher deviation in expansions (1.1 vs. 0.8%).

IPI and GDP show higher values in expansions (IPI = 0.3% and GDP = 0.2%) than in recessions (IPI = −1.4% and GDP = −0.5%), and these differences are significant at 99%. In both cases, variability is higher in recessions.

Finally, it is worth mentioning that Inflation does not present significant differences in its average for the economic cycle, although in the period studied, it has presented a higher average value in expansions than in recessions (0.2 versus 0.1%).

Table A2 shows the bivariate correlations of the variables used. It should be noted that the correlation coefficient between all the explanatory variables among themselves and the dependent variables is low. Only the correlations between IPI and GDP (0.637) and Default spread and Cycle (−0.561) are greater than 0.50 but remain below 0.90, the threshold maximum suggested by Hair *et al.* (2010). Therefore, the multicollinearity problem does not arise in this study.

A more detailed analysis of the bivariate correlations between the different variables indicates how the returns of the four types of stocks are highly correlated with a significance level of less than 1%. In particular, the correlations of $R_{\text{Large-Value}}$ y $R_{\text{Small-Value}}$ (0.859) and $R_{\text{Small-Value}}$ y $R_{\text{Small-Growth}}$ (0.845) stand out.

EPU correlates negatively and significantly with the returns of the four types of stocks, where the strongest correlation is with growth stocks, especially small-cap stocks (−0.270). This result aligns with Hu *et al.* (2018) and Luo and Zhang (2020). More evidence of this result has been found in the literature that examines the impact of investor sentiment on stocks depending on their profile (Lakonishok *et al.*, 1994; Baker and Wurgler, 2006; Waggle and Agrrawal, 2015).

Cycle, as expected given the results in Table A1, is positively and significantly correlated with stock returns (recall Recession = 1 and Expansion = 2). In regard to the rest of the control variables, only GDP is positively and significantly correlated with the returns of the four types of stocks, especially with $R_{\text{Small-Value}}$ (0.204), while Default spread is negatively and significantly correlated only with the returns of value stocks, especially with $R_{\text{Large-Value}}$ (−0.136).

Results of the quantile-based approach

Considering Eq (1), Table 3 shows the results obtained when analysing the influence of EPU on conditional distribution of returns of value and growth stocks of higher and lower capitalisation (PANEL A).

The results show how EPU has a negative and significant impact with a significance level of less than 5% on stock returns, especially small-cap stocks, and between them, growth stocks. Therefore, it is evident that the most determinant characteristic to measure the impact of EPU on stock returns is the larger or smaller capitalisation of the stocks, with smaller capitalisation stocks being the most affected. The literature related to the impact of investor sentiment on stock returns points in the same direction (Lemmon and Portniaguina, 2006; Kumar and Lee, 2006). Though with more minor differences, another determining characteristic in the influence of EPU on stock returns is whether the stocks are value or growth stocks, where the latter are most affected by EPU increases. In this sense, there is evidence that growth stocks are more sensitive to investor sentiment (Lakonishok *et al.*, 1994; Baker and Wurgler, 2006; Wu *et al.*, 2014). Therefore, we accept H1. It can be confirmed that

Table 3.
Estimates of the quantile regression models

Variable	$R_{Large\text{-}Value}$ τ_{25} Coef. (*p*-value)	$R_{Large\text{-}Value}$ τ_{50} Coef. (*p*-value)	$R_{Large\text{-}Value}$ τ_{75} Coef. (*p*-value)	$R_{Large\text{-}Growth}$ τ_{25} Coef. (*p*-value)	$R_{Large\text{-}Growth}$ τ_{50} Coef. (*p*-value)	$R_{Large\text{-}Growth}$ τ_{75} Coef. (*p*-value)	$R_{Small\text{-}Value}$ τ_{25} Coef. (*p*-value)	$R_{Small\text{-}Value}$ τ_{50} Coef. (*p*-value)	$R_{Small\text{-}Value}$ τ_{75} Coef. (*p*-value)	$R_{SmallGrowth}$ τ_{25} Coef. (*p*-value)	$R_{SmallGrowth}$ τ_{50} Coef. (*p*-value)	$R_{SmallGrowth}$ τ_{75} Coef. (*p*-value)
PANEL A: Model 3 estimates												
Cons	−0.029 (0.52)	−0.004 (0.84)	−0.027 (0.35)	−0.036 (0.11)	−0.022 (0.53)	0.040** (0.03)	0.025 (0.46)	0.024 (0.55)	0.007 (0.78)	−0.074 (0.13)	0.001 (0.98)	0.009 (0.86)
EPU	−0.056*** (0.01)	−0.046*** (0.00)	−0.031** (0.03)	−0.064*** (0.00)	−0.048*** (0.01)	−0.043*** (0.00)	−0.081*** (0.00)	−0.064*** (0.00)	−0.036*** (0.00)	−0.095*** (0.00)	−0.086*** (0.00)	−0.055** (0.02)
Cycle	0.028 (0.14)	0.016* (0.07)	0.021* (0.08)	0.020** (0.04)	0.021 (0.16)	0.002 (0.78)	0.006 (0.66)	0.002 (0.89)	0.008 (0.40)	0.035* (0.10)	0.007 (0.74)	0.014 (0.51)
Default spread	−3.880*** (0.00)	−1.099* (0.08)	2.449*** (0.01)	−2.488*** (0.00)	−0.163 (0.88)	1.016* (0.06)	−5.548*** (0.00)	−1.405 (0.24)	1.700** (0.01)	−2.546* (0.08)	0.479 (0.74)	1.730 (0.25)
Inflation	−1.544 (0.22)	−0.572 (0.34)	−0.114 (0.89)	0.359 (0.57)	−0.503 (0.62)	−1.442*** (0.01)	−0.034 (0.97)	−0.986 (0.39)	−1.856*** (0.01)	1.800 (0.19)	−0.967 (0.48)	−1.510 (0.29)
IPI	−1.196** (0.02)	−1.095*** (0.00)	−0.599* (0.06)	−0.667*** (0.01)	−0.631 (0.11)	−0.927*** (0.00)	−1.571*** (0.00)	−1.306*** (0.00)	−0.768*** (0.00)	−1.490*** (0.01)	−1.292** (0.02)	−0.727 (0.19)
Term spread	0.125 (0.76)	−0.045 (0.81)	0.058 (0.82)	0.373* (0.06)	−0.158 (0.62)	−0.513*** (0.00)	0.198 (0.52)	0.191 (0.60)	0.321 (0.12)	0.262 (0.55)	−0.019 (0.97)	0.154 (0.73)
GDP	2.711* (0.06)	2.744*** (0.00)	0.245 (0.79)	2.376*** (0.00)	1.760 (0.13)	3.122*** (0.00)	4.387*** (0.00)	4.776*** (0.00)	1.587** (0.03)	3.037* (0.06)	4.038*** (0.01)	0.775 (0.63)
No Obs	317	317	317	317	317	317	317	317	317	317	317	317
PANEL B: Model 4 estimates												
Cons	−0.028 (0.54)	−0.001 (0.95)	0.009 (0.78)	−0.051*** (0.00)	−0.007 (0.81)	0.043** (0.03)	0.025 (0.41)	0.028 (0.37)	−0.008 (0.73)	−0.076 (0.16)	−0.018 (0.65)	0.029 (0.51)
EPU	−0.054 (0.53)	−0.179*** (0.00)	−0.149** (0.02)	−0.131*** (0.00)	−0.122** (0.02)	−0.190*** (0.00)	−0.088 (0.13)	−0.169*** (0.01)	−0.183*** (0.00)	−0.081 (0.43)	−0.280*** (0.00)	−0.293*** (0.00)
EPU • Cycle	−0.001 (0.98)	0.074*** (0.00)	0.067* (0.05)	0.037** (0.03)	0.041 (0.16)	0.078*** (0.00)	0.006 (0.84)	0.062* (0.06)	0.075*** (0.00)	−0.012 (0.83)	0.119*** (0.01)	0.127*** (0.01)
Cycle	0.028 (0.15)	0.016* (0.09)	0.006 (0.66)	0.027*** (0.00)	0.015 (0.21)	0.001 (0.91)	0.007 (0.59)	−0.003 (0.80)	0.015 (0.14)	0.036 (0.12)	0.015 (0.38)	0.007 (0.70)
Default spread	−3.865*** (0.00)	−1.367** (0.03)	1.659* (0.09)	−2.442*** (0.00)	−0.532 (0.52)	1.008* (0.09)	−5.662*** (0.00)	−0.437 (0.64)	1.779** (0.01)	−2.367 (0.14)	0.652 (0.58)	0.974 (0.46)
Inflation	−1.563 (0.22)	−0.454 (0.45)	−0.390 (0.67)	0.573 (0.20)	−0.393 (0.61)	−1.132** (0.04)	−0.045 (0.96)	−1.070 (0.23)	−1.772*** (0.01)	1.523 (0.31)	−0.900 (0.41)	−1.302 (0.30)
IPI	−1.172** (0.02)	−1.009*** (0.00)	−0.718** (0.05)	−0.882*** (0.00)	−0.533* (0.08)	−0.898*** (0.00)	−1.712*** (0.00)	−1.044*** (0.00)	−0.776*** (0.00)	−1.610*** (0.01)	−0.856** (0.05)	−0.529 (0.28)
Term spread	0.114 (0.77)	−0.028 (0.88)	0.038 (0.90)	0.431*** (0.00)	−0.142 (0.56)	−0.560*** (0.00)	0.248 (0.35)	0.215 (0.44)	0.329 (0.12)	0.232 (0.63)	0.224 (0.52)	0.104 (0.79)
GDP	2.714* (0.07)	1.913*** (0.01)	1.159 (0.28)	2.054*** (0.00)	1.234 (0.17)	2.192*** (0.00)	4.470*** (0.00)	3.646*** (0.00)	1.524** (0.05)	4.033** (0.02)	2.304* (0.07)	0.486 (0.74)
No Obs	317	317	317	317	317	317	317	317	317	317	317	317

Note(s): ***, ** and * indicate the significance at 1%, 5% and 10% levels, respectively
Source(s): Own elaboration

the impact of EPU is not the same for all types of stocks, with growth and small-cap stocks being the most sensitive to changes in EPU and larger cap value stocks being least affected by EPU. These results align with Hu *et al.* (2018) and Luo and Zhang (2020).

The application of quantile regression additionally allows us to evaluate the impact on different levels of the dependent variable. The results show that the stocks with the lowest returns (quantile 0.25) are more sensitive to EPU in all cases, with the lowest returns of growth and small-cap stocks being the most affected by EPU increases. Specifically, in this type of stock, a 1-point increase in EPU is associated with a −9.5% reduction in return. Thus, we accept H2 partially. These results are in line with Bekiros *et al.* (2016) and Raza *et al.* (2018). The under and overreaction of stock returns come from a financial context resulting from Economic Policy Uncertainty (Barberis *et al.*, 1998; Lewellen, 2002), leading to a different dependence structure across the stock return distribution (Baur *et al.*, 2012; Guo *et al.*, 2018).

There is no unified pattern for all stocks in regard to economic cycle. In growth stocks, the economic cycle has a positive and significant impact on the lowest return stocks; however, in the case of value stocks, only the largest capitalisation and stocks with the highest returns are influenced by this variable. These results show that the growth stocks with the smallest capitalisation and lowest return and value stocks with the highest capitalisation and return are most sensitive to changes in the economic cycle (Bekiros *et al.*, 2016). The result of growth stocks aligns with previous literature (Kirby, 2019; Bianchi, 2020). For value stocks, a broad literature shows that the historical excess return of value stocks over growth stocks (the denominated HML-factor) is statistically associated with economic growth (Bretschger and Lechthaler, 2018).

For the rest of the control variables, it should be noted that Default spread has a negative impact on the return of the lowest return stocks but a positive impact on the highest return stocks (except for growth and small-cap stocks, with value stocks being the most affected, especially small-cap stocks). IPI has a negative and significant impact on stock returns, especially on smaller cap, profitable and value stocks. Finally, GDP has a positive impact on the return of smaller cap stocks and lower returns, especially value stocks.

Examining the results obtained by including the interaction term Eq. (2) (PANEL B), we can observe how the economic cycle moderates the impact of EPU on stock returns, i.e. in expansions, the impact of EPU on stock returns is diluted, as previous literature has shown (Baker *et al.*, 2016; Adjei and Adjei, 2017). So, the negative impact of EPU is lesser in expansions than in recessions. Looking at the different types of stocks, we show how the economic cycle moderates the impact of EPU on the return of growth and small-cap stocks. We therefore accept H3. These results indicate the higher sensitivity of growth and lower cap stocks, confirming evidence shown by Roh *et al.* (2019) and Bianchi (2020).

However, this moderating effect is in general only present when stocks have higher returns. Therefore, we accept H4. Baker and Wurgler (2006) evidenced a similar behaviour in relation to investor sentiment. This means that the moderating effect of the economic cycle gradually loses its impact as the stock market tends to be more bearish. This is the advantage of using the quantile approach, as it can capture more factors of uncertainty and provide more granular and detailed empirical results. Furthermore, Bekiros *et al.* (2016) show the importance of business cycle fluctuations in EPU predictive power in a quantile regression.

Results of the OLS regression analysis

To add further robustness to the results, OLS with heteroskedasticity correction has been applied. Table 4 shows the results obtained by applying this method.

The results show how EPU has a negative and significant impact with a significance level of less than 1% on stock returns, especially in growth and small-cap stocks. Without considering the possible moderating effect of the economic cycle, it is shown how a 1-point

Table 4.
Estimates of the OLS regression models with heteroscedasticity correction

Variable	$R_{Large\text{-}Value}$ (1) Coef. (*p*-value)	Std. Dev	(2) Coef. (*p*-value)	Std. Dev	$R_{Large\text{-}Growth}$ (1) Coef. (*p*-value)	Std. Dev	(2) Coef. (*p*-value)	Std. Dev	$R_{Small\text{-}Value}$ (1) Coef. (*p*-value)	Std. Dev	(2) Coef. (*p*-value)	Std. Dev	$R_{Small\text{-}Growth}$ (1) Coef. (*p*-value)	Std. Dev	(2) Coef. (*p*-value)	Std. Dev
Cons	−0.015 (0.53)	0.023	−0.007 (0.74)	0.020	0.016 (0.58)	0.029	0.013 (0.65)	0.455	0.005 (0.86)	0.028	0.017 (0.46)	0.022	0.009 (0.82)	0.040	0.008 (0.79)	0.032
EPU	−0.037*** (0.00)	0.011	−0.133*** (0.01)	0.049	−0.041*** (0.00)	0.014	−0.175*** (0.01)	−2.609	−0.052*** (0.00)	0.013	−0.143*** (0.01)	0.052	−0.058*** (0.00)	0.019	−0.227*** (0.00)	0.037
EPU • Cycle			0.052* (0.05)	0.026			0.069* (0.06)	1.915			0.047 (0.11)	0.029			0.087*** (0.00)	0.024
Cycle	0.020** (0.04)	0.010	0.017** (0.04)	0.008	0.007 (0.59)	0.012	0.007 (0.56)	0.584	0.008 (0.48)	0.012	0.004 (0.63)	0.009	0.005 (0.77)	0.017	0.004 (0.76)	0.013
Default spread	−1.425* (0.098)	0.858	−1.261 (0.15)	0.866	−1.734* (0.08)	0.974	−1.581 (0.11)	−1.593	−0.928 (0.39)	1.083	−1.276 (0.24)	1.076	−0.702 (0.60)	1.352	−0.375 (0.76)	1.248
Inflation	−0.505 (0.39)	0.587	−0.955* (0.10)	0.573	−0.201 (0.76)	0.670	−0.489 (0.48)	0.711	−0.623 (0.40)	0.732	−0.911 (0.20)	0.713	−0.423 (0.65)	0.933	−0.678 (0.47)	0.931
IPI	−0.800*** (0.00)	0.278	−0.922*** (0.00)	0.240	−0.325 (0.36)	0.357	−0.290 (0.39)	−0.855	−0.950*** (0.00)	0.310	−0.983*** (0.00)	0.321	−0.574 (0.16)	0.403	−0.512 (0.11)	0.321
Term spread	0.071 (0.70)	0.183	0.061 (0.74)	0.181	−0.067 (0.77)	0.225	−0.048 (0.83)	−0.216	0.112 (0.62)	0.224	0.106 (0.68)	0.253	0.035 (0.92)	0.333	0.081 (0.79)	0.303
GDP	2.509*** (0.01)	0.925	2.306*** (0.00)	0.631	2.228*** (0.01)	0.792	2.307* (0.07)	1.835	3.278*** (0.00)	1.120	3.769*** (0.00)	1.046	2.906*** (0.00)	1.013	2.407*** (0.00)	0.338
No Obs	317		317		317		317		317		317		317		317	
R^2	0.108		0.196		0.099		0.116		0.096		0.155		0.078		0.884	
Durbin–Watson	1.973		1.982		1.958		1.993		1.895		1.912		1.937		1.952	

Note(s): ***, ** and * indicate the significance at 1%, 5% and 10% levels, respectively
Source(s): Own elaboration

increase in EPU is associated with a reduction of -5.8% in the return of small-cap growth stocks, -5.2% in small-cap value stocks, -4.1% in large-cap growth stocks and -3.7% in large-cap value stocks.

When we include the interaction of EPU with Cycle, we observe how the economic cycle moderates the impact of EPU on stock returns, especially in the case of growth stocks with the lowest capitalisation.

In the end, we can determine that these findings remain robust when the methodology changes. As noted, in addition to the advantages of quantile regression (i.e. more robust estimates in the presence of outliers, heteroskedasticity and skewness), this methodology has allowed us to analyse the influence of EPU during the economic cycle on different stocks, considering their level of return. This particularity, not present in models based on conditional expectation, has allowed us to analyse the dependence structure in bull and bear markets.

Conclusions

Understanding the impact of EPU on stock returns considering stock typology and the role played by the economic cycle under different circumstances can help investors make better investment decisions. In this paper, we also employ a quantile regression model to analyse how EPU affects growth/value and small/large-caps stock returns under bearish (lower quantiles) and bullish (higher quantiles) markets differentiated by periods of recession and expansion.

According to the research objectives, the conclusions are as follows: first, the negative sensitivity pattern of EPU on stock returns is moderated by the economic cycle, especially for growth and small stocks, with higher impact during recessions, in line with the existing literature (Kelly, 2003; Aretz *et al.*, 2010). Second, the economic cycle moderates negative EPU impact only on the most profitable stocks. This moderation loses its effect as stock prices achieve lower returns, with minimal effects experienced at the lower tail of the stock return distribution. These findings deepen our knowledge about the behaviour of the extreme stocks under EPU, contributing to the literature and expanding on the work of Bekiros *et al.* (2016), Raza *et al.* (2018) and Huang and Liu (2022), among others.

This research has several implications. A better understanding of the asymmetry and extreme effect of EPU on stock market returns considering stock type can help investors improve and optimise portfolio allocation decisions. Moreover, this paper sheds further light on investment strategies that pursue opportunities arising from a changing economic cycle, especially for extreme stocks. Our findings show that investment in growth stocks is only advisable in times of expansion and low EPU. However, in times of recession and high EPU, investment in large cap and value stocks will likely be more stable to deal with the uncertain environment characterised by high EPU.

The limitations of this study relate to the data sample corresponding only to the US stock market and the consideration of different moderating variables. In terms of the study period, one approach could be to analyse two different periods of time to examine the emergence of technology companies becoming powerful growth stocks and an important factor driving stock market returns since the early 2000s. A comparison of a period before and after the emergence of these technology companies could present different outcomes, especially during recessions.

Future research could take several directions, one being to analyse the opportunities that arise from an increase/decrease in EPU impact on value premium strategies considering the changes in the economic cycle. Another approach could explore the profitability of different types of stocks under extreme risk. Lastly, investigating other methodological approaches, including a different moderating variable, could result in a better understanding of the relationship between uncertainty and growth/value and small/large cap stocks.

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Corresponding author
Jessica Paule-Vianez can be contacted at: jessica.paule@urjc.es

Appendix

Variable	Full sample $N = 317$ Mean	Std. Dev	Recession $N = 28$ Mean	Std. Dev	Expansion $N = 289$ Mean	Std. Dev	T-test mean difference (p-value)
$R_{Large\text{-}Value}$	0.009	0.044	−0.018	0.076	0.012	0.038	2.048** (0.05)
$R_{Large\text{-}Growth}$	0.010	0.049	−0.009	0.080	0.012	0.045	1.356 (0.19)
$R_{Small\text{-}Value}$	0.010	0.053	−0.013	0.096	0.012	0.047	1.380 (0.18)
$R_{Small\text{-}Growth}$	0.009	0.065	−0.011	0.101	0.011	0.061	1.141 (0.26)
EPU	0.019	0.199	0.073	0.357	0.013	0.177	−0.865 (0.39)
Default spread	0.010	0.004	0.017	0.009	0.009	0.002	−4.939*** (0.00)
Inflation	0.002	0.004	0.001	0.007	0.002	0.003	0.835 (0.41)
IPI	0.001	0.011	−0.014	0.026	0.003	0.007	3.354*** (0.00)
Term spread	0.016	0.011	0.022	0.008	0.015	0.011	−4.161*** (0.00)
GDP	0.000	0.004	−0.005	0.010	0.000	0.002	2.626** (0.01)

Note(s): ***, ** and * indicate the significance at 1%, 5% and 10% levels, respectively
Source(s): Own elaboration

Table A1.
Descriptive statistics of the variables under study

Table A2. Bivariate correlations of the variables under study

Variable	$R_{Large\text{-}Value}$	$R_{Large\text{-}Growth}$	$R_{Small\text{-}Value}$	$R_{Small\text{-}Growth}$	EPU	Cycle	Default spread	Inflation	IPI	Term spread	GDP
$R_{Large\text{-}Value}$	1										
$R_{Large\text{-}Growth}$	0.806*** (0.00)	1									
$R_{Small\text{-}Value}$	0.859*** (0.00)	0.699*** (0.00)	1								
$R_{Small\text{-}Growth}$	0.714*** (0.00)	0.839*** (0.00)	0.845*** (0.00)	1							
EPU	−0.245*** (0.00)	−0.263*** (0.00)	−0.255*** (0.00)	−0.270*** (0.00)	1						
Cycle	0.194*** (0.00)	0.120** (0.03)	0.135** (0.02)	0.096* (0.09)	−0.084 (0.14)	1					
Default spread	−0.136** (0.02)	−0.089 (0.12)	−0.094* (0.09)	−0.056 (0.32)	0.006 (0.91)	−0.561*** (0.00)	1				
Inflation	0.035 (0.53)	0.027 (0.63)	0.024 (0.67)	0.025 (0.66)	−0.010 (0.86)	0.087 (0.12)	−0.239*** (0.00)	1			
IPI	−0.023 (0.69)	−0.031 (0.59)	−0.019 (0.74)	−0.033 (0.56)	−0.082 (0.15)	0.422*** (0.00)	−0.290*** (0.00)	0.158** (0.01)	1		
Term spread	−0.036 (0.52)	−0.038 (0.50)	0.016 (0.78)	0.006 (0.91)	−0.044 (0.44)	−0.170*** (0.00)	0.329*** (0.00)	−0.058 (0.30)	0.003 (0.96)	1	
GDP	0.173*** (0.00)	0.125** (0.03)	0.204*** (0.00)	0.129** (0.02)	−0.207*** (0.00)	0.367*** (0.00)	−0.202*** (0.00)	0.202*** (0.00)	0.637*** (0.00)	0.026 (0.65)	1

Note(s): ***, ** and * indicate the significance at 1%, 5% and 10% levels, respectively
Source(s): Own elaboration