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Economic policy uncertainty: The probability and duration of economic recessions in major European Union countries

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ABSTRACT

We study the impact of economic policy uncertainty on the probability and duration of economic recessions in 10 major European Union countries over the period 1987Q2–2021Q1. We find that economic policy uncertainty results in not only a higher probability of economic recessions but also longer recessions. Specifically, with a one-standard-deviation increase in the economic policy uncertainty index, on average the probability of an economic recession goes up by 14%, and the probability of an economic recession ending reduces by 27%, controlling for general economic uncertainty and economic and political factors. Moreover, we find that fiscal expansion, adequate political support, and left-wing governments' policies are important to alleviate the effects of policy uncertainty on the likelihood of economic recessions.

1. Introduction

The world economy has become more uncertain than ever before due to the elevated economic policy uncertainty associated with recent challenges such as the Great Recession of 2007/08, the European sovereign debt crisis, the disordered Brexit in the United Kingdom, the trade war between the United States (US) and China, and Trump's election. More recently, the ongoing COVID-19 pandemic has trigged a massive increase in economic policy uncertainty and deepened economic recessions in most countries in the world. These challenges call for cohesion policies to stabilise within-country and the worldwide economy. Regrettably, what we are observing recently is the rising polarisation and disrupted relationships within and between countries along with unprecedented government responses to these challenges. This seems to indicate that governments have underestimated the recent adverse effects of heightened economic policy uncertainty on the economy.

Given that uncertainties can determine the changes in government policy and the behaviour of both politicians, financial intermediaries, and enterprises (Julio and Yook, 2012; Bordo et al., 2016), there is growing concerns about whether economic policy uncertainty was somehow to blame for these phenomena. This concern has emerged as an issue of great interest for both market participants and policy makers. In this regard, a large body of work offers a number of theoretical frameworks and empirical evidence to explore whether and how policy uncertainty foreshadows financial decisions and economic policies. They find that firms tend to delay their investment decision during periods of high policy uncertainty (Bloom et al., 2007; Julio and Yook, 2012; Gulen and Ion, 2016). Moreover, banks are more likely to seek higher returns from riskier activities (Wu et al., 2020; Nguyen, 2021) until a part or almost of economic policy uncertainty is resolved. There are also well-established empirical findings that economic policy uncertainty is associated with higher unemployment, market volatility, and sluggish economic recovery (see, e.g., Bloom, 2009; Choudhry et al., 2020; Caggiano et al., 2020; Pruser and Schlosser, 2020).

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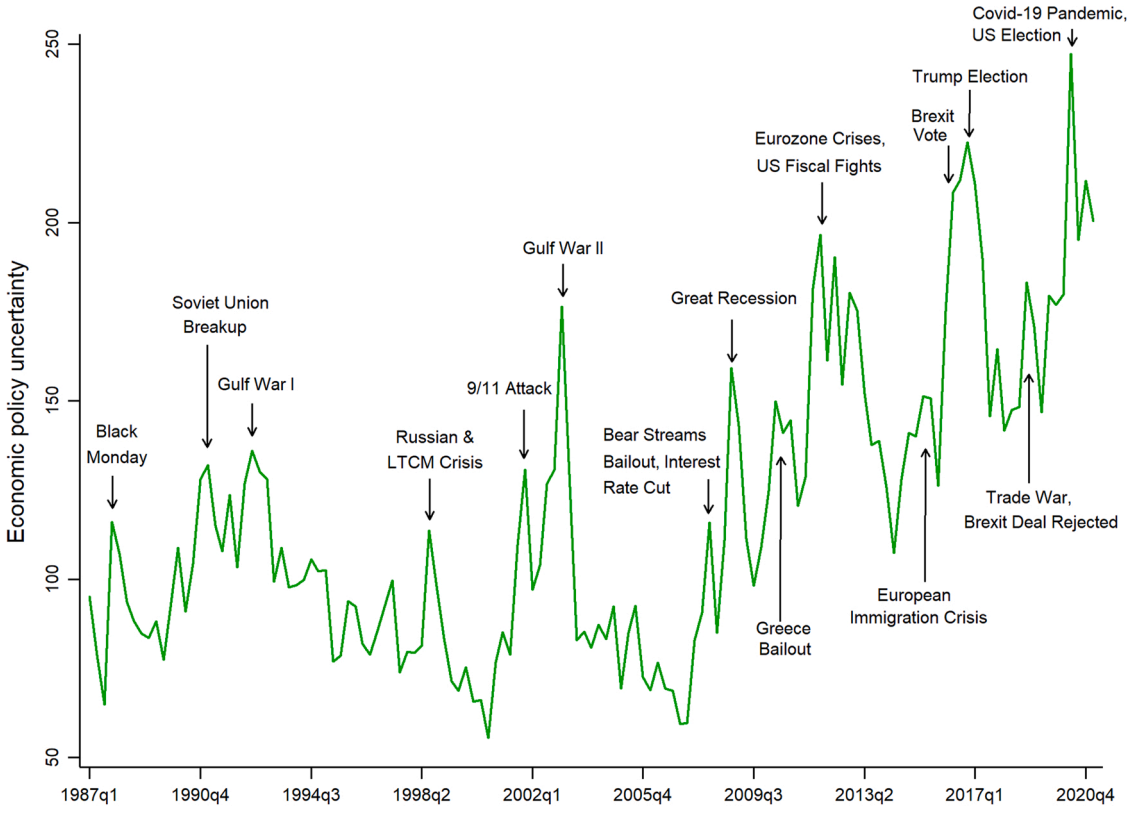

Fig. 1. Economic policy uncertainty in 10 major EU countries (19871Q1–2021Q1).

However, there has been surprisingly limited attention to the effects of economic policy uncertainty on the probability and duration of economic recessions. Earlier assessments of economic recessions were based on several economic uncertainty indices – such as the yield spread, stock market return, macroeconomic uncertainty, financial uncertainty, and industrial production growth – for forecasting economic recessions in the US (Bloom, 2009; Ng, 2012; Ercolani and Natoli, 2020). Nevertheless, it is worth noting that proxies for economic uncertainty used in these references do not imply economic policy uncertainty, which focuses on uncertainty generated by political and regulatory systems and not other sources of uncertainty (Gulen and Ion, 2016). In particular, economic policy uncertainty is only a portion of general economic uncertainty.

An exception is Karnizova and Li (2014), who examine how economic policy uncertainty forewarns economic recessions in the US. Using a probit recession forecasting model, they find that policy uncertainty increases the probability of economic recessions in six to nine quarters ahead of their quarterly sample. Apart from their work, as far as we are concerned, none studies the direct impact of policy uncertainty on the likelihood of economic recessions. Moreover, the influence of policy uncertainty on the duration of economic recessions remains virtually unexplored in the literature. They are major shortcomings found in the literature, and this paper is an attempt to contribute to these dimensions.

In this study, we pay special attention to the European Union (EU) as this area has been in the age of heightened economic policy uncertainty, which is evident from Fig. 1. Moreover, existing studies using recession forecasting models tend to focus on only the US. Thus, little is known about drivers of economic recessions and their duration in the EU countries, especially in what regards to economic policy uncertainty. Due to the availability of data for economic policy uncertainty, our sample covers 10 major EU countries: Belgium, France, Germany, Greece, Ireland, Italy, Netherlands, Spain, Sweden, and United Kingdom.[1] Their total GDP makes up around 83% of GDP in the EU and 71.2% of GDP in Europe in 2019.

The main challenge in this line of research is to find an appropriate measure of economic policy uncertainty. Isolating the effect of policy uncertainty from general economic uncertainty is not an easy task. In this context, Baker et al. (2016) develop the economic policy uncertainty index, which is calculated by the weighted average of three components. The first component quantifies the newspaper articles containing key terms of policy-related uncertainty. The second component measures the extent to which tax codes change in the near future. The third and final component accounts for the degree of uncertainty about fiscal and monetary policy by measuring the degree of disagreement among economic forecasters regarding future levels of the Consumer Price Index and government spending. The authors also undertook various experiments involving both human audits of newspaper articles and

[1] Our sample includes the United Kingdom, but we exclude its observations in 2020 and 2021Q1 since it left the European Union in January 2020.

computer-generated indices to make sure that the index is unbiased and captures only economic policy uncertainty and not other sources of uncertainty.

Taking the advantages of the economic policy uncertainty index developed by Baker et al. (2016), we aim to explore the effects of economic policy uncertainty on economic recessions and their duration in the EU. Having an insight into these dimensions is useful for policy makers to shape appropriate policies to prevent economic recessions and sluggish recoveries when such uncertainty increases.

While our paper shares some similarities with the study of Karnizova and Li (2014), it significantly departs from this reference in what regards to time/country coverage, variables used, methodology, and duration of economic recessions. First, while these authors only consider the impact of policy uncertainty on economic recessions in the US from 2006Q1 to 2013Q1, our panel consists of 10 major EU countries from 1987Q2 to 2021Q1. Our cross-country observations with a longer time dimension assure higher comparability/homogeneity of data. Second, the strict focus on policy uncertainty and several economic uncertainty indices, neglecting the potential impact of macroeconomic and political factors on economic recessions, is a shortcoming found in Karnizova and Li (2014). We extend their controllers by accounting for a range of political and economic factors. Third, unlike Karnizova and Li (2014) who use a probit recession forecasting model based on the policy uncertainty time series for the US, we employ a panel fixed-effects (FE) logit model to explore the probability of economic recessions and a Weibull discrete-time duration model to examine the duration of economic recessions. Fourth, this study also represents the first to examine the role that economic policy uncertainty plays as a potential driver of the duration of economic recessions and the channels it works through.

This paper contributes to the existing literature in the following ways. On the conceptual side, we provide a throughout review and discussion of the channels through which economic policy uncertainty could increase the likelihood of an economic recession. On the empirical side, we find robust evidence that economic policy uncertainty results in a higher probability of economic recessions in the short run. In particular, policy uncertainty is useful to predict economic recessions in five quarters ahead. These findings are robust to the use of onsets of economic recessions, an instrumental variable estimation, and cleaner measures of policy uncertainty to mitigate endogeneity. In addition, our findings suggest that policy uncertainty effects on economic recessions are weakened under higher levels of government spending and the presence of left-wing and majority governments, suggesting that fiscal expansion, left-wing governments' policies, and adequate political support help to prevent economic recessions when policy uncertainty is higher. Our discrete-time duration analysis also reveals that economic recessions are more prolonged at higher levels of economic policy uncertainty.

The rest of the paper is organised as follows. Section 2 briefly reviews the related literature. Section 3 presents our data and variables and introduces empirical methodology. Section 4 reports our empirical findings on the effects of economic policy uncertainty on the probability of economic recessions. Section 5 presents the effects of economic policy uncertainty on the duration of economic recessions. Section 6 concludes.

2. Literature review

A significant body of research has tried to comprehend the adverse effects of economic uncertainty on various dimensions of the economy such as financial instability (Phan et al., 2021), output losses (Bassett et al., 2014; Bordo et al., 2016), market return volatility (Bloom, 2009; Pastor and Veronesi, 2013; Amengual and Xiu, 2018), exchange rate volatility (Beckmann and Czudaj, 2017; Bartsch, 2019), unemployment (Baker et al., 2016; Caggiano et al., 2020), and hedging behaviour (Brogaard and Detzel, 2015; Nguyen et al., 2017). All of which reflects worsening economic conditions in times of heightened policy uncertainty. A comprehensive review of this literature is beyond the scope of this study. Instead, our interest lies primarily in the main channels through which policy uncertainty affects the probability of economic recessions and their duration, which are less discussed in the literature. In what follows, we briefly discuss these channels.

Motivated by the literature on real options, many theoretical analyses show that rising economic policy uncertainty impedes corporate investment by raising policy-related investment costs. They include not only direct taxes and government subsidies on investment, but also indirect costs relating to changes in regulations and replacement of officials and their enforcement (De Soto, 1989; Jeong, 2002). For this reason, firms – especially those pursuing irreversible investment projects – will have less incentives to invest (Gieseck and Rujin, 2020). In fact, Bernanke (1983), Bloom et al. (2007), Julio and Yook (2012), among others, builds on the theory of irreversible choice and point out that if investment projects are (or even partially) irreversible, firms tend to delay their investment and hiring in periods of high uncertainty – a caution effect. They will wait for additional information as it is costly to undo a project and costly to hire and fire workers. Using the index of economic policy uncertainty, Gulen and Ion (2016) and Wu and Suardi (2021) reached the same conclusion that policy uncertainty significantly reduces aggregate investment. This could increase the likelihood of economic recessions and lengthen their duration.

Households may also respond to heightened policy uncertainty in a similar way. When policy uncertainty is higher, households tend to save more and consume less, which leads to the so-called precautionary savings effect (Basu and Bundick, 2017). In particular, high uncertainty of employment and economic outlook could induce private households to delay their decisions on buying durable consumer goods – which are an important feature of the business cycle – and wait until new information has become available in the period of increased policy uncertainty (Bernanke, 1983; Bloom, 2014). This in turn reduces private consumption and further hampers economic growth (Gieseck and Rujin, 2020).

Another channel through which economic policy uncertainty can restrain economic activities and trigger economic recessions is declining credit growth. This happens due to the hesitation of banks to lend, the lower demand for loans, and the higher cost of capital when policy uncertainty is higher. There is considerable consensus in the literature that elevated levels of policy uncertainty are associated with a lower level of credit growth as banks are unable to predict future policy changes. For example, the delay in implementing the Dodd-Frank Act in the aftermath of the Great Recession of 2007/08 created regulatory policy uncertainty that

Table 1
Description of variables.

Variable	Definition	Source
Dependent variable		
Economic recession	A dummy variable that is equal to 1 for recession episodes, and 0 otherwise	OECD Composite Leading Indicators (CLI)
Key independent variable		
Economic policy uncertainty	Standardised economic policy uncertainty index constructed byBaker et al. (2016). Original index is available with monthly frequency. We calculated the average over 3 months to get quarter values	Baker et al. (2016)
Control variables		
Yield spread	10-Year Treasury Constant Maturity Minus 3-Month Treasury Constant Maturity	Eurostat
Industrial production	Percentage change in industrial production corresponding previous year period, seasonally adjusted	Eurostat
Stock return	Log-difference of the prices of common shares of companies traded on national or foreign stock exchanges	Eurostat
Current account balance	Current account balance as a percentage of GDP	Eurostat
Trade openness	Sum of exports and imports to GDP	Eurostat
Inflation	Consumer price index rate	Eurostat
Right-wing government	A dummy variable that is equal to 1 if the ruling government is formed by a right-wing, and 0 otherwise	DPI
Centre government	A dummy variable that is equal to 1 if the party position is centrist, and 0 otherwise	DPI
Majority government	A dummy variable that is equal to 1 if the ruling government has more than 50% of total seats in the legislature or parliament, and 0 otherwise	DPI
Instrumental variable		
Polarisation	The polarisation index measures the distance between the chief executive's party's values of political ideology and the values of the three largest government parties and the largest opposition party. Higher values of the index indicate higher levels of disagreement between politicians.	DPI
Additional analyses		
Onset recessions	A dummy variable that is equal to 1 for onsets of economic recessions, and 0 for tranquil episodes	CLI
Government spending	General government spending as a percentage of GDP	IFS
Fiscal balance	Fiscal balance as a percentage of GDP	IFS
Balance of payments	Balance of payments as a percentage of GDP	Eurostat
Six quarters before elections	A dummy variable that is equal to 1 for 6 quarters before elections, and 0 otherwise	DPI
Four quarters before elections	A dummy variable that is equal to 1 for 4 quarters before elections, and 0 otherwise	DPI
Four quarters after elections	A dummy variable that is equal to 1 for 4 quarters after elections, and 0 otherwise	DPI
Government instability	The ratio of veto players who drop from the government in a given year	DPI
Left-wing government	A dummy variable that is equal to 1 when the ruling government is formed by a left-wing, and 0 otherwise	DPI
Single majority government	A dummy variable that is equal to 1 for single majority governments, and 0 otherwise	DPI
Coalition majority government	A dummy variable that is equal to 1 for coalition majority governments, and 0 otherwise	DPI
US macroeconomic uncertainty	Macroeconomic uncertainty index for the US with higher values indicating higher levels of uncertainty.	Jurado et al. (2015)
US financial uncertainty	Financial uncertainty index for the US with higher values indicating higher levels of uncertainty.	Jurado et al. (2015)

restrained banks from extending their credit to the economy, which resulted in a sluggish economic recovery afterwards (Koch, 2012).

At higher levels of policy uncertainty, borrowers become opaquer and hence information asymmetry tends to thrive (Mishkin, 1999; Nguyen, 2021). In this regard, banks have less incentive to lend because they face more difficulties to assess borrowers' creditworthiness (Gieseck and Rujin, 2020; Nguyen, 2021; Phan et al., 2021). Due to the increased risk premia along with worsening economic conditions during periods of high policy uncertainty, banks tend to tighten their lending standards to reduce their risk exposure (Bassett et al., 2014; Berger et al., 2018; Bermpei et al., 2018).

Besides, banks tend to charge higher when policy uncertainty rises to compensate for higher risk-taking (Bassett et al., 2014; Brogaard and Detzel, 2015; Asharf and Shen, 2019; Gieseck and Rujin, 2020) and expected rate of returns from creditors (Choudhry et al., 2020; Wu and Suardi, 2021). Moreover, due to the "caution effect" firms may not have less incentive to take additional loans, especially when loan price is higher and lending standards are tightened. Thereby, the demand for loans will be lower in the face of policy uncertainty (Nguyen et al., 2021; Wu and Suardi, 2021). For example, Bordo et al. (2016) examine consumer and industrial loans in the US and find that elevated policy uncertainty reduces annualised loan growth by around 2.5% on average during the period 2007–2013. Thus, policy uncertainty would result in a higher cost of capital and a substantial decline in aggregate credit provision, which in turn increases the likelihood of economic recessions and restrains economic recovery.

Based on the above discussions, policy uncertainty could forewarn an economic recession and lengthen its duration in the sense that it reduces corporate investment and private consumption and obstructs banks' abilities to perform their key functions of intermediating liquid funds to the economy. Therefore, we conjecture that economic policy uncertainty is associated with not only a higher probability of economic recessions but also more prolonged recessions.

Table 2
Economic recessions and duration.

Country	Recessions	Ave duration	Min duration	Max duration
Belgium	8	8.38	4	14
France	7	9.43	6	15
Germany	8	8.50	4	16
Greece	9	7.00	4	12
Ireland	8	8.88	5	15
Italy	7	9.29	6	16
Netherland	7	9.43	4	18
Spain	6	10.00	7	15
Sweden	6	11.50	6	20
United Kingdom	8	9.50	5	20
Total	74	9.07	4	20

Notes: The table reports the number of economic recessions (Recessions), average duration (Ave duration), the minimum duration (Min duration), and the maximum duration (Max duration) of economic recessions over the period 1987Q2-2021Q1.

3. Data and methodology

Our quarterly dataset consists of 10 major EU countries over the period 1987Q2–2021Q1. The sample period is chosen to match the data availability of the policy uncertainty index constructed by Baker et al. (2016). We obtain information for financial and macroeconomic variables from the Eurostat database and the International Financial Statistics (IFS) database. Data for political variables come from the World Bank Database of Political Institutions (DPI). Definitions and sources of all variables are provided in Table 1.

3.1. Economic recessions

Data for recession episodes are provided by the Composite Leading Indicator (CLI) database, which uses GDP as the reference to identify turning points in business cycles based on the deviation-from-trend series. Although there is no consensus definition of an economic recession, in the spirit of the OECD (2010), a recession is defined as periods between the peaks and troughs in a business cycle identified by the CLI. Thus, the onset and ending quarters of economic recessions are their peak and trough quarters in business cycles, respectively. The duration of an economic recession is the number of quarters between the peak quarter and the trough quarter in a business cycle. Table 2 provides basic descriptive statistics for economic recessions and their duration over the period 1987Q2–2021Q1. Sweden and Spain experienced fewer economic recessions than other EU countries, but their average duration of recessions is more prolonged. The average duration of economic recession in our sample is more than 9 quarters, while the shortest and longest duration of recessions is 4 and 20 quarters, respectively. Further details of economic recessions and duration for each country are provided in Table A1 in Appendix.

3.2. Data and variables

We use the economic policy uncertainty (EPU) index developed by Baker et al. (2016) to proxy for the level of policy-related economic uncertainty. The index is constructed by three components. The first component – which makes up the largest share of the index – quantifies newspapers coverage of policy-related economic uncertainty. The second component reflects the future scheduled tax code expirations. The third component measures the disagreement among professional forecasters about future consumer prices and government expenditure. For ease of interpretation, the EPU index is then normalised to unit standard deviation. Thus, its coefficient is interpreted based on a one-standard-deviation increase in the EPU index.

In addition to EPU, a range of financial, economic, and political control variables are included in our models to account for their potential effects on the probability of economic recessions and to isolate the specific influence of EPU on economic recessions. We consider term spread, which is the difference between 10-year and 3-month Treasury yields, industrial production growth, and log-difference stock price as they are standard in the literature for forecasting economic recessions (see, e.g., Karnizova and Li, 2014; Ercolani and Natoli, 2020). These financial variables also capture macroeconomic uncertainty and therefore important to make sure that the main findings on policy uncertainty and economic recessions are not driven by non-policy-related economic uncertainty. Inflation is included as it is also a source of macroeconomic uncertainty, and its high levels reflect the mismanagement of macroeconomic and monetary policies (Demirguc-Kunt and Detragiache, 2002; Nguyen et al., 2020). We control for trade openness as more open countries could be more exposed to risk spill-over effects (Kaminsky and Reinhart, 1999; Nguyen et al., 2020). Current account balance constitutes another macroeconomic variable. Countries with larger external imbalances are more vulnerable to external capital flows (Falcetti and Tudela, 2006) and, in this regard, economic recessions could be more likely to occur.

Moreover, we account for the effects of political factors since the decisions for macroprudential policies or government interventions ultimately involve political choices (Rosas, 2006; Nguyen et al., 2021). We consider the effects of political ideology due to the heterogeneous economic orientations between the left-wing and right-wing governments (Castro and Martins, 2019). As argued by Bechtel (2009), right-wing governments – representing the interests of high-income groups – with strong connections with industrial associations and firms could be associated with lower systematic capital risk, a more secure business environment, and better

Table 3
Economic policy uncertainty and economic recessions.

	(1)	(2)	(3)	(4)	(5)
	Pooled logit	OLS	Pooled logit	RE Logit	FE Logit
EPU (t – 1)	0.0916 * **	0.0851 * **	0.102 * **	0.0965 * **	0.140 * **
	(0.0187)	(0.0149)	(0.0210)	(0.0223)	(0.0464)
Yield spread (t – 1)		-0.0178 * *	-0.0253 * *	-0.0292 * *	-0.0968 * **
		(0.00725)	(0.0114)	(0.0136)	(0.0314)
Industrial production (t – 1)		-0.00800 * *	-0.00889 * **	-0.00770 * *	-0.0200 * **
		(0.00305)	(0.00323)	(0.00354)	(0.00738)
Stock return (t – 1)		-0.0127 * **	-0.0166 * **	-0.0168 * **	-0.0346 * **
		(0.00193)	(0.00296)	(0.00266)	(0.00559)
Current account balance (t – 1)		0.0952 * **	0.0132 * **	0.0125 * **	0.0208 * *
		(0.0153)	(0.00483)	(0.00433)	(0.0101)
Trade openness (t-1)		0.0104 * **	0.00155 * **	0.00168 * **	0.0109 * **
		(0.00346)	(0.000505)	(0.000597)	(0.00356)
Inflation (t – 1)		0.00130 * **	0.124 * **	0.125 * **	0.278 * **
		(0.000405)	(0.0224)	(0.0184)	(0.0402)
Right (t – 1)		-0.106 * **	-0.131 * **	-0.116 * *	-0.197 * *
		(0.0368)	(0.0456)	(0.0493)	(0.0992)
Centre (t – 1)		-0.0701	-0.0942	-0.0806	0.0450
		(0.0703)	(0.0897)	(0.0844)	(0.201)
Majority (t – 1)		-0.125 * **	-0.152 * **	-0.156 * **	-0.290 * *
		(0.0417)	(0.0519)	(0.0523)	(0.118)
Time effects	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes
Observations	1028	796	796	796	796
Log likelihood	-698.083		-467.471	-467.090	-433.391
LR test	28.85 * **		94.49 * **	120.85 * **	175.28 * **
AIC	1400.167	1013.168	958.947	960.178	888.782
SBIC	1410.038	1069.323	1015.102	1021.013	940.257
Hausman test			92.85 * **	109.38 * **	

Notes: The table reports the effects of economic policy uncertainty on economic recessions in 10 major European Union countries over the period 1993Q2-2021Q1 using a pooled logit model in Columns (1) and (3), an ordinary least square in Column (2), a random-effects logit model in Column (4), and a fixed-effects logit model in Column (5). AIC and BIC report Akaike's and Schwarz's Bayesian information criteria with smaller values indicating better-fitting models. Hausman tests provide comparisons between the FE logit model and pooled logit model in Column (3) and between the FE logit model and RE logit model in Column (4). Marginal effects are reported in Columns (1) to (4), while Column (5) reports the average (semi-) elasticities. Robust standard errors are in parentheses. One, two, and three asterisks indicate significant levels of 10%, 5%, and 1%, respectively.

performance of the financial market. The majority government variable is also included to account for the effect of adequate political support. Those governments holding an absolute majority of seats in the parliament are less likely to face policy gridlock for the implementation of necessary macro-prudential policies (Nguyen et al., 2020). All explanatory variables are lagged one period (quarter) to reduce problems of simultaneity bias and potential reverse causality. Basic descriptive statistics of all variables are provided in Table A2 in Appendix.

3.3. Methodology

As our dependent variable – economic recession – is binary, which is equal to 1 for recession episodes, and 0 otherwise, a panel data logit model is employed to examine the effects of economic policy uncertainty on the likelihood of economic recessions. The probability of economic recessions can be characterised by the following function:

$$\Pr(Recession) = f(EPU, \quad X), \tag{1}$$

where *Recession* is economic recession, *EPU* is the economic policy uncertainty index, and *X* indicates the vector of macroeconomic and political controllers.

Employing a panel logit model, Eq. (1) can be described as follows:

$$\Pr(Recession_{it} = 1 | EPU_{it-1}, \quad X_{it-1}) = \Lambda(\alpha' EPU_{it-1} + \beta' X_{t-1}), \tag{2}$$

where *i* and *t* represent country and year, respectively, and $\Lambda(\bullet)$ is a logistic cumulative distribution function. Our structural logit model can be expressed as follows:

$$y_{it}^{*} = \alpha' EPU_{it-1} + \beta' X_{it-1} + \varepsilon_{it}, \tag{3}$$

$$Recession_{it} = \begin{Bmatrix} 1 & if \quad y_{it}^{*} > 0 \\ 0 & otherwise \end{Bmatrix} \tag{4}$$

Table 4
In-sample predictions of economic recessions.

Quarters lag (k)	1	2	3	4	5	6
Panel A: One-factor models						
EPU	0.193 * **	0.154 * **	0.122 * **	0.113 * **	0.0857 * *	0.0501
	(0.0387)	(0.0376)	(0.0368)	(0.0375)	(0.0369)	(0.0365)
Observations	1028	1019	1010	1001	992	982
Log likelihood	-670.625	-669.392	-666.594	-661.054	-656.524	-650.725
LR test	29.04 * **	18.67 * **	11.80 * **	9.74 * **	6.76 * **	3.24 * *
Panel B: Full models						
EPU	0.140 * **	0.154 * **	0.139 * **	0.120 * *	0.100 * *	0.0404
	(0.0464)	(0.0477)	(0.0497)	(0.0506)	(0.0503)	(0.0498)
Other variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	796	793	788	783	778	773
Log likelihood	-433.391	-431.021	-430.028	-427.338	-423.389	-417.763
LR test	175.28 * **	176.13 * **	171.50 * **	161.11 * **	169.28 * **	172.48 * **

Notes: The table reports the effects of economic policy uncertainty on economic recessions in 10 major EU countries over the periods 1987Q2-2021Q1 for Panel A and 1993Q2-2021Q1 for Panel B. The model for Panel A can be expressed as $y^*_{it} = c_i d_{it} + \alpha' EPU_{it-k} + \varepsilon_{i,t}$, where k is the number of quarters lag. The model for Panel B is $y^*_{it} = c_i d_{it} + \alpha' EPU_{it-k} + \beta' X_{it-1} + \varepsilon_{i,t}$. Results of the control variables in Panel B are not reported here for the sake of parsimoniousness, but they are available upon request. Time and country effects are included in both Panel A and Panel B. Robust standard errors are in parentheses. One, two, and three asterisks indicate significant levels of 10%, 5%, and 1%, respectively.

where y^*_{it} is the unobservable latent variable of economic recessions, and ε_{it} is the usual error term.

Moreover, we employ a conditional fixed-effects (FE) logit model to control for time-invariant at the country level. Including country fixed effects also allows our results to derive from within-country variations in the explanatory variables and eliminates potential biases that stem from different data-reporting standards in different countries. Our FE logit model is defined as follows:

$$y^*_{it} = c_i d_{it} + \alpha' EPU_{it-1} + \beta' X_{it-1} + \varepsilon_{i,t}, \tag{5}$$

where c_i is the constant term, d_{it} represents dummy variables that are equal to 1 for country i, and 0 otherwise, and $\varepsilon_{i,t}$ is the error term which includes time effects τ_t. One advantage of the FE logit model is that it accounts for country effects by assigning dummy variables (d_{it}) to each individual (country).

4. Results

4.1. Baseline results

Table 3 displays our main results. We start with the one-factor model between economic policy uncertainty and economic recessions, as is evident from Column (1). The result indicates that, when all else is held constant, economic policy uncertainty increases the probability of economic recession. Quantitatively, with one-standard-deviation increase in the EPU index, the probability of an economic recession increases by more than nine percentage points. However, the finding can be driven by omitted variables. In Column (2), Eq. (1) is estimated by an ordinary least square (OLS) with controllers, and the result remains consistent: policy uncertainty is associated with a higher probability of economic recessions. Nevertheless, this finding can also be biased as OLS has various problems in the binary-dependent framework. Pooled, random effects (RE), and FE logit models are then employed in Columns (3), (4), and (5), respectively, to examine the effects of policy uncertainty on economic recessions, controlling for factors that have been found in the literature to have an impact on the probability of economic recessions. Our favoured method is the FE logit model presented in Column (5), hereafter "the baseline model", as it controls for time-invariant unobservable factors and the fact that most variables vary more across units than over time. AIC and SBIC tests also favour the FE logit model as they produce the smallest values. Moreover, FE tests indicate that the FE logit model is more efficient than pooled and RE logit models.[2]

Despite using different econometric methods, the estimates on *EPU* across all regressions are positive and statistically significant at under 1 per cent level, indicating that policy uncertainty has been consistently linked to a higher probability of economic recessions. Economically, the coefficient reported in the baseline model indicates that with a one-standard-deviation increase in the *EPU,* on average the probability of an economic recession goes up by 14%.[3] This evidence can be essentially explained by the decline in corporate investment (Bloom et al., 2007; Gulen and Ion, 2016; Wu and Suardi, 2021), aggregate consumption (Bernanke, 1983; Basu and Bundick, 2017; Bloom, 2014), and credit growth (Bordo et al., 2016; Wu and Suardi, 2021), as well as higher cost of capital (Bassett et al., 2014; Brogaard and Detzel, 2015; Asharf and Shen, 2019) during periods of high policy uncertainty.

[2] Our explanatory variables show remarkably little correlations, which are evident from Table A3 in Appendix. This means that our results do not suffer from serious multicollinearity problems.

[3] As marginal effects cannot be obtained from FE logit models (Wooldridge, 2010, p. 622), the result is interpreted based on the average (semi-) elasticities (see Kemp and Silva, 2016).

Table 5
Economic policy uncertainty and economic recessions: Additional controllers and interactive effects.

	(1)	(2)	(3)	(4)	(5)
EPU (t – 1)	0.569 *	0.163 * **	0.168 * **	0.176 * **	0.105 *
	(0.298)	(0.0597)	(0.0782)	(0.0503)	(0.0615)
EPU * Government spending	-0.01280 * **				
	(0.00433)				
EPU * Fiscal balance		-0.00254			
		(0.00984)			
EPU * Right-wing government			0.0277 * **		
			(0.00995)		
EPU* Centre government				-0.0786	
				(0.191)	
EPU * Majority government					-0.116 * **
					(0.0377)
Yield spread (t – 1)	-0.140 * **	-0.134 * **	-0.126 * **	-0.133 * **	-0.130 * **
	(0.0401)	(0.0395)	(0.0397)	(0.0396)	(0.0395)
Industrial production (t – 1)	-0.0447 * **	-0.0461 * **	-0.0463 * **	-0.0462 * **	-0.0456 * **
	(0.00929)	(0.00928)	(0.00931)	(0.00929)	(0.00925)
Stock return (t – 1)	-0.0318 * **	-0.0325 * **	-0.0320 * **	-0.0325 * **	-0.0317 * **
	(0.00636)	(0.00632)	(0.00630)	(0.00632)	(0.00633)
Current account balance (t – 1)	0.0288 * *	0.0294 * *	0.0323 * **	0.0293 * *	0.0306 * *
	(0.0118)	(0.0122)	(0.0122)	(0.0122)	(0.0122)
Trade openness (t-1)	0.0140 * **	0.0136 * **	0.0147 * **	0.0142 * **	0.0126 * **
	(0.00464)	(0.00417)	(0.00418)	(0.00448)	(0.00419)
Inflation (t – 1)	0.276 * **	0.284 * **	0.283 * **	0.283 * **	0.287 * **
	(0.0427)	(0.0432)	(0.0432)	(0.0433)	(0.0432)
Right (t – 1)	-0.323 * **	-0.308 * **	-0.324 * **	-0.308 * **	-0.323 * **
	(0.110)	(0.109)	(0.109)	(0.109)	(0.109)
Centre (t – 1)	0.0316	-0.0490	0.0324	-0.00402	-0.132
	(0.239)	(0.232)	(0.231)	(0.252)	(0.238)
Majority (t – 1)	-0.287 * *	-0.289 * *	-0.264 * *	-0.253 *	-0.216 *
	(0.130)	(0.129)	(0.131)	(0.134)	(0.129)
Government spending (t – 1)	-0.0339 * **	-0.0358 * **	-0.0325 * *	-0.0356 * **	-0.0355 * **
	(0.0129)	(0.0127)	(0.0128)	(0.0127)	(0.0128)
Fiscal balance (t – 1)	-0.0207 * *	-0.0222 * *	-0.0238 * *	-0.0226 * *	-0.0222 * *
	(0.0102)	(0.0101)	(0.0102)	(0.0102)	(0.0101)
Time effects	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes
Observations	715	715	715	715	715
Log likelihood	-355.854	-356.485	-352.448	-356.434	-354.847
LR test	217.15 * **	213.97 * **	222.04 * **	214.07 * **	192.54 * **

Notes: The table reports the conditioning effects of economic and political factors on the impact of policy uncertainty on the probability of an economic recession over the period 1988Q2-2021Q1. Robust standard errors are in parentheses. One, two, and three asterisks indicate significant levels of 10%, 5%, and 1%, respectively.

Our control variables also provide some results that are worth highlighting. In line with empirical evidence provided by the existing literature (e.g., Karnizova and Li, 2014; Ercolani and Natoli, 2020), higher yield spread, industrial production growth, and stock price return reduce the probability of economic recessions. As expected, countries with higher levels of inflation and trade openness are more likely to experience economic recessions. We also find that increased current account balance raises the probability of economic recessions. This contrasts with some claims that countries with large external imbalances (deficits) are more vulnerable to external capital flows (Falcetti and Tudela, 2006; Nguyen et al., 2020). In fact, current account deficits reflect a strong expansion of internal demand. In this regard, increased current account balance might reflect a decline in domestic consumption and investment, which forewarn a recession (Aizenman and Jinjarak, 2014). In terms of political variables, as expected, the probability of economic recessions is lower when right-wing governments stay in office and when incumbent governments hold an absolute majority of seats in the parliament.

4.2. Additional analyses

Given that economic policy uncertainty and general economic uncertainty can forewarn economic recessions up to nine quarters ahead (Ng, 2012; Karnizova and Li, 2014; Ercolani and Natoli, 2020), in this analysis we examine whether economic policy uncertainty is useful to predict economic recessions at 10 quarters forecast horizons. Results from Table 4 show that policy uncertainty is positively correlated with the probability of economic recessions in five quarters ahead. Its effects are statistically insignificant for seventh to tenth forecast horizons.[4] This indicates that economic policy uncertainty generates a higher likelihood of economic recessions in the

[4] The results using quarters lags from 7 to 10 are not reported here, but they are available upon request.

Table 6
Alternative measures of controllers and economic policy uncertainty.

	(1)	(2)	(3)	(4)	(5)
EPU (t – 1)	0.148 * **				
	(0.0469)				
Six quarters before elections		0.138 * *			
		(0.0617)			
Four quarters before elections			0.342 * **		
			(0.117)		
Four quarters after elections				0.162 * **	
				(0.0621)	
Government instability					0.280 * **
					(0.101)
Yield spread (t – 1)	-0.0823 * **	-0.0970 * **	-0.0794 * **	-0.0751 * **	-0.098 * **
	(0.0289)	(0.0277)	(0.0272)	(0.0269)	(0.0263)
Industrial production (t – 1)	-0.0202 * **	-0.0247 * **	-0.0165 * *	-0.0165 * *	-0.0175 * **
	(0.00673)	(0.00656)	(0.00659)	(0.00655)	(0.00331)
Stock return (t – 1)	-0.0331 * **	-0.0343 * **	-0.0299 * **	-0.0287 * **	-0.0406 * **
	(0.00526)	(0.00492)	(0.00476)	(0.00474)	(0.00379)
Balance of payment (t – 1)	0.0149 * *	0.0131 * **	0.0151 * **	0.0129 * *	0.0276 * *
	(0.00667)	(0.00626)	(0.00675)	(0.00578)	(0.0139)
Trade openness (t-1)	0.00913 * **	0.00995 * **	0.0140 * **	0.0140 * **	0.0199 * **
	(0.00293)	(0.00260)	(0.00275)	(0.00275)	(0.00526)
Inflation (t – 1)	0.278 * **	0.287 * **	0.307 * **	0.298 * **	0.284 * **
	(0.0379)	(0.0357)	(0.0359)	(0.0356)	(0.0705)
Left-wing government (t – 1)	0.176 * *	0.135 * *	0.139 * **	0.165 * **	0.203 * **
	(0.0815)	(0.0614)	(0.0616)	(0.0628)	(0.0661)
Centre government (t – 1)	-0.00234	-0.0222	0.0308	0.0424	-0.0618
	(0.168)	(0.165)	(0.165)	(0.165)	(0.337)
Single Majority government (t – 1)	-0.382 * **	-0.483 * **	-0.450 * **	-0.437 * **	-0.485 * **
	(0.128)	(0.122)	(0.120)	(0.120)	(0.147)
Coalition majority government	-0.201 *	-0.300 * **	-0.243 * *	-0.234 * *	-0.321 * **
	(0.113)	(0.106)	(0.105)	(0.104)	(0.115)
Time effects	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes
Observations	872	981	981	981	980
Log likelihood	-477.477	-544.945	-550.076	-547.610	-546.392
LR test	195.45 * **	209.48 * **	201.15 * **	195.06 * **	206.59 * **

Notes: The table reports the effects of economic policy uncertainty on economic recession over the period 1988Q2-2021Q1 using election dummy variables as alternative proxies of policy uncertainty with alternative measures of control variables. Robust standard errors are in parentheses. One, two, and three asterisks indicate significant levels of 10%, 5%, and 1%, respectively.

short run. In one-factor models (Panel A of Table 4), the probability of an economic recession reduces gradually when the number of forecast horizons increases. This remains consistent when control variables are added in Panel B. Empirically, a one-standard-deviation increase in policy uncertainty produces a peak increase in the probability of an economic recession at the second quarter of about 15.4% before declining afterwards, ceteris paribus.

In the next experiment, we add government spending and fiscal balance into our models and explore their interactive effects with economic policy uncertainty. The classic Keynesian theory suggests that fiscal expansion is vital to prevent economic recessions by boosting aggregate demand and stimulating short-run output growth (Keynes, 1936). In this regard, a higher degree of government spending is expected to reduce the probability of economic recessions. We also account for the role of fiscal balance as countries with budget constraints might be unable to implement costly and timely interventions against economic shocks, especially during periods of high policy uncertainty. Moreover, we also interact political variables with economic policy uncertainty to examine whether and how political factors influence the relationship between policy uncertainty and economic recessions.

Table 5 reports the effects of economic policy uncertainty on economic recessions and its interaction terms with economic and political variables using a FE logit model. However, due to the data availability of government spending and fiscal balance, we lose several observations. Despite the inclusion of additional controllers and interaction terms, the impact of policy uncertainty on economic recessions remains statistically significant (at a more than 99% confidence level), and the coefficients of *EPU* do not change much.

Government spending and fiscal balance enter negatively, reflecting that economic recessions are less likely to occur when governments expand their fiscal policies and have low levels of deficits. Moreover, the interaction term in Column (1) of Table 5 also indicates that the positive effect of policy uncertainty on economic recessions weakens under higher levels of government spending, which is in accordance with the Keynesian theory that increasing government spending is important to stimulate economic growth. The coefficient of the interaction term of policy uncertainty with fiscal balance is insignificant, despite carrying the same (negative) expected sign. Perhaps, major EU countries are less likely to face budget constraints for their necessary macro-prudential policies as the level of uncertainty rises. If that is not the case, they can find financial support from the European Central Bank (Crosignani, 2021).

Turning to political variables, the interaction term in Column (3) shows that right-wing governments appear to strengthen the

positive association between policy uncertainty and economic recessions. This is a striking and very important issue not yet considered in the literature but that deserves to analyse with special attention. That is, while right-wing governments appear to decrease the probability of economic recessions, they are more prone to economic recessions when economic policy uncertainty raises. A possible explanation for this result is that right-wing governments are more likely to implement small and temporary macro-prudential policies (Talving, 2017). In sharp contrast, left-wing governments tend to pursue large and permanent interventions (Talving, 2017; Nguyen et al., 2021), which could be more effective to prevent an economic shock from turning into an economic recession. Besides, majority governments help to reduce the adverse effects of policy uncertainty on the economic environment. This is not surprising as majority governments are able to implement necessary policies to stabilise the economy at higher levels of policy uncertainty without facing policy gridlock (Aisen and Veiga, 2013; Nguyen et al., 2020, 2021).

4.3. Alternative measures of controllers and economic policy uncertainty

To check for the robustness of the main finding, we perform several sensitivity analyses. In the first analysis presented in Column (1) of Table 6, we use alternative measures of economic and political variables. In particular, *current account balance* is replaced by *balance of payment*, which includes not only current accounts but also the capital and financial accounts of a country. Nevertheless, the result remains unchanged: Increased balance of payment is associated with a higher probability of economic recessions. Next, we replace right-wing governments with left-wing governments. Given that their economic and macroprudential policies are opposite (Castro and Martins, 2019; Nguyen et al., 2020, 2021), we expect that the inverse relationship should happen with the left-wing governments. Indeed, *left-wing government* enters positively, indicating that left-wing governments are generally associated with a higher probability of economic recessions. As majority governments can be formed by single majority governments or coalition majority governments, we replace *majority government* with dummy variables of *single majority government* and *coalition majority government*. The results show that both single and coalition majority governments help to reduce the probability of economic recessions.

In the next experiment, we follow Ashraf and Shen (2019) and Nguyen (2021) to use general elections dummy variables as alternative proxies for policy uncertainty. General elections are political events that generate a great deal of uncertainty regarding the government's future economic policy (Julio and Yook, 2012; Baker et al., 2016). Firms are more likely to delay their investment before elections as they are uncertain about how the government will shape future financial regulations and macroeconomic policies (Julio and Yook, 2012; Jens, 2017). There is also well-established empirical evidence of worsening economic conditions when elections are tight such as higher stock return volatility (Chang and Lai, 1997), financing costs (Kelly et al., 2016; Ashraf and Shen, 2019), and bank risk-taking (Nguyen, 2021). For these reasons, we create three elections dummy variables – six quarters before elections, four quarters before elections, and four quarters after elections – to explore the impact of the electoral cycle on the probability of economic recessions.

As shown in Columns (2) and (3) of Table 6, the results strengthen our inferences by showing that elevated policy uncertainty before elections increases the probability of economic recessions, and this effect becomes stronger when elections are tight. Column (4) also shows that in the period of four quarters after elections the probability of economic recessions also increases but with smaller economic magnitude. As argued by Ashraf and Shen (2019), policy uncertainty still exists within the first year after elections as newly elected governments have to take the position at various policy issues. Since a part of the overall policy uncertainty has been resolved after elections, electoral effects on the probability of economic recessions are smaller in magnitude than those before elections.

Another alternative proxy for policy uncertainty is the level of government instability, which is measured by the ratio of veto players who drop from the government in any given year. The veto player theory suggests that, ceteris paribus, a greater number of veto players with greater ideological differences between them reduces the likelihood of policy change (Tsebelis, 1999; Angelova et al., 2017). In this regard, a higher government turnover rate reflects that the government is less stable, and its policies are more likely to be changed (Castro and Martins, 2019). This could result in a higher probability of economic recession. The recent study by Nguyen et al. (2020) also shows that higher government turnover increases the probability of financial crises. Replacing policy uncertainty index with government instability, results of Column (5) of Table 6 shows that government instability appears to increase the probability of economic recessions. This corroborates our main finding that policy uncertainty increases the likelihood of an economic recession.

4.4. Further tests to mitigate endogeneity problems

A matter of concern to our empirical results is the possibility that the explanatory variables are endogenous. In our regression models, we try to ease reverse causality concerns by using lagged one-period of explanatory variables. However, this may not fully mitigate endogeneity concerns inherent in our analysis. For this reason, we further address those problems by performing further tests that focus only on the onsets of economic recessions, employ an appropriate instrumental variable (IV) approach, and provide cleaner measures of policy uncertainty for the EU countries.

4.4.1. Economic policy uncertainty and onsets of economic recessions

As economic recessions might themselves generate a great deal of policy uncertainty (Julio and Yook, 2012; Gieseck and Rujin, 2020), we remove all observations of the duration of economic recessions, except for their onsets, to alleviate reversal causality concerns. While this procedure reduces around 40% of observations compared to the baseline model, it is useful to avoid the fact that economic policy uncertainty and economic and political factors are influenced by the development of economic recessions themselves.

Column (1) of Table 7 reports the impact of economic policy uncertainty on onsets of economic recessions using a FE logit model.

Table 7
Economic policy uncertainty and economic recessions: Mitigation of endogeneity concerns.

	(1)	(2)	(3)	(4)
	Onsets	IV-Probit	EUEPU1	EUEPU2
EPU (t – 1)	0.136 * **	0.0918 * *	0.121 * **	0.152 * **
	(0.0454)	(0.0458)	(0.0490)	(0.0505)
Yield spread (t – 1)	-0.0554 * **	-0.0232 * *	-0.0779 * **	-0.0887 * **
	(0.0208)	(0.0106)	(0.0298)	(0.0300)
Industrial production (t – 1)	-0.0203 * **	-0.0191 * **	-0.0176 * *	-0.0192 * **
	(0.00740)	(0.00673)	(0.00711)	(0.00714)
Stock return (t – 1)	-0.0478 * **	-0.0132 * *	-0.0360 * **	-0.0371 * **
	(0.00942)	(0.00555)	(0.00559)	(0.00565)
Current account balance (t – 1)	0.0368 * **	0.0104 * *	0.0214 * *	0.0202 * *
	(0.0190)	(0.00431)	(0.0103)	(0.0101)
Trade openness (t-1)	0.0244 * **	0.00144 * **	0.0149 * **	0.0150 * **
	(0.00682)	(0.000538)	(0.00356)	(0.00352)
Inflation (t – 1)	0.430 * **	0.103 * **	0.287 * **	0.286 * **
	(0.0695)	(0.0207)	(0.0415)	(0.0416)
Right-wing government (t – 1)	-0.268 * **	-0.150 * **	-0.176 * **	-0.175 * *
	(0.103)	(0.0474)	(0.0658)	(0.0664)
Centre government (t – 1)	0.248	-0.0391	0.116	0.148
	(0.330)	(0.0856)	(0.197)	(0.198)
Majority government (t – 1)	-0.388 * *	-0.245 * **	-0.307 * **	-0.293 * *
	(0.115)	(0.0663)	(0.116)	(0.116)
First stage		0.326 * **		
		(0.0823)		
Time effects	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes
Observations	472	778	796	796
Log pseudolikelihood	-275.196	-1554.704	-433.371	-434.941
Wald test	104.14 * **	300.09 * **	174.44 * **	172.18 * **
AIC	572.393	3161.408	890.911	891.88
SBIC	620.137	3282.483	942.386	943.36
UIT		15.643 * **		
WIT with		35.130		
critical value		16.38		
OIT p-value		0.000		
Wald test of exogeneity		4.76		

Notes: The table reports the effects of economic policy uncertainty on economic recession addressing endogeneity concerns. Column (1) focuses only on the onsets of economic recessions. Column (2) estimates Eq. (1) by an IV-probit model. Columns (3) and (4) provide cleaner measures of economic policy uncertainty, eliminating the effects of the economic policy uncertainty (USEPU) and macroeconomic and financial uncertainty (USEPU & MFU) in the US. The First stage reports the impact of political polarisation (the instrumental variable) on economic policy uncertainty. UIT is the under-identification LM test by Kleibergen and Paap, which requires a p-value lower than 0.05 to reject the null hypothesis at the 5% level. WIT is the Wald F-statistic of the weak identification test by Kleibergen and Paap, which must be higher than its critical value to reject the null hypothesis. OIT is the over-identification test of Hansen, which requires a value higher than 0.05 to reject the null hypothesis at the 5% level. Robust standard errors are in parentheses. One, two, and three asterisks indicate significant levels of 10%, 5%, and 1%, respectively.

The coefficient on the policy uncertainty index again signifies that increasing this variable will result in a higher likelihood of economic recessions. Its magnitude is just slightly smaller than that reported in the baseline model presented in Table 3, indicating that our results are not influenced by serious endogeneity problems. The coefficients of economic and political variables remain consistent and significant, except for industrial production growth which turns out to be insignificant.

4.4.2. Instrumental variable analysis

A traditional method to address endogeneity concerns is to find an appropriate instrument for our main variable of interest. A valid instrument must have a strong correlation with economic policy uncertainty and affects the probability of economic recessions only through its effects on policy uncertainty. We use the political polarisation index as an instrumental variable for economic policy uncertainty. Our choice of the instrumental variable relies on the insights of the political science literature on political polarisation.

Partisan polarisation obstructs political parties to build legislative coalitions and reach policy agreements, which result in policy gridlock and greater variation in government policy (Rigby and Wright, 2015). For this reason, increased disagreements between politicians have been argued to be the main source of policy uncertainty (Gulen and Ion, 2016). Moreover, it is not immediately apparent how partisan polarisation influences the probability of economic recessions. Therefore, in the context of our study, political polarisation can be considered as an appropriate instrumental variable. The polarisation index measures the distance between the chief executive's party's values of political ideology and the values of the three largest government parties and the largest opposition party. The index is constructed by the DPI with higher values indicating higher levels of disagreement between politicians.

In Column (2) of Table 7, we employ an IV-Probit model to estimate Eq. (1) using the political polarisation index as the instrumental variable. Results from the first stage are positive and statistically significant at the 1% level, indicating that political polarisation is

positively correlated with the level of policy uncertainty. The Kleibergen and Paap under-identification LM test (UIT) confirms that the regression is well identified at the 1% level. The Wald F-test of the Kleibergen and Paap weak identification test (WIT) is higher than its critical value, rejecting the null hypothesis that political polarisation is a weak instrument. In general, diagnostic tests confirm the validity of our instruments used.[5] However, the Wald test of exogeneity indicates that the null hypothesis of no endogeneity cannot be rejected. This means that a standard probit/logit model would be preferable as it will produce smaller standard errors. Nevertheless, the result of the exogeneity test also indicates that our baseline results presented in Table 3 are not influenced by serious endogeneity problems. Nevertheless, the positive and statistically significant of policy uncertainty further confirms that economic policy uncertainty increases the probability of economic recessions.

4.4.3. *Economic policy uncertainty in the United States*

Our regressions presented above assume that the economic policy uncertainty index accurately captures policy-related economic uncertainty but not other sources of economic uncertainty. If the index inadvertently captures economic uncertainty that is not policy-related, our estimates will be biased due endogeneity problems arising when non-policy-related economic uncertainty incorporated in the policy uncertainty index affects both the policy uncertainty and the probability of economic recessions. For this reason, Baker et al. (2016) intensively minimise this measurement error by using an audit study based on human readings and comparing their policy uncertainty index with other measures of general economic uncertainty. In our models, yield spread, industrial production growth, and stock return are always included to capture the effects of non-related policy uncertainty. In this section, we go one step further to provide a purer measure of economic policy uncertainty by eliminating the similarities between major EU and US economies.

Given that the US is the largest trade partner of the EU, economic shocks affecting the US economy may also have an impact on the EU economy. Indeed, using a Vector Autoregressive model, Colombo (2013) and Cheng et al. (2016) find that economic policy uncertainty in the US creates deeper spill-over effects to the Euro economy. In the case that the economic policy uncertainty index, to some extent, inadvertently captures non-policy-related economic uncertainty, we can rule out this part from the policy uncertainty index by estimating economic policy uncertainty for EU countries as a function of the US economic policy uncertainty index and control variables, then use the regression residuals as a proxy for policy-related economic uncertainty for EU countries. In doing so, we perform the following first-stage regression:

$$EUEPU_{it} = \alpha + \quad \beta USEPU_t + \gamma X_{it-1} + \varepsilon_{it}, \tag{6}$$

where *EUEPU* and *USEPU* indicate economic policy uncertainty indices for the major EU countries considered in this study and the US, respectively. *X* represents the vector of control variables. The residual term ε_{it} should include purer information of economic policy uncertainty in EU countries, having been eliminating non-policy-related economic uncertainty affecting both the US and EU countries.

$$EUEPU_{it} = \alpha + \quad \beta USEPU_t + \gamma USMU_t + \delta USFU_t + \theta X_{it-1} + \varepsilon_{it}, \tag{7}$$

To further capture the possible contaminating part of the US general economic uncertainty in the economic policy uncertainty indices of EU countries, Eq. (6) is extended by introducing the macroeconomic uncertainty index (*USMU*) and financial uncertainty index (*USFU*) for the US developed by Jurado et al. (2015). These uncertainty indices measure the total level of macroeconomic uncertainty and financial uncertainty in the US. The residual term ε_{it} in Eq. (7) therefore provides an even cleaner measure of economic policy uncertainty for the EU countries.

Using cleaner measures of policy uncertainty obtained from Eqs. (6) and (7), the results of the baseline model are reported in Columns (3) and (4) of Table 7. *EUEPU1* and *EUEPU2* enter positively and significantly, which further corroborates the main finding on a positive impact of economic policy uncertainty on the probability of economic recessions. The economic magnitude in these models is just slightly smaller than that of the baseline model, indicating that our findings do not suffer from measurement error. The coefficients of control variables remain consistent and do not change much.

Overall, economic policy uncertainty is found to be an important driver of economic recessions. Our findings are not overly sensitive to the inclusion of additional controllers, alternative proxies of economic policy uncertainty, and endogeneity problems.

5. Economic policy uncertainty and the duration of economic recessions

While we provide robust evidence that economic policy uncertainty increases the likelihood of economic recessions, there is growing concern that higher levels of economic policy uncertainty hamper economic recovery as they may foreshadow declines in employment, investment, and output growth (Bloom, 2009, Baker et al., 2012; Choudhry et al., 2020; Caggiano et al., 2020; Pruser and Schlosser, 2020). In this regard, economic recessions could be more prolonged. However, to the best of our knowledge, no previous studies have empirically examined whether and how economic policy uncertainty affects the duration of economic recessions. In this section, we employ an appropriate duration model to shed more light on how increased economic policy uncertainty lengthens/shortens economic recessions, i.e, decreases/increases the probability of an economic recession ending. It is worth mentioning that, in duration analysis, a lower probability of an economic recession ending results in a longer economic recession.

In our duration analysis, the duration variable measures the length of an economic recession. It equals 1 at time $t = 1$ – the onset quarter of an economic recession – and increases by one for each subsequent quarter of a recession episode until time t_i, which is the

[5] The p-value of the over-identification test of Hansen is equal to zero because we only use one instrumental variable (political polarisation), which means that the equation is exactly identified.

Table 8
Economic policy uncertainty and the duration of economic recessions.

	(1)	(2)	(3)	(4)	(5)
p	3.088 * **	3.247 * **	3.250 * **	3.251 * **	3.085 * **
	(0.256)	(0.280)	(0.302)	(0.315)	(0.286)
EPU (t – 1)	-0.311 * **				
	(0.115)				
EPU (t – 2)		-0.502 * **			
		(0.167)			
EPU (t – 3)			-0.562 * **		
			(0.215)		
EPU (t – 4)				-0.550 * *	
				(0.221)	
EPU (t – 5)					-0.264
					(0.131)
Yield spread (t – 1)	0.283 * **	0.360 * *	0.318 * **	0.297 * *	0.248 * *
	(0.107)	(0.179)	(0.115)	(0.139)	(0.125)
Industrial production (t – 1)	-0.113 * **	-0.131 * **	-0.121 * **	-0.115 * **	-0.119 * **
	(0.0243)	(0.0284)	(0.0297)	(0.0285)	(0.0302)
Stock return (t – 1)	-0.00516	0.00794	0.0129	0.00779	0.00532
	(0.0151)	(0.0167)	(0.0178)	(0.0177)	(0.0167)
Current account balance (t – 1)	-0.0571 * *	-0.0498 * *	-0.0498 * *	-0.0437 *	-0.0440 *
	(0.0265)	(0.0242)	(0.0221)	(0.0231)	(0.0253)
Trade openness (t-1)	-0.00372	-0.00471	-0.00523	-0.00520	-0.00293
	(0.00494)	(0.00481)	(0.00506)	(0.00528)	(0.00497)
Inflation (t – 1)	-0.547 * **	-0.494 * **	-0.481 * **	-0.482 * **	-0.479 * **
	(0.182)	(0.172)	(0.167)	(0.171)	(0.177)
Right-wing government (t – 1)	0.946 * *	1.081 * **	1.078 * *	1.051 * *	0.843 * *
	(0.387)	(0.401)	(0.421)	(0.417)	(0.404)
Centre government (t – 1)	0.298	0.713	0.759	0.696	0.407
	(1.364)	(1.281)	(1.338)	(1.360)	(1.374)
Majority government (t – 1)	1.195 * *	1.239 * *	1.166 * *	1.130 * *	1.133 * *
	(0.488)	(0.483)	(0.483)	(0.486)	(0.501)
Observations	399	395	390	385	380
Number of recessions	46	46	45	45	45
Log pseudolikelihood	-97.989	-94.675	-93.810	-93.687	-96.723
Wald test	83.23 * **	81.23.48 * **	82.15 * **	76.30 * **	68.23 * **
AIC	221.978	215.351	213.621	213.374	219.447
SBIC	273.834	267.076	265.181	264.767	270.669

Notes: The table reports the effects of economic policy uncertainty on the duration of economic recessions using a discrete-time duration model over the period 1993Q3-2020Q3. Robust standard errors are in parentheses. One, two, and three asterisks indicate significant levels of 10%, 5%, and 1%, respectively.

quarter that the recession ends, or its observation is censored. Continuous-time duration and discrete-time duration models are two groups of approaches that can be employed to explore the determinants of the duration of economic recessions. However, the latter group is more appropriate in our analysis for two reasons. First, they allow for the inclusion of time-varying covariates (Jenkins, 1995; Wooldridge, 2010, p. 1011). Second, given that our quarterly sample is grouped duration data in nature, the estimates of continuous-time duration models will be problematic due to the large length of discrete data (Castro, 2010; Nguyen et al., 2021). Indeed, Cameron and Trivedi (2005), p.600) suggest that discrete-time duration models should be used when time intervals are in the quarter, month, or week. Therefore, we employ the following discrete-time duration model:

$$P_{it} = \lambda(t, \quad \boldsymbol{X}_{it}) = 1 - \quad e^{-e^{\theta_t + \boldsymbol{X}_{it}^{'}\beta}}, \tag{8}$$

which can be expressed in the form of the so-called complementary log-log (Cloglog) hazard function:

$$\text{cloglog}(P) = \text{cloglog}(\lambda_{it}) = \quad \log[-log(1-\lambda_{it})] = \quad \theta_t + \boldsymbol{X}_{it}^{'}\beta \tag{9}$$

where P_{it} represents the conditional probability of an economic recession i ending at time t, given that the recession has not ended until that moment. The probability is measured by a hazard rate (λ). $\boldsymbol{X}$ is the vectors of economic policy uncertainty and control variables. β represents their coefficients to be estimated. θ_t is the Weibull hazard function and is defined as $\theta_t = log\lambda_t = \alpha + (p-1)logt$. [6] In this function, p is the shape parameter that captures the effects of duration dependence.[7] It allows examining whether the probability of economic recessions ending depends on their own duration.

[6] By using different assumptions of distributions of the baseline hazard function such as exponential, the gamma, the Gompertz-Makeham, or the log-normal distribution, different types of hazard functions can be obtained. However, Weibull distribution is employed as it is flexible to model a variety of data sets (Nelson, 1982).

[7] $p > 1$, $p < 1$, and $p = 1$ refer to positive duration dependence, negative duration dependence, and no duration dependence, respectively.

Table 9
Flexible duration dependence of economic recessions.

	(1)	(2)	(3)
Panel A			
Duration	0.173 * **	0.515 * **	1.762 * **
	(0.0204)	(0.109)	(0.316)
$Duration^2$		-0.0179 * **	-0.156 * **
		(0.00639)	(0.0347)
$Duration^3$			0.00443 * **
			(0.00109)
Observations	671	671	671
Number of recessions	74	74	74
Log pseudolikelihood	-209.566	-204.322	-197.758
Wald test	71.83 * **	78.45 * **	85.94 * **
AIC	423.133	414.643	403.516
SBIC	432.150	428.170	421.551
Panel B			
Duration	0.280 * **	0.769 * **	1.951 * **
	(0.0349)	(0.165)	(0.411)
$Duration^2$		-0.0261 * **	-0.163 * **
		(0.00936)	(0.0464)
$Duration^3$			0.00459 * **
			(0.00156)
EPU (t – 1)	-0.399 * **	-0.524 * **	-0.499 * **
	(0.152)	(0.177)	(0.165)
Other variables	Yes	Yes	Yes
Observations	395	395	395
Number of recessions	46	46	46
Log pseudolikelihood	-102.334	-96.780	-93.404
Wald test	89.18 * **	83.14 * **	76.91 * **
AIC	230.669	221.561	216.809
SBIC	282.395	277.265	276.492

Notes: The table examines how duration dependence contributes to the likelihood of economic recessions ending using a Cloglog model over the periods 1988Q4-2020Q3 (Panel A) and 1993Q2-2020Q3 (Panel B). Duration, $Duration^2$, and $Duration^3$ are the linear, quadratic, and cubic specifications of the duration of economic recessions, respectively. Results for control variables in Panel B are not reported here, but they are available upon request. Robust standard errors are in parentheses. One, two, and three asterisks indicate significant levels of 10%, 5%, and 1%, respectively.

Using a Weibull discrete-time duration model, Table 8 reports the effects of economic policy uncertainty on the duration of economic recessions. The shape parameter p is greater than one in all models, confirming the existence of positive duration dependence. That is, economic recessions are more likely to end when they grow older. More precisely, the value of p in Column (1) indicates that a 1% increase in the duration of an economic recession from its start increases the hazard of its ending by approximately 2.09%, ceteris paribus.[8]

Economic policy uncertainty enters negatively in all regressions with different lags quarters, indicating that economic recessions have a lower propensity to end when policy uncertainty is higher, which means that economic recessions will be longer. In particular, the coefficient of $EPU_{(t-1)}$ indicates that, holding other variables unchanged at their sample means, a one-standard-deviation increase in the policy uncertainty index above its sample mean is associated with a 26.73% decrease in the probability of an economic recession ending.[9] This, along with our findings presented so far, indicate that elevated economic policy uncertainty is associated with not only a higher probability of economic recessions but also a more prolonged recession. The decline in investment (Gulen and Ion, 2016; Wu and Suardi, 2021), aggregate demand (Bernanke, 1983; Bloom, 2014), and credit growth (Bordo et al., 2016; Wu and Suardi, 2021) can be the explanation for longer economic recessions during periods of high policy uncertainty.

The control variables provide some further results that are worth highlighting. Larger yield spread and higher industrial production growth contribute to shortening economic recessions. Conversely, higher levels of inflation and trade openness appear to lengthen the duration of economic recessions. Moreover, right-wing governments and majority governments are associated with shorter economic recessions. This result seems in line with Nguyen et al. (2021) who find that right-wing and majority governments help to shorten financial crises.

The shape parameter presented in Table 8 might not reveal the proper patterns of the duration dependence of economic recessions as it only allows for the probability of recessions ending to increase/decrease monotonically over time. We thus allow for more flexible duration dependence by using a non-monotonic baseline hazard function. As far as we are concerned, this study represents the first to explore the non-monotonic behaviour of duration dependence of economic recessions.

[8] The estimate is obtained from the equation $log\lambda_t = \alpha + (p-1)logt$. See Allison (2014) for further details of how the coefficient is interpreted.
[9] Coefficients reported in Table 8 are the log of hazard rates. 100(exp(b) – 1) corresponds to the percentage change in the hazard with a one unit increase in the explanatory variable, when all else is held constant (Allison, 2014).

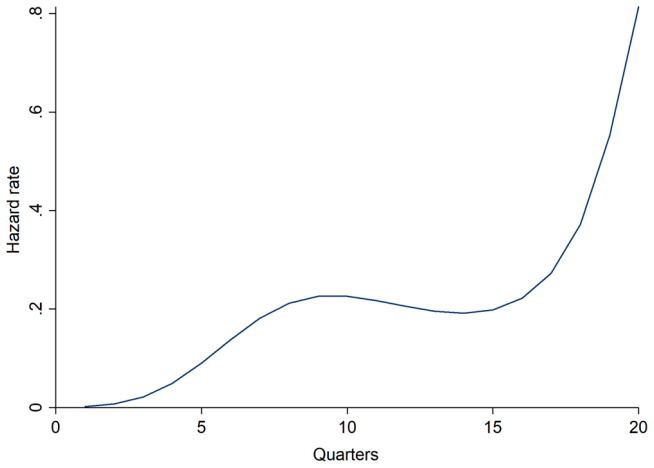

Fig. 2. Duration dependence shape of economic recessions.

In doing so, using a Cloglog model, we investigate the impact of linear, quadratic, and cubic specifications of the duration of economic recessions on the probability of economic recessions ending. The results are reported in Table 9. In panel A, we only consider the effects of duration dependence, and the coefficient in Column (3) clearly confirms a cubic behaviour of duration dependence. This is because the coefficients are statistically significant and their AIC and SBIC values are the smallest. The finding remains consistent when economic policy uncertainty and other controllers are added in Panel B.

To better illustrate the cubic pattern of the duration dependence, Fig. 2 shows the shape of the duration dependence of economic recessions over time. It is clear that the probability of economic recessions ending increases until their ninth quarters of duration, then it slightly decreases until fourteenth quarters before significantly increasing again. Digging deeper into our economic recession dataset, we find that most recessions that lasted more than nine quarters in EU countries are those relating to three main crisis events: the breakup of the Soviet Union in the early 1990 s, the 9/11 attack and Gulf War II in the early 2000 s, and fiscal austerity episodes in the aftermath of the Great Recession of 2007/08. For this reason, crisis-related recessions could be deeper and more prolonged than non-crisis recessions (Cerra et al., 2012; Nguyen et al., 2022), which means that their probability of ending is smaller. Nevertheless, the probability of recessions ending tends to increase sharply since the fourteenth quarter of duration. As suggested by Amengual and Xiu (2018), significant crisis resolutions and/or stimulus measures in the midst of hard times may help to rapidly bring crisis-related recessions to an end. An alternative explanation is that rising investment during prolonged recessions helps countries to escape from deep recessions faster. In fact, investment projects could not be delayed too long. This happens because cash flow loss could become too large when firms further delay their investment (Bloom, 2014; Gulen and Ion, 2016). In this regard, firms eventually invest despite the persistently high policy uncertainty, and this, in turn, contributes to a higher probability of a recession ending.

6. Conclusion

In this paper, we examine the impact of economic policy uncertainty on economic recessions in major EU countries. Our main finding is that economic policy uncertainty has a significant positive association with the probability of economic recessions and is useful to forecast economic recession within five quarters ahead. By using general elections as an alternative proxy of policy uncertainty and controlling for traditional proxies of general economic uncertainty such as yield spread, stock return, and industrial production growth, we confirm that our results are driven by policy-related uncertainty, but not other sources of general economic uncertainty. Our main findings also hold for several tests addressing endogeneity concerns. Furthermore, digging deeper into the duration of economic recessions, we find that economic policy uncertainty results in more prolonged economic recessions.

Overall, our results suggest that economic policy uncertainty not only increases the likelihood of economic recessions but also lengthen their duration. By identifying the roles of economic and political factors, the major policy implication of our results is that fiscal stimulus measures can cushion the impact of policy uncertainty on the probability of economic recessions. A majority government with adequate political support is also critical to implement necessary macro-prudential policies without facing policy gridlock. Moreover, left-wing governments' policy orientations such as pursuing large and permanent government interventions are useful to prevent an economic recession.

Given that our sample is limited to 10 major EU countries, this paper can be extended by accounting for countries in the OECD. Moreover, as policy uncertainty is found to be a driver of economic recessions, there might be concerns over the effects of policy uncertainty on the probability and duration of financial crises, which is unexplored in the existing literature. However, considering the limited scope of this study, we leave it for future research.

CRediT authorship contribution statement

Thanh Cong Nguyen: Conceptualization, Data curation, Formal analysis, Methodology, Writing – review & editing.

Data Availability

The data that support the findings of this study are available upon reasonable request.

Appendix

See Table A1–A3

Table A1
Economic recession episodes and duration (1988Q2–2021Q1).

Country	Begin	End	Duration	Country	Begin	End	Duration
Belgium	1990Q1	1993Q2	14	Ireland	2010Q4	2013Q2	11
Belgium	1994Q4	1996Q3	8	Ireland	2015Q2	2016Q2	5
Belgium	1997Q3	1998Q4	6	Ireland	2017Q4	2020Q2	11
Belgium	2000Q4	2003Q3	12	Italy	1989Q4	1993Q3	16
Belgium	2008Q1	2009Q2	6	Italy	1995Q4	1997Q1	6
Belgium	2011Q2	2014Q1	12	Italy	1997Q4	1991Q1	6
Belgium	2015Q2	2016Q2	5	Italy	2001Q1	2003Q3	11
Belgium	2019Q3	2020Q2	4	Italy	2008Q1	2009Q2	6
France	1990Q1	1993Q3	15	Italy	2011Q2	2013Q2	9
France	1995Q1	1997Q1	9	Italy	2017Q4	2020Q2	11
France	2000Q4	2003Q2	11	Netherland	1990Q3	1993Q4	14
France	2008Q1	2009Q2	6	Netherland	1994Q4	1996Q1	6
France	2011Q3	2013Q1	7	Netherland	2000Q4	2005Q1	18
France	2013Q4	2016Q3	12	Netherland	2008Q2	2009Q2	5
France	2019Q1	2020Q2	6	Netherland	2011Q2	2013Q2	9
Germany	1991Q1	1993Q3	11	Netherland	2015Q1	2015Q4	4
Germany	1994Q4	1996Q1	6	Netherland	2018Q1	2020Q2	10
Germany	1998Q1	1998Q4	4	Spain	1991Q3	1993Q2	8
Germany	2001Q2	2005Q1	16	Spain	1995Q2	1996Q4	7
Germany	2008Q1	2009Q2	6	Spain	2000Q4	2004Q2	15
Germany	2011Q3	2013Q1	7	Spain	2008Q1	2009Q3	7
Germany	2014Q1	2015Q2	6	Spain	2011Q1	2013Q3	11
Germany	2017Q4	2020Q3	12	Spain	2017Q3	2020Q2	12
Greece	1989Q4	1990Q3	4	Sweden	1990Q1	1993Q1	13
Greece	1991Q4	1993Q4	9	Sweden	1995Q3	1996Q4	6
Greece	1994Q4	1996Q1	6	Sweden	2000Q3	2003Q2	12
Greece	1998Q1	2000Q1	9	Sweden	2007Q4	2009Q3	8
Greece	2000Q4	2002Q1	6	Sweden	2011Q2	2013Q3	10
Greece	2004Q1	2005Q2	6	Sweden	2015Q3	2020Q2	20
Greece	2009Q3	2012Q2	12	United Kingdom	1988Q4	1992Q2	15
Greece	2015Q1	2016Q2	6	United Kingdom	1994Q3	1996Q2	8
Greece	2019Q2	2020Q2	5	United Kingdom	1998Q1	1999Q2	6
Ireland	1990Q3	1994Q1	15	United Kingdom	2001Q2	2002Q3	6
Ireland	1995Q4	1996Q4	5	United Kingdom	2003Q4	2004Q4	5
Ireland	2000Q3	2001Q4	6	United Kingdom	2008Q1	2009Q2	6
Ireland	2002Q3	2004Q3	9	United Kingdom	2010Q4	2013Q1	10
Ireland	2007Q4	2009Q4	9	United Kingdom	2015Q3	2020Q2	20

Table A2
Summary statistics of main variables.

Variable	Obs	Mean	Std. Dev.	Min	Max
Economic recession	1370	0.50	0.50	0	1
Economic policy uncertainty	1032	124.15	72.23	20.04	659.82
Yield Spread	1297	-1.29	2.35	-24.70	13.83
Industrial production	1252	1.75	6.25	-26.01	46.63
Stock return	1356	1.65	9.78	-38.85	82.43
Inflation	955	0.43	5.39	-45.37	21.69
Current account balance	1116	85.85	45.66	35.52	270.65
Trade openness	1325	2.50	2.69	-6.13	23.36
Right-wing government	1304	0.52	0.50	0	1
Centre government	1304	0.10	0.31	0	1
Majority government	1356	0.78	0.41	0	1
Financial uncertainty	1360	0.89	0.18	0.63	1.49
Macroeconomic uncertainty	1360	0.64	0.10	0.53	1.18

Table A3
Correlations between variables.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Economic recession	(1)	1											
Economic policy uncertainty	(2)	0.22	1										
Yield spread	(3)	-0.01	-0.02	1									
Industrial production	(4)	-0.24	-0.14	0.07	1								
Stock return	(5)	-0.27	-0.15	0.01	0.12	1							
Current account balance	(6)	0.02	-0.09	0.16	0.14	0.10	1						
Trade openness	(7)	0.07	-0.04	-0.01	0.21	0.01	0.22	1					
Inflation	(8)	0.15	-0.11	0.19	0.07	-0.19	-0.25	-0.11	1				
Right-wing government	(9)	-0.05	0.11	-0.01	0.02	0.04	0.16	0.19	-0.02	1			
Centre government	(10)	0.03	0.01	0.00	0.02	-0.01	-0.11	0.18	0.10	-0.24	1		
Majority government	(11)	-0.10	-0.08	-0.15	-0.01	-0.04	-0.06	-0.07	0.07	0.17	-0.08	1	

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