MEASURING ECONOMIC AND ECONOMIC POLICY UNCERTAINTY, AND THEIR MACROECONOMIC EFFECTS: THE CASE OF SPAIN

2019

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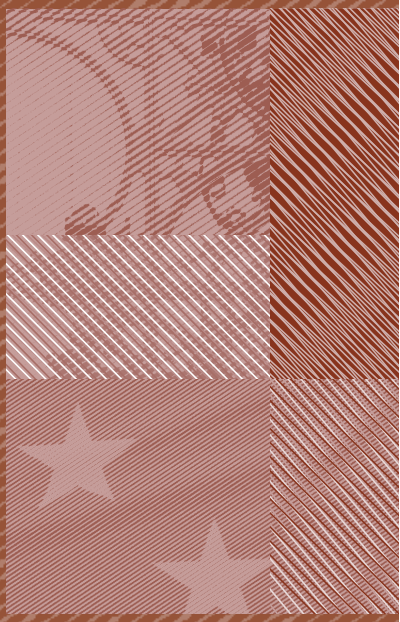

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Abstract

We provide additional evidence on the relationship between uncertainty and economic activity. For this purpose, we gather and construct a wide range of proxy indicators of economic and economic policy uncertainty from Spain. We distinguish between the relative merits of different types of measures based on: (i) the volatility of financial markets; (ii) economic analysts' disagreement; (iii) economic policy uncertainty. We show that the first and the third block of measures are the most relevant to grasp the negative effects of unexpected changes in uncertainty on aggregate economic developments, as measured by real GDP. In addition, we find that economic policy uncertainty and financial uncertainty shocks produce visible negative effects on private consumption. The negative responses on capital goods investments are initially bigger in magnitude but vanish more quickly.

Keywords: economic uncertainty, economic policy uncertainty, impact of uncertainty shocks.

JEL classification: D8, C43, E2, E3.

Resumen

En este documento proporcionamos nueva evidencia acerca del impacto de la incertidumbre sobre la actividad económica. Para ello construimos, utilizamos y desarrollamos un conjunto amplio de indicadores sobre la incertidumbre económica y sobre las políticas económicas, para el caso de la economía española. Las medidas se agrupan en tres bloques: i) volatilidad de los mercados financieros; ii) desacuerdo entre los agentes económicos, y iii) incertidumbre sobre las políticas económicas. Los aumentos inesperados de la incertidumbre (perturbaciones asociadas a los indicadores) afectan negativamente al crecimiento económico, medido por el crecimiento del PIB real, en particular las de los bloques i) y iii). Además, en este trabajo se muestra que las perturbaciones en las medidas de incertidumbre sobre las políticas económica y financiera producen efectos negativos significativos en el consumo privado. Finalmente, la respuesta de la inversión en equipo es más pronunciada en el corto plazo, pero presenta un efecto menos persistente.

Palabras clave: incertidumbre económica, incertidumbre sobre la política económica, *shocks* de incertidumbre.

Códigos JEL: D8, C43, E2, E3.

1 Introduction

Since the end of the financial crisis, a number of geopolitical events have brought to the forefront of the policy discussion the risks that heightened economic uncertainty may pose for global economic prospects. Most recent events include the unexpected results of the UK referendum on the EU (the so-called *Brexit*) and the hurdle around subsequent UK-EU negotiations, the political situation in Italy since the Constitutional referendum of 2016, or the vagaries around the recent trade protectionist measures and trends. In the case of Europe, some specific factors have shed additional doubts on the strengths of the EU project, including policy responses to the refugee crisis, political threats to the euro project, or the willingness and ability of peripheral countries to implement structural reforms and commit credibly to their fiscal consolidation plans. In addition, uncertainty has been frequently quoted as a fundamental reason for the weak global recovery from the financial crisis (see Moore (2017), and the references quoted therein).

By now, it is well established in the theoretical and empirical literature that heightened economic uncertainty has the potential to harm economic activity (see, among others, Guiso and Parigi, 1999; Bloom, 2009; Mumtaz and Zanetti, 2013; Christiano et al., 2014; Bloom, 2014). The latter may occur through various channels, particularly through effects on household consumption and saving decisions (precautionary savings), or on firms' investment and hiring decisions.

Different measures have been used to assess the effects of economic uncertainty in a number of economies, including the US (see, e.g. Bloom, 2009; Caggiano et al., 2017; Charles et al., 2018), the UK (Denis and Kannan, 2013; Haddow et al., 2013), Germany (Bachmann et al., 2013), Australia (Moore, 2017), Turkey (Arslan et al., 2015), Spain (Posada et al., 2014; Gil et al., 2017; Basile and Girardi, 2017), or Ireland (Zalla, 2017), among others.[1] They show that uncertainty shocks hamper real GDP. Finally, Meinen and Roehe (2017) study the impact of uncertainty on investment dynamics for the four largest euro-area countries (Germany, France, Italy and Spain) using five different uncertainty indexes available in the literature: i.e. a measure of implied stock market volatility (Bloom, 2009), a survey-based

[1] See also Castelnuovo et al. (2017) for a short review of the most recent literature.

measure of expectations dispersion (Bachmann et al., 2013), the text-based Economic Policy Uncertainty (EPU) index (Baker et al., 2016), and two indicators of uncertainty based on the unpredictable components of several macroeconomic series (Jurado et al., 2015; Rossi and Sekhposyan, 2015).

Against this framework, we propose a number of measures of macroeconomic uncertainty for Spain, based on the following procedure. First, we select a number of single uncertainty indexes that pertain to different domains, i.e. indicators related to the financial markets, indicators capturing the degree of disagreement based on agents' expectations, and indicators about economic policy uncertainty. Second, we build synthetic indicators that combine information from all these indicators by means of a principal component analysis (PCA). That is, we do not take any *a priori* position on the relative relevance of the specific uncertainty indexes to represent aggregate uncertainty, but rather exploit all of them at once. This allows a picture which is more complete and subject to lower volatility of the uncertainty in the Spanish economy than that which can be provided by single indicators taken one by one. This empiricist approach is in line with the methodology used in Jurado et al. (2015) and Rossi and Sekhposyan (2015), which proxy uncertainty with errors from forecasting several macroeconomic variables, or of Charles et al. (2018), which construct a synthetic index of uncertainty for the US based on dynamic factor models.

Our contribution to the literature is twofold. First, we construct three synthetic indicators of macroeconomic uncertainty for Spain, each one related to a specific domain: one indicator of uncertainty related to financial markets, an indicator capturing the degree of disagreement between agents about future economic prospects, and one indicator of economic policy uncertainty. For each of these indicators we extract information from different sets of individual uncertainty indicators. Some of them are borrowed from the literature, while the others are constructed by us. We document that our synthetic indicators react differently to relevant events commonly related to uncertainty, depending on the nature of the information they rely on. This is reasonable and reminds that a meaningful interpretation of results based on uncertainty measures hinges upon a good understanding of the type of information fed into the index in the first place.

The second contribution of the paper is that we estimate the effects of unexpected increases in the different sources of uncertainty on economic activity, by means of structural vector autoregressive (SVAR) analysis, using as sample of reference the period 1997Q1-2018Q2. We find that unanticipated positive shocks in financial uncertainty and in economic policy uncertainty cause a significant and quite persistent drop in real GDP and private consumption. The negative responses of capital goods investments are initially bigger in magnitude but vanish more quickly.

The literature for the Spanish case is quite scarce - see Basile and Girardi (2017) and the references quoted therein. Our results are in line with those obtained with similar exercises, even though our scope is significantly broader, most notably as regards the measures of uncertainty used in the different analyses.

The rest of the paper is organized as follows. In Section 2 we describe the data sources and methodology to construct the individual indicators of uncertainty. Section 3 presents our synthetic measures of uncertainty, and provide some stylized facts based on the latter. In Section 4 we turn to set up and estimate an empirical SVAR model to capture the impact of unexpected increases of economic uncertainty on the economy. Finally, in Section 5 we provide the main conclusions of the paper.

2 Measuring uncertainty

We construct our three synthetic measures of macroeconomic uncertainty combining information from three domain-specific sets of individual indexes of uncertainty by means of PCA. Note that the uncertainty measures used in this article refer to a broad definition of uncertainty, defined as the lack of complete information about the future trajectory of economic activity and future economic policy stances, as it is standard in the economic literature on uncertainty. This encompasses both concepts of *risk* and *Knightian uncertainty*.[2]

[2]The latter refers to a situation in which the future outcome of an event is unknown, and in addition one cannot extract from past experience information in order to set up a probability distribution function that assigns probabilities to future potential states of the world. Hence, one cannot compute the odds of an event. By contrast, risk refers to a situation in which it is possible to construct a probability distribution function that assigns probabilities to potential outcomes. That is, the future outcome of an event is unknown but the odds of this event can be computed based on current information.

Table 1: Single indicators of uncertainty

	Starts in:	Mean		Persistence‡		Kurtosis	Skewness
		All§	Rec./Exp.†	All	Rec./Exp.		
I Indicators of uncertainty in financial markets							
IBEX-35 volatility	Mar-97	23.70	(29.2 - 20.4)	0.86	(0.90-0.85)	3.68	0.82
IBEX-35 volatility index	Dec-99	101.58	(119.5 - 90.8)	0.82	(0.86-0.82)	2.68	0.25
Exchange rate \$/€ volatility index	Dec-99	89.64	(119.5 - 77.7)	0.83	(0.87-0.84)	3.99	0.09
Brent price volatility index	Dec-99	81.89	(74.9 - 86.1)	0.86	(0.78-0.80)	3.23	-0.08
10 year bond Spanish government volatility index	Dec-99	99.09	(162 - 61.3)	0.90	(0.86-0.85)	3.18	0.34
II Indicators of economic disagreement							
Disagreement on GDP forecasts *	Jan-99	0.05	(0.10 - 0.02)	0.78	(0.78-0.74)	13.72	3.15
Disagreement on private consumption forecasts *	Jan-99	0.16	(0.28 - 0.09)	0.86	(0.91-0.83)	13.18	3.04
Disagreement on equipment investment forecasts *	Jan-99	3.61	(6.42 - 1.92)	0.93	(0.96-0.87)	10.85	2.84
Uncertainty about unemployment expectations *	Jun-86	0.45	(0.46 - 0.44)	0.92	(0.83-0.81)	1.97	0.28
Uncertainty about industry order-book levels *	Jan-93	0.57	(0.59 - 0.56)	0.58	(0.61-0.55)	2.97	-0.18
Uncertainty about industry production expectations *	Jan-93	0.53	(0.55 - 0.52)	0.38	(0.25-0.35)	3.04	-0.11
III Indicators of economic policy uncertainty							
Current political situation indicator	Jan-96	28.36	(29.3 - 29.8)	0.98	(0.92-0.91)	1.55	-0.24
Political expectations indicator	Jan-96	44.78	(43.1 - 45.8)	0.88	(0.74-0.81)	2.97	0.31
Political risk indicator	Jan-84	73.40	(72.0 - 74.3)	0.99	(0.97-0.96)	1.80	-0.23
Economic policy uncertainty indicator * †-†	Jan-97	118.78	(133.5 - 109.9)	0.87	(0.71-0.75)	4.37	0.93
Disagreement on public deficit forecasts *	Jan-99	0.24	(0.43 - 0.13)	0.89	(0.90-0.88)	15.00	3.25
Disagreement on public consumption forecasts*	Jan-99	0.69	(1.30 - 0.33)	0.71	(0.80-0.75)	63.97	7.19

Notes: Sources: Bloomberg, IESE, FUNCAS, European Commission, CIS barometer, PRS Goup, and own elaboration.
*: Indicators marked with an asterisk are based on our own elaboration.
†-†: based on Ghirelli et al. (2018).
§: Column *All* provides the corresponding statistic of each indicator considering the entire period.
†: Column *Rec./Exp.* provides the corresponding statistic distinguishing between recessions and expansions. Recessionary periods are defined based on the expansions and recessions chronology proposed by the Business Cycle Dating Committee of the Spanish Economic Association.
‡: Persistence is measured by the auto-correlation coefficient of an AR(1) model.

This Section outlines the single uncertainty indexes we select to build our synthetic uncertainty indicators (Section 2.1), and then presents a descriptive analysis of the single uncertainty indexes (section 2.2).

2.1 Single indicators of uncertainty

The single uncertainty indexes we select to build our synthetic uncertainty indicators are grouped into three categories as shown in Table 1: (a) indicators based on financial market data (group I); (b) indicators based on the degree of disagreement between economic agents regarding the economic outlook (group II); and (c) indicators of uncertainty about economic policy and about the political situation of the country (group III).

The financial measures (group I) have the advantage of being readily available in real time and directly comparable across countries. As for the indicators of disagreement between economic agents in group II, they rely on the hypothesis that an increase in uncertainty would,

under certain conditions, broaden the range of possible future results, which in turn widens the dispersion of agents' expectations. Based on this idea, we compute the degree of disagreement between economic experts, which is based on the dispersion of expectations between the analysts contributing to FUNCAS forecast panels.[3] In addition we calculate similar measures of disagreement between consumers and firms. These are based on the opinion-based surveys carried out monthly by the Joint Harmonised EU Programme of Business and Consumer Surveys of the European Commission.[4]

Finally, the measures in group III refer to political expectations and opinions, the "political risk" (which is a weighted index of a number of factors such as government stability, socio-economic conditions, and the quality of institutions) and variables proxying the degree of economic policy uncertainty. In particular, we consider three indicators to proxy economic policy uncertainty. First, we compute a new and improved version of the well-known economic policy uncertainty (EPU) index by Baker et al. (2016) for Spain.[5] This index is based on monthly searches in the press and represents the volume of newspapers' articles that simultaneously contain words related with the notion of "uncertainty", "economy", and "policy". Second, we construct two indicators of disagreement, both based on a set of economic experts' forecasts responding to the FUNCAS forecast panels: one related to the disagreement about budget deficit forecasts and another on the disagreement over government consumption forecasts.[6] The rest of the section briefly outlines the single uncertainty indicators and how they are constructed.

[3] FUNCAS is a private sector institute that has been compiling forecasters' views of the Spanish economy since 1999. For more information on the panel see `https://www.funcas.es/Indicadores/Index.aspx`. In the Spanish case, the use of this panel of experts instead of the one elaborated by *Consensus Economics* is warranted, given the longer sample size available, the fact that it covers more variables of interest and also that it is publicly available.

[4] Note that we focus on measures that proxy disagreement about the economic outlook, as it is standard in the literature. In equilibrium, these measures might capture not only uncertainty about real economic developments, but also uncertainty about the evolution of prices. Alternatively, one could also add indicators that measure directly the nominal side of the economy.

[5] For details about the new EPU index for Spain and its comparison with the original one, see Ghirelli et al. (2018).

[6] Fernández-Villaverde et al. (2015) develop an alternative measure of uncertainty related to fiscal policy and study how it affects the business cycle. On the ability of economic agents to learn how to anticipate future fiscal policy stances based on government policy announcements, see Paredes et al. (2015).

2.1.1 Group I: Financial markets

Volatility of the Spanish Stock Market (IBEX-35): it is the monthly average of the daily volatility of IBEX35 as reported by Bloomberg.

Components of the the IESE Index on Economic Uncertainty (I3E): i.e. the IBEX-35 volatility index, the \$/€ exchange-rate volatility index, the oil Brent price quoted in dollars volatility index, and the 10 years Spanish government bond volatility index. All these indexes are constructed every month by the International Center for Decision Making (ICDM) of the IESE Business School. These measures are used by the ICDM to construct the IESE Index on Economic Uncertainty (I3E).[7]

2.1.2 Group II: Economic Disagreement

Disagreement measures based on experts' forecasts: we take as starting point the month t cross-section of current and one-year-ahead forecasts about a number of national accounts' aggregates (e.g. GDP, private consumption and capital goods investment) produced by analysts contributing to the FUNCAS panel.[8] At each point in time, the measure of disagreement is computed as the standard deviation of such cross-section of n forecasters from the mean ("consensus") forecast $\hat{C}_A$, $\frac{1}{n}\sum_{i=1} n\left(\hat{C}_i - \hat{C}_A\right)^2$. Given that each analyst i provides growth rates of two fixed-event (fe) forecasts m months ahead (for the current and next years), it is necessary to correct each time-t value by the fact that it is computed on an evolving information set. Thus, in line with the literature, we compute fixed-horizon (fh) (e.g., one-year-ahead) forecasts. fh forecasts are preferable to fe for the analysis of disagreement because the forecasting horizon of fixed-event forecasts varies from month to month and consequently their uncertainty and cross-sectional dispersion is strongly seasonal. For the calculation of fh forecasts we follow the methodology of **?**, as follows:

$$F^{fh}_{y_0,m,12}(x) = \frac{12-m+1}{12} F^{fe}_{y_0,m,y_0}(x) + \frac{m-1}{12} F^{fe}_{y_0,m,y_{0+1}}(x)$$

[7] The I3E indicator reflects the variation in the daily growth rate of these underlying components. It is published monthly on the second Tuesday of the month, or on the first available working day if this Tuesday is a holiday (see `https://blog.iese.edu/icdm/que-es-el-i3e/`).

[8] See Footnote 3.

To give an example, the forecast of the growth rate of variable x (i.e. GDP, private consumption or capital goods investment) between May ($m = 5$) 2017 and May 2018 is given by the weighted average of the (current) May 2017 forecast $F^{fe}_{y_0,m,y_0}(x)$ and of the (year-ahead) May 2018 forecast $F^{fe}_{y_0,m,y_{0+1}}(x)$ provided by the panelists, weighted by 8/12 y 4/12, respectively.

Uncertainty measures based on opinion-based surveys: These indexes are based on the Joint Harmonised EU Programme of Business and Consumer Surveys of the European Commission. We compute three measures: a proxy of uncertainty about unemployment expectations in the next 12 months; a proxy of uncertainty about industry order-book levels; a proxy of uncertainty about the expectations of industry production. The former is based on answers to the following question from the consumer survey module: *QUESTION: How do you expect the number of people unemployed in this country will change over the next 12 months? ANSWER: The number will: increase sharply; increase slightly; remain the same; fall slightly; fall sharply; don't Know.* The other two uncertainty indicators are based on the industry survey module and rely on the answers to the following two questions. *QUESTION: Excluding seasonal variations, you expect that in volume terms your total order book for the next three months will: ANSWERS: increase; remain the same; fall. QUESTION: Excluding seasonal variations, you expect that in volume terms your total production for the next three months will: ANSWERS: increase; remain the same; fall.*

To construct these uncertainty measures we follow the approach of Bachmann et al. (2013) that exploit the information contained in the dispersion of responses. Specifically, respondents to the above-mentioned questions can be grouped in three answers: "decrease", "unchanged" or "increase". Let $Frac_t^+$ denote the weighted fraction of agents (consumers or firms) in the cross-section with "increase" responses at time t, and $Frac_t^-$ the weighted fraction of agents with "decrease" responses. Then the "uncertainty indicator" is computed as:

$$\sqrt{Frac_t^+ + Frac_t^- - \left(Frac_t^+ - Frac_t^-\right)^2}$$

This boils down to computing the standard deviation of answers in the cross-section, with weights equal to $+1$, 0, -1 assigned to "increase", "unchanged", and "decrease" answers, respectively.

2.1.3 Group III: economic policy uncertainty

Individuals' opinions about the current and future political situation: both indexes are computed by the Spanish Center for Research on Sociology (CIS) based on their monthly survey data.[9] In particular, they rely on individuals' answers to two questions, asking to assess the quality of the current political situation (from very good to very bad) and whether the political situation is expected to be worse, the same, or better in the next future.

Indicator of political risk: this indicator is constructed by the PRS Group based on the International Country Risk Guide methodology.[10] Specifically, the index is computed as a weighted average of the following variables: government stability, socio-economic conditions, investment profile, internal conflicts, external conflicts, corruption, military in politics, religious tensions, law and order, ethnic tensions, democratic accountability, and bureaucracy quality.

New EPU index: we use the new and improved version of the EPU index proposed by Baker et al. (2016),[11] as computed by Ghirelli et al. (2018). Recall, the EPU index is based on searches for keywords in the press and aims to proxy economic policy-related uncertainty with the volume of newspapers' articles that contain at the same time words that are related to the notion of "uncertainty", "economy", and "policy". While methodologically Ghirelli et al. (2018) follow closely the procedure used by Baker et al. (2016), they improve the EPU index for Spain in two ways. First, they broaden the press and time coverage. Second, they refine the keywords used for the text-based search. Both adjustments improve the index substantially.

Disagreement about public deficit forecasts: we compute this indicator based on FUNCAS panel forecasts on fiscal policy following the procedure explained to construct the

[9] The CIS survey targets each month representative samples of the Spanish society. Both indexes are calculated as weighted averages of the shares of responses.

[10] For details on the methodology see `http://www.prsgroup.com/wp-content/uploads/2012/11/icrgmethodology.pdf`.

[11] Which is available for Spain at `http://www.policyuncertainty.com/europe_monthly.html`. See also Davis (2016).

disagreement indicators in group II of Table 1. Note, since public deficit is endogenous to the economic cycle, we isolate fiscal policy-related uncertainty by controlling the disagreement about GDP forecasts. To do this, we regress the indicator of disagreement about fiscal policy on the indicator of disagreement about GDP and take the residual as a genuine measure of uncertainty about fiscal policy stances.

Disagreement about government consumption: this indicator relies on FUNCAS panel forecasts on public consumption. It is based on the procedure explained to construct the disagreement indicators in group II of Table 1.

2.2 Descriptive statistics of single uncertainty indicators

Table 1 presents some descriptive statistics of the single uncertainty indicators considered. These indexes are highly persistent, with coefficients above 0.7 in most of the cases. This suggests that periods of high/low uncertainty tend to persist over time. In addition, the distributions of these indicators show excess kurtosis (higher kurtosis values compared to the kurtosis of a normal distribution, which is equal to 3), which implies that extreme events or outliers explain an important part of the variance of the distribution (i.e. extreme values of uncertainty are more likely to occur than in a normal distribution). Finally, most of the indicators are positively skewed (i.e. the right tail of the distribution is fatter than the left one), which indicates a higher probability of extreme positive events.

Note that, in the current globalized setting in which economies are strongly integrated owing to trade flows and movements of people and capital, domestic agents' decisions are influenced by domestic and cross-border factors alike. This is particularly so in the euro area countries, because many economic policies (in particular monetary policy) are common to various countries. For this reason, the single uncertainty measures presented in Table 1 do not only capture genuinely domestic uncertainty, but also changes in uncertainty in other European countries or factors of a global nature. Since this feature is inherent to the macroeconomic uncertainty we aim to measure, we are going to take this as given when building our synthetic indicators. However, in Section 4, when studying the impact of Spanish macroeconomic uncertainty on economic activity, we will additionally control for a number of measures of European macroeconomic uncertainty, in order to disentangle the impacts of global factors from those of domestic ones.

3 Synthetic indicators of uncertainty and stylized facts

This section describes our synthetic indicators. We construct them by means of a Principal Component Analysis (PCA), which allows us to combine information from different specific uncertainty indicators. The PCA is a dimension-reduction statistical method that allows to convert a large bunch of variables to a smaller set, which still contains most of the information contained in the former one, thereby minimizing the information loss. From the original set of (possibly correlated) variables, this approach extracts a new set of linearly uncorrelated variables (called principal components). These components are ordered by the share of explained variance, so that the first component accounts for most of the variance in the data. To calculate the principal components, we use the recursive method of Stock and Watson (2002), which allows to exploit the data from January 1997 onwards.[12] We obtain three domain-specific synthetic indicators for the period 1997:Q1-2018:Q2, respectively related to financial markets, the degree of economic disagreement between agents' expectations, and economic policy uncertainty. Our synthetic measures of uncertainty are the first principal component extracted from the PCA, each one based on the corresponding group of single uncertainty measures outlined in Table 1. These resulting measures are shown in Figure 1. In addition, this Figure allows to inspect whether each of the aforementioned synthetic indicators of uncertainty show significant changes at the time of events which, *a priori*, are typically associated with changes in uncertainty, such as the terrorist attacks of 11^{th} September 2001 in the US, the Lehman Brothers bankruptcy in September 2008, or the request for bail-out by Greece in April 2010.[13]

A number of facts stand out. First, both the financial uncertainty indicator and the economic disagreement one (Figure 1a and 1b, respectively) show important spikes during the Spanish Great recession, encompassing both the financial crisis of 2008-2009 and the sovereign debt crisis 2010-2012, which culminated with the financial aid request from Spain

[12] We start from January 1997 since most of our individual indicators are available at this date (in particular, the IBEX-35 volatility and the new EPU index are available from 1997 onwards).

[13] Additional details on the PCA approach, like factor loadings, are available from the authors upon request.

in June 2012. In addition, the financial uncertainty indicator reacts importantly to global and external events, such as Brexit in June 2016 (point L in Figure 1a) or the Dot-com recession in the early 2000s, as opposed to local crisis, such as the Catalan one in October 2017 (point M Figure 1a). In turn, the economic disagreement indicator does not react neither to global/external factors nor to local political events, while it mostly captures the Spanish Great Recession. This is understandable, since this indicator is intrinsically linked to recessionary periods in which it is harder to reach a consensus on future economic prospects. By contrast, the economic policy uncertainty indicator behave quite differently from the previous two, as expected. For instance, instead of jumping up at the time of the Lehman Brothers collapse, it increases gradually throughout the Great recession, reaching the highest level at the time in which Spain asked for the bank rescue package in June 2012. Afterward, it decreases with a similar gradual pace. In addition, the economic policy uncertainty indicator captures political events which may lead to an increase in economic policy uncertainty (e.g. the Catalan crisis: point M in Figure 1c). For instance, it raises at the time of the request for the Greek bail-out in April 2010 (point H in Figure 1c) and persists at a high level afterward, possibly reflecting the deadlock situation that occurred before the EU interventions were defined. Another example may refer to periods preceding national elections, which coincide with the electoral campaigns. The latter can increase economic policy uncertainty depending on whether the electorate believes that the announced political stands will be followed coherently after the election's results.[14]

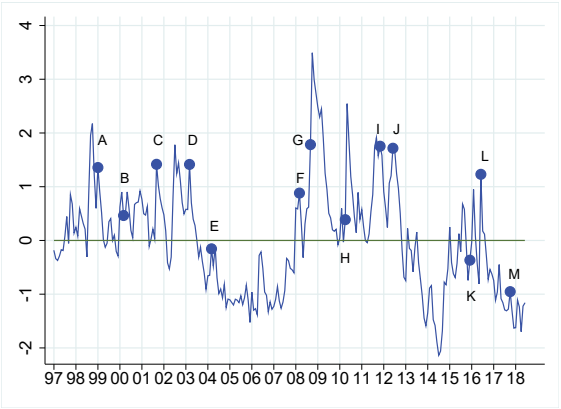
Table 2 shows descriptive statistics of our synthetic indicators of uncertainty. As expected, all indicators are counter-cyclical, i.e. they are higher in downturns than in upturns, in line with the findings reported for other countries.[15] In addition, these measures are highly persistent, in a manner that does not seem to vary along the business cycle.

[14]Note, economic policy uncertainty does not necessarily have to increase during each electoral campaign. This depends on citizens' expectations about future policies.

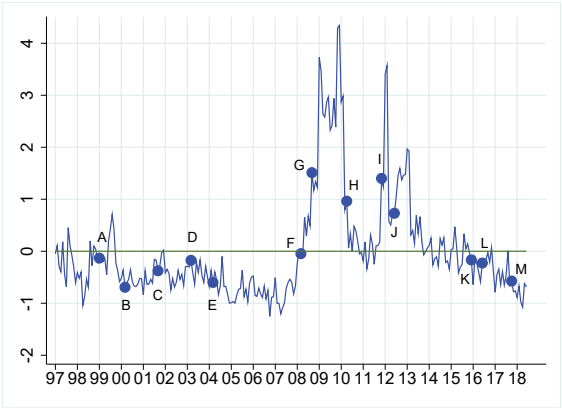
[15]E.g. see the discussion in Bloom (2014) for the US, Moore (2017) for Australia, and references therein.

Figure 1: Synthetic indicators of uncertainty and relevant events

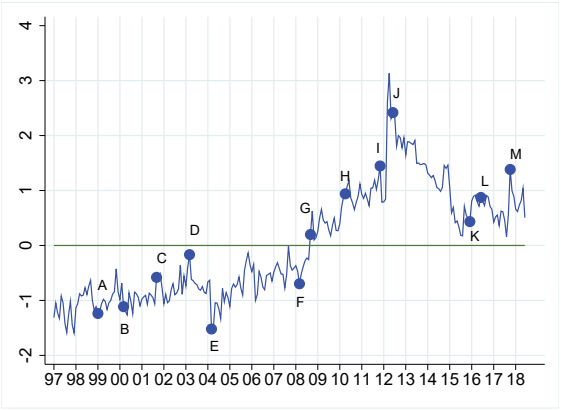
(a) Financial uncertainty



(b) Economic disagreemnt



(c) Political uncertainty



Prominent Events	
A. Jan-99	EMU constitution
B. Mar-00	General elections in Spain (ES)
C. Sep-01	Terrorist attacks (11/09)
D. Mar-03	Invasion of Iraq
E. Mar-04	Terrorist attacks & general elections in ES
F. Mar-08	Bear Sterns collapse & general elections in ES
G. Sep-08	Lehman Brothers collapse
H. Apr-10	Financial assistance for Greece
I. Nov-11	General elections in ES
J. Jun-12	Financial aid request from ES
K. Dec-15	General elections in ES
L. Jun-16	Brexit & general elections in ES
M. Oct-17	Catalan crisis

Table 2: Synthetic indicators of uncertainty

	Mean		Persistence‡		Kurtosis	Skewness
	All§	Rec./Exp.†	All	Rec./Exp.		
Financial uncertainty	-0.04	(1.37 / -0.89)	0.88	(0.91-0.89)	3.21	0.51
Economic disagreement	0.58	(2.15 / -0.37)	0.89	(0.93-0.90)	7.81	2.14
Political uncertainty	1.16	(1.77 / 0.79)	0.96	(0.95-0.96)	2.32	0.52

Notes: Sources: Own elaboration. Each synthetic indicator is the first component resulting from the PCA based on the corresponding group of single indicators of uncertainty showed in Table 1.

§: Column *All* provides the corresponding statistic of each indicator considering the entire period.

†: Column *Rec./Exp.* provides the corresponding statistic distinguishing between recessions and expansions. Recessionary periods are defined based on the time-line proposed by the Committee of experts of the Economic Spanish Association.

‡: Persistence is measured by the auto-correlation coefficient of an AR(1) model.

Table 3: Granger causality tests

	Direction of causality	Financial uncertainty	Economic disagreement	Policy uncertainty
GDP (2 lags)	→	0.7846	0.1826	0.4884
	←	0.0142 **	4.00E-05 ***	0.0197 **
GDP (4 lags)	→	0.2827	0.4257	0.3166
	←	0.0707 *	1.00E-05 ***	3.00E-03 ***
UR (2 lags)	→	0.3643	0.9149	0.0517 *
	←	0.2133	1.00E-05 ***	0.1592
UR (4 lags)	→	0.4314	0.9569	0.1599
	←	0.1092	3.00E-05 ***	0.1067

Notes: P-value reported. *** Significant at 1%; ** Significant at 5%; * significant at 10%. Quarterly data used. UR stays for unemployment rate, while GDP refers to the GDP growth rate. In the lines in which the direction of causality is →, the null hypothesis is that the corresponding macroeconomic variable (GDP or UR) does not Granger-causes the corresponding uncertainty indicator. When the direction of causality is ←, it is the other way around. In this exercise all uncertainty measures represent genuine Spanish-related uncertainty, accounting for global/external uncertainty. This is obtained by removing from each uncertainty measure the effect of global/external uncertainty, which is estimated from a regression of the former on the EPU for the EU and a constant.

4 The impact of uncertainty shocks on the economy

This section presents an analysis on the impact of increased macroeconomic uncertainty on the Spanish economic activity as measured by GDP, private consumption and investment. We investigate the relative role of each of the synthetic uncertainty indicator we build in this paper. We estimate the impact of an unexpected increase in uncertainty on the Spanish economy by means of a structural vector autoregressive (SVAR) models, in which we include as endogenous variables our three synthetic uncertainty indicators (the synthetic financial uncertainty indicator, the synthetic indicator of uncertainty based on economic disagreement, and the economic policy uncertainty indicator) together with one macroeconomic variable of interest among the GDP, private consumption and investment in capital goods (one at the time). In addition, we include the Spanish sovereign debt spread over the German

Bund, and a price index,[16] to control for possible effects of financial and nominal variables on the uncertainty indicators. VAR models allow to control for the possible endogeneity of the uncertainty indicators by further including lags of the variable of interest (alternatively, GDP, private consumption or capital goods investment).

The aim of the exercise is to study impulse response functions to simulate the impact of an unexpected shock in uncertainty on the macroeconomic variable of interest, under the assumption that all other shocks are held constant. To do that we need to impose some restrictions on the contemporaneous relations between the endogenous variables. We use the Cholesky decomposition, following the same order we used to present the variables of the model. This assumption is common to the literature and relies on the idea that the impact of financial uncertainty affects contemporaneously unexpected economic policy decisions as well as the overall economy. Finally, we further include as exogenous variables the Eurostoxx-50 volatility, the EPU index for the EU as computed by Baker et al. (2016), and a synthetic indicator of economic disagreement at the EU level, which is calculated using the same procedure described in this paper to construct the economic disagreement indicators for Spain.[17] This way we account for sources of uncertainty that are common to the EU area and/or external to Spain, and hence better isolate the effects of domestic idiosyncratic shocks. The VAR models are estimated by OLS. In each model we include lags according to the optimal lag length based on the Schwarz Information Criterion.[18]

Before moving to the main empirical exercise of this section, in Table 3 we test the direction of causality between uncertainty and the business cycle, based on Granger tests, given potential concerns with the endogeneity of our uncertainty measures. As business cycle proxies we use alternatively the GDP growth rate and the unemployment rate. A number of results are worth noticing. As for the financial uncertainty and the economic policy uncertainty indicators, the tests are significant only when considering economic activity as opposed to the labour market. In addition, the direction of causality goes from uncertainty

[16] We use the seasonally adjusted Consumer Price Index (CPI) excluding unprocessed food and energy, regulated prices and VAT.

[17] Own calculation, based on opinion-based surveys of the European Commission for the EU as a whole. The index is a combination of uncertainty about expectations of unemployment, industry order-book levels, and industry production at the EU level.

[18] The results are robust, in qualitative terms, to the exclusion of the exogenous variables.

to economic activity. This is reasonable, as one expects that an exogenous shock in financial market or in economic policy uncertainty propagates into the real economy, and not the other way around.[19] Similarly, the economic disagreement indicator Granger-causes both the GDP and the unemployment rate. All in all, this descriptive evidence tends to suggest that, based on our synthetic uncertainty measures, it is uncertainty that affects the business cycle and not the other way around. This reduces the endogeneity concerns when estimating the macroeconomic effects of uncertainty shocks, which is the focus of the next Section.

Results of the impulse response exercises are shown in Figures 2, 3 and 4. Figure 2a reports the GDP responses to unexpected one-unit standard deviation increases in the three aforementioned synthetic measures of uncertainty, explicitly controlling for the indicators of external uncertainty. The uncertainty shocks lead to a decrease in GDP, and this holds for all three synthetic indicators. Both the synthetic indicator of financial uncertainty and the synthetic indicator of economic policy uncertainty display large and persistent effects, while the negative response to a shock in the economic disagreement indicator vanishes quickly.

Figures 2b, 2c, and 2d show the GDP response to unexpected uncertainty increases in each of the synthetic uncertainty measures, comparing the baseline model with a model that does not take into account external sources of uncertainty. In this latter case, the negative GDP responses to unexpected shocks in each of the uncertainty measure are more persistent and more statistically significant compared to the baseline results, especially in the case of financial uncertainty. This suggests that, as expected, our Spain-related synthetic uncertainty measures partially reflect external uncertainty shocks, which significantly affect the dynamics of the Spanish economy. This holds also for responses in private consumption and capital goods investment (see Figures 3b-3d and 4b-4d, respectively).

Finally, Figures 3a and 4a show the responses of private consumption and capital goods investment to unexpected shocks in the three synthetic measures of uncertainty. Qualitatively, results are in line to those obtained for the GDP, i.e. an unexpected increase in uncertainty causes a decline in private consumption and capital goods investment. In addition, private consumption responses to uncertainty shocks show a similar persistence to GDP.

[19] In case of economic policy uncertainty, also the other direction of causality could be possible. It would suggests that for instance politicians may take advantage of business cycle conditions to put forward populistic agendas, which may generate policy instability.

This is expected, and suggests that due to an unexpected increase in uncertainty households may increase precautionary saving, thereby reducing the resources devoted to consumption under normal circumstances. This in turn may reduce aggregate demand. By contrast, investment responses fade away quickly from the third quarter onwards. Also this results is consistent with theoretical predictions available in the literature. When uncertainty is high, firms may delay new investment and hiring decisions, thereby shrinking aggregate supply in the short-run. Moreover, the reduction in investment spending may even reduce the future supply capacity, thereby weakening the economic growth of the economy in the long-term. According to our results investment in Spain comes back to the initial level within a year.

Our results are in line with those obtained with similar exercises, though with a more limited scope, for Spain. Basile and Girardi (2017) find negative GDP responses to a shock in their proxy of uncertainty, which lasts about 5 quarters. This is in line with our GDP responses to innovations in our financial uncertainty and economic policy uncertainty indicators, but diverges from the GDP response we get after a shock in our economic disagreement index, which shows no persistence. While it is natural to associate their proxy of uncertainty to our synthetic indicator of economic disagreement, the two measures differ in the set of expectations they rely on. First, we add expectations of economic experts to the expectations of firms and consumers. Second, they consider expectations about a wider set of economic variables (including prices).[20]

In addition, our investment responses are in line with those found by Meinen and Roehe (2017) for Spain. Based on SVAR models, they document negative but not persistent reactions of investment to shocks in the stock market volatility, which is similar in nature to our synthetic indicator of uncertainty in financial markets. Investment responses to innovations in the original EPU index as well as in their measure of economic disagreement about production's expectations are statistically not significant. Our negative and significant - yet not persistent - responses in investment to a shock in our synthetic indicator of economic policy

[20]Note, the uncertainty proxy of Basile and Girardi (2017) captures the degree of disagreement between agents' expectations about future economic prospects, as represented by a rich - yet heterogeneous - set of dimensions: i.e. firms' expectations about selling prices and employment in industry, services, retail trade, and construction; export orders and production in industry; demand in services; orders and sales in retail trade; consumers' expectations about their own economic situation, and about the general economic situation, prices and unemployment.

uncertainty and economic disagreement can be rationalized by the specific characteristics of our indicators. In particular, our economic policy uncertainty indicator relies on a new improved version of the EPU index for Spain, as opposed to their measure which is based on the original EPU index.[21] On top of this, our synthetic indicator combines the information contained in the new EPU index with the one available from other indexes related to economic policy uncertainty.[22]

5 Conclusions

In this paper, we propose new macroeconomic indicators of uncertainty for Spain and study their impact on the dynamics of GDP, private consumption, and capital goods investment. We focus on the period 1997Q1-2018Q2. Our proposed indicators are synthetic measures of uncertainty resulting from a Principal Component Analysis (PCA) based on a number of specific uncertainty measures. We construct three uncertainty measures, each one referring to a specific domain: a synthetic indicator of uncertainty related to financial markets, a synthetic indicator of disagreement between agents' expectations over future economic prospects, and one synthetic indicator of economic policy uncertainty. For each domain, we select a number of specific uncertainty measures: some of these measures are already available in the literature, while the rest is constructed by ourselves. Rather than relying on a specific uncertainty index, we combine all information embedded in all specific uncertainty indexes related to a given domain (i.e. financial markets, economic disagreement or economic policy uncertainty) to proxy domain-specific economic uncertainties, by means of a PCA. This methodology allows us to come up with measures of uncertainty that are more complete and less volatile compared to each of the individual uncertainty indexes we selected in the first place.

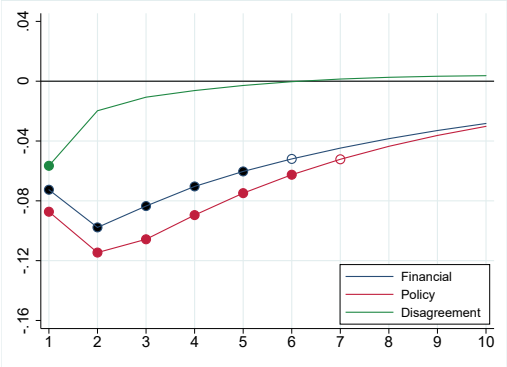
Based on a graphical inspection, we discuss the evolution of our synthetic indicators against a time-line of *relevant* events, i.e. potentially associated to increases in economic

[21] For a comparison between the new EPU and the original one, see Ghirelli et al. (2018).

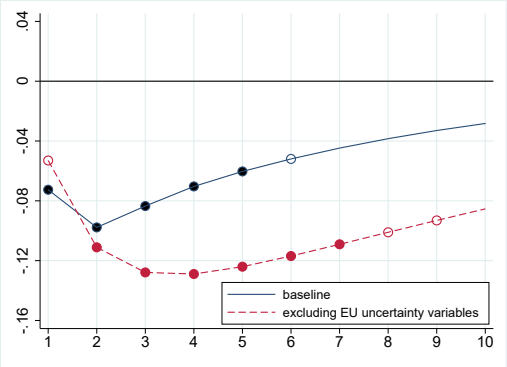
[22] Note, Meinen and Roehe (2017) find larger responses of investment to shocks in uncertainty measures based on the unpredictable components of a set of macroeconomic variables. These results are not comparable to ours.

Figure 2: VAR results. Impulse responses of GDP

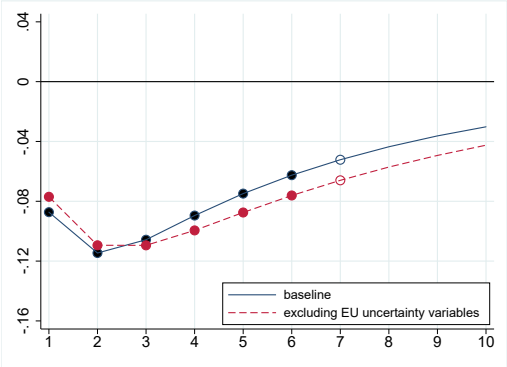
(a) All uncertainty measures



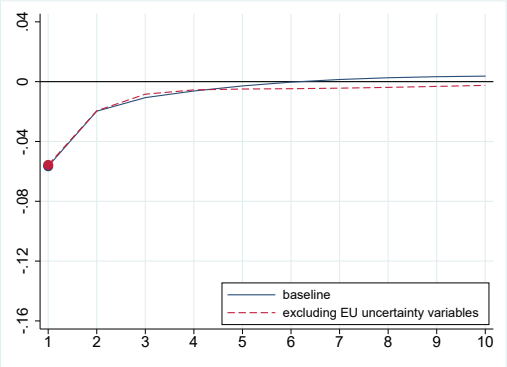
(b) Financial uncertainty



(c) Policy uncertainty



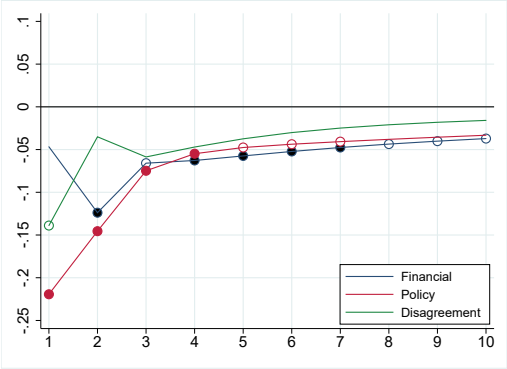
(d) Economic disagreement



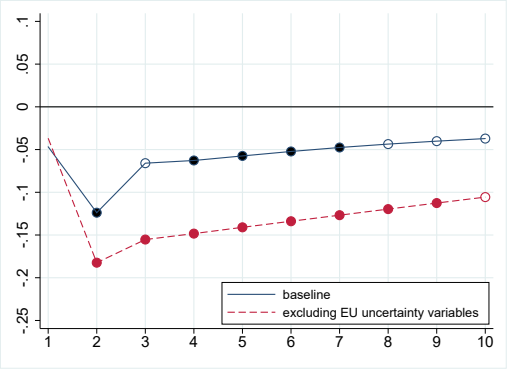
Notes: VAR models include as endogenous variables the synthetic indicator of financial uncertainty, the synthetic indicator of economic policy uncertainty, the synthetic indicator of economic disagreement, the GDP growth rate, the Spanish sovereign debt spread over the German Bund, and a price index; in addition, it includes as exogenous variables the volatility index of the European Stock exchange, the EPU index by Baker et al. (2016) for the EU, and a measure of economic disagreement for the EU based on experts' forecasts of GDP (own calculation). All models consider the period 1997Q1:2018Q2. Quarterly data used. Each graph shows the impulse response function up to 10 quarters after a positive shock of one standard deviation in a specific uncertainty measure. Full circles indicate statistical significance at 5%; empty circles indicate statistical significance at 10%; solid line indicates no statistical significance.

Figure 3: VAR results. Impulse responses of private consumption

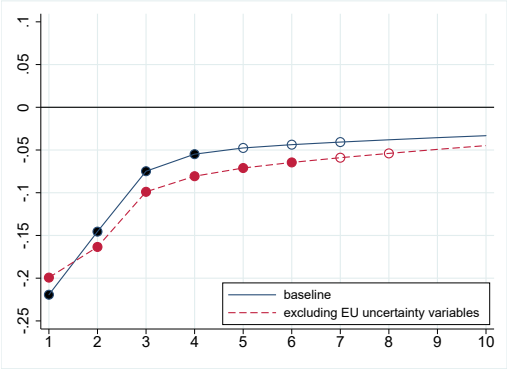
(a) All uncertainty measures



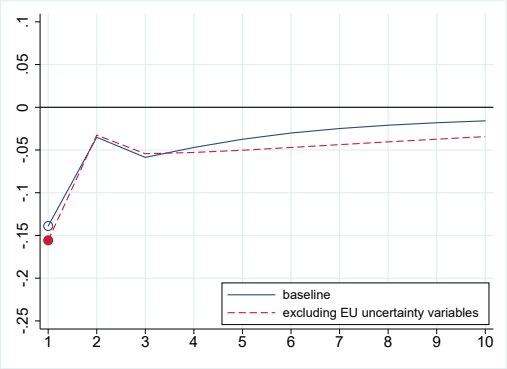
(b) Financial uncertainty



(c) Policy uncertainty



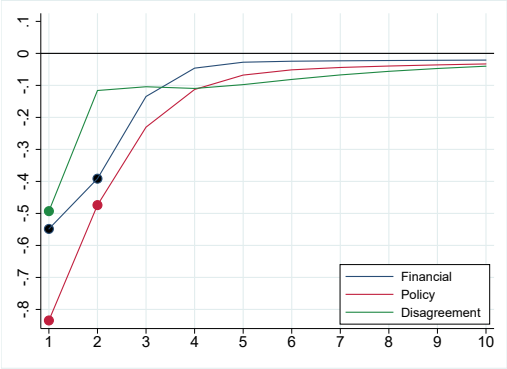
(d) Economic disagreement



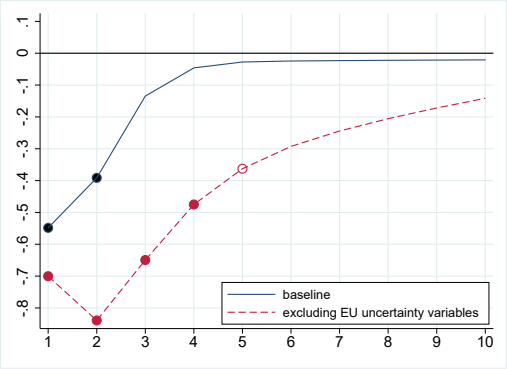
Notes: VAR models include as endogenous variables the synthetic indicator of financial uncertainty, the synthetic indicator of economic policy uncertainty, the synthetic indicator of economic disagreement, private consumption, the Spanish sovereign debt spread over the German Bund, and a price index; in addition, it includes as exogenous variables the volatility index of the European Stock exchange, the EPU index by Baker et al. (2016) for the EU, and a measure of economic disagreement for the EU based on experts' forecasts of GDP (own calculation). All models consider the period 1997Q1:2018Q2. Quarterly data used. Each graph shows the impulse response function up to 10 quarters after a positive shock of one standard deviation in a specific uncertainty measure. Full circles indicate statistical significance at 5%; empty circles indicate statistical significance at 10%; solid line indicates no statistical significance.

Figure 4: VAR results. Impulse responses of capital goods investment

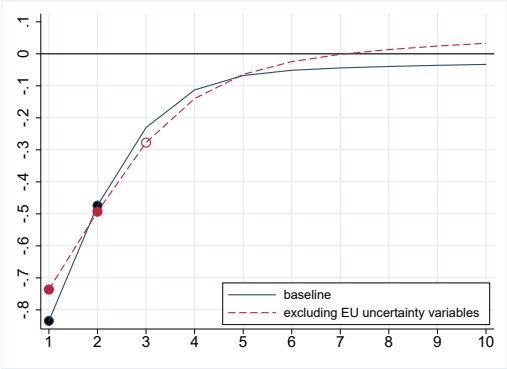
(a) All uncertainty measures



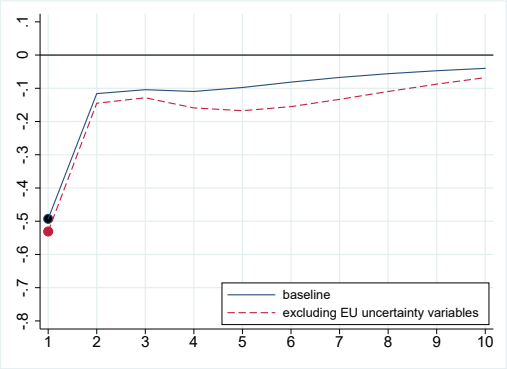
(b) Financial uncertainty



(c) Policy uncertainty



(d) Economic disagreement



Notes: VAR models include as endogenous variables the synthetic indicator of financial uncertainty, the synthetic indicator of economic policy uncertainty, the synthetic indicator of economic disagreement, capital goods investment, the Spanish sovereign debt spread over the German Bund, and a price index; in addition, it includes as exogenous variables the volatility index of the European Stock exchange, the EPU index by Baker et al. (2016) for the EU, and a measure of economic disagreement for the EU based on experts' forecasts of GDP (own calculation). All models consider the period 1997Q1:2018Q2. Quarterly data used. Each graph shows the impulse response function up to 10 quarters after a positive shock of one standard deviation in a specific uncertainty measure. Full circles indicate statistical significance at 5%; empty circles indicate statistical significance at 10%; solid line indicates no statistical significance.

uncertainty. As expected, our three indicators behave differently, depending on the nature of the information they are built upon. For instance, the indicator of financial uncertainty strongly reacts to global/external phenomena (such as Brexit in June 2016), while it does not capture Spanish political events (such as the Catalan crisis of October 2017). By contrast, the indicator of economic disagreement is highly related to the Spanish Great recession, while the economic policy uncertainty indicator is more sensitive to political events that are associated to increased uncertainty about future political stands (e.g. electoral campaigns, and the Catalan crisis).

In addition, we propose an empirical application in which we study the macroeconomic impact of our uncertainty measures by means of structural vector autoregressive (SVAR) models. We find significant and negative responses of, in turn, GPD, private consumption and capital goods investment, to unexpected shocks in financial uncertainty as well as in economic policy uncertainty. GDP and private consumption responses are quite persistent (up to 5/6 quarters and 4/7 quarters depending on the uncertainty measure, respectively), while investment responses are initially bigger in magnitude but fade away more quickly, three quarters after the shocks.

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