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Characterizing very high uncertainty episodes☆

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HIGHLIGHTS

- We identify episodes of very high uncertainty for the US economy using a Markov-switching model.
- Very high uncertainty episodes are associated with weaker growth and sharp declines in stock prices.
- High uncertainty may have played an important role in the low growth performance of the US economy in recent years.

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ABSTRACT

This paper uses a two-step approach to characterize the evolution of US macroeconomic and financial variables during episodes of very high uncertainty. First, we identify episodes of very high uncertainty using a regime-switching model. Second, we assess the behavior of macroeconomic and financial variables during these episodes of very high uncertainty. This methodology is analogous to the approach followed by Baele et al. (2012), who study episodes of flights to safety in financial markets. We find that very high uncertainty episodes are associated with a weaker growth performance and sharp declines in stock prices.

1. Introduction

The role of uncertainty in the low growth performance of many advanced economies in recent years has received increasing attention among researchers and policy-makers. Macroeconomic theory suggests that uncertainty can have a powerful impact on macroeconomic activity, for example because it may give firms an incentive to delay investment and employment (Bernanke, 1983). Similarly, consumers may postpone their acquisition of durable goods if uncertainty increases (Romer, 1990). Moreover, uncertainty may push up the cost of finance via an increase in risk premia (e.g. Gilchrist et al., 2010) or have an impact on stock prices as it increases discount rates and hence decreases the net present value of future profitability (Pástor and Veronesi, 2012; Bansal and Yaron, 2004; Bekaert et al., 2009).

In practice, however, measuring uncertainty and capturing its actual impact on macroeconomic variables has proved challenging. An increasing number of empirical studies have addressed this issue in recent years, mainly focusing on the US. Following Bloom (2009), several recent empirical investigations have found a significant countercyclical link between uncertainty and macroeconomic activity (see, for example, Baker et al., 2012, Leduc and Liu, 2013, IMF, 2012), although others, such as Knotek and Khan (2011), find only a modest relationship using data on US households. While most of the empirical literature uses linear VAR models, there is evidence that uncertainty shocks exert different effects over different phases of the business cycle. Caggiano et al. (2012), for example, find that uncertainty shocks have a larger macroeconomic impact during recessions than during economic upturns. It may thus be appropriate to allow for non-linearities in empirical analyses of uncertainty.

This paper uses a two-step approach to characterize the evolution of macroeconomic and financial variables during episodes of

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Table 1
Estimation results for a three-state regime-switching model of uncertainty.

Panel A: estimation results									
		μ_1	μ_2	μ_3	σ_1	σ_2	σ_3	p_{33}	$P(S_t = 3)$
	EPU_t	52.753***	111.984***	218.909***	22.788***	43.063***	100.676***	0.693***	13.4%
	VIX_t	13.464***	19.804***	30.935***	1.772***	2.338***	8.346***	0.979***	23.9%
Bivariate	VIX_t	14.264***	21.840***	32.693***	2.210***	2.260***	9.574***	0.953***	21.0%
Model	EPU_t	84.260***	85.821***	167.842***	51.414***	55.493***	105.627***		

Note: Panel A reports the estimation results for regime switching models. The first two rows show the results for a 3-regime univariate Markov-switching model using alternatively as a dependent variable the economic policy uncertainty (EPU) index from Baker et al. (2012) and the VIX. The last two rows of Panel A instead show the estimation results for a bivariate regime switching model using the EPU and the VIX as a dependent variable. The estimation sample runs from January 1, 1985 to December 31, 2012 for the EPU index and from January 1, 1990 to December 31, 2012 for the VIX and the bivariate model. p_{33} is the transition probability of staying in the third regime and $P(S_t = 3)$ is the unconditional probability of being in the third regime.
* Indicates significance at the 10% level.
** Indicates significance at the 5% level.
*** Indicates significance at the 1% level.

high uncertainty in the US. First, we aim at identifying episodes of very high uncertainty using a regime-switching model. Second, we study the behavior of macroeconomic and financial variables during these episodes of very high uncertainty.

This methodology is analogous to the approach followed by Baele et al. (2012) to identify and characterize episodes of flights to safety in financial markets. An advantage of this approach is that it allows us to account for non-linearities in the relationship between uncertainty and macroeconomic variables. Instead of the uncertainty variable itself, our uncertainty measures are based on the number of days in each month that the economy is in the very high uncertainty regime, i.e. the highest uncertainty regime of the three uncertainty regimes that we distinguish. In other words, our measures of uncertainty increase only when the economy enters a period of very high uncertainty. Finally, as uncertainty is not directly measurable, we identify very high uncertainty regimes using three alternative measures: the economic policy uncertainty index (Baker et al., 2012), the implied volatility index on the S&P500 (VIX index) and a combination of both these measures.

2. Identifying episodes of very high uncertainty

We consider a univariate regime switching model for the uncertainty variable y_t defined as follows:

$$y_t = \mu(S_t) + \epsilon_t(S_t) \quad (1)$$

where $\epsilon_t|S_t \sim N(0, \sigma(S_t))$. The regime generating process is an ergodic Markov chain with a finite number of states $S_t = \{1, \ldots, M\}$ defined by the following constant transition probabilities:

$$p_{ij} = Pr(S_{t+1} = j|S_t = i)$$

$$\sum_{j=1}^{M} p_{ij} = 1 \quad \forall i, j \epsilon \{1, \ldots, M\}.$$

This mean–variance regime switching model is often estimated for equity returns (see e.g. Perez-Quiros and Timmermann, 2001). Baele et al. (2012) estimate Eq. (1) with a three-state regime-switching model using as a dependent variable the difference between equity return and the return on a benchmark government bond to identify flight-to-safety episodes. We follow Baele et al. (2012) and estimate Eq. (1) with three regimes using as a dependent variable each of our uncertainty variables to identify extreme uncertainty episodes. The first regime is an episode with a low level of uncertainty and volatility, while the second regime is an episode of a high level of uncertainty and volatility. The third regime captures the episodes of a very elevated level and volatility of uncertainty.[1]

[1] We consider a model with a switch in both the mean and the volatility of uncertainty since this specification is considerably preferred by standard information criteria compared with a model that only considers a switch in the intercept.

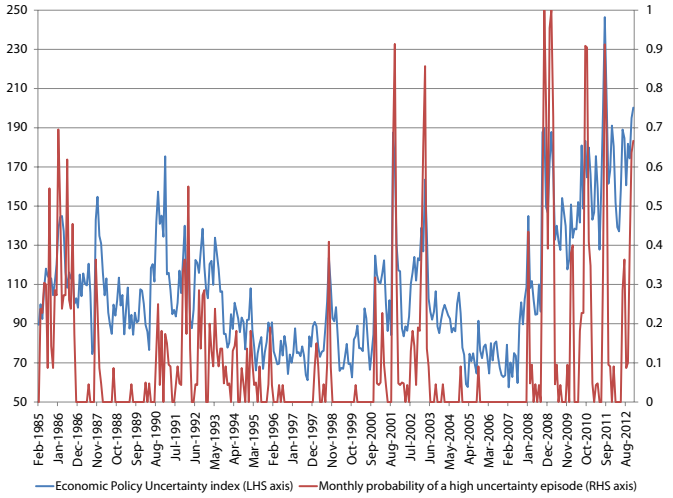

Fig. 1. Economic policy uncertainty index and monthly probability of very high uncertainty episodes. *Note*: This figure plots the economic policy uncertainty (EPU) index and the monthly probability of being in a very high uncertainty episode (i.e. the third regime) using the EPU index. The monthly probability corresponds to the number of days per month when the daily probability of being in the third regime is higher than 0.5.

Very high uncertainty episodes are infrequent: using the bivariate model (based on both the economic policy uncertainty index (EPU) and the VIX index), the US economy was in a period of very high uncertainty during around 20% of the sample (Table 1). In more detail, Table 1 shows that, as expected, the third regime exhibits the highest mean and variance for the EPU index, the VIX and the bivariate model. This regime can thus be interpreted as the very high uncertainty episode. When using the EPU index, the unconditional probability of being in the third regime is 13.5%. Using the VIX as a measure of uncertainty yields similar results, albeit the unconditional probability of being in the third regime is 23.9% and the third regime is more persistent as the transition probability of staying in this regime is 0.979 (compared with 0.693 for the model using the EPU index).

Very high uncertainty episodes have been more frequent during the most recent decade of the sample and especially since 2008. Clearly visible are the peaks following September 2001, the start of the second Gulf war and, more recently, the increases associated with various phases of the global financial crisis and the debt ceiling debate (Fig. 1). Noteworthy is the divergence between the EPU index and the VIX towards the end of the sample, suggesting that the high level of uncertainty in recent years may have been associated with uncertainty about economic policies rather than financial market volatility. Fig. 2, plotting the daily probability of being in the third regime during the past five years, confirms the recent divergence between both uncertainty measures.