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Economic policy uncertainty and unemployment in the United States: A nonlinear approach

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ABSTRACT

We model US post-WWII monthly data with a Smooth Transition VAR model and study the effects of an unanticipated increase in economic policy uncertainty on unemployment in recessions and expansions. We find the response of unemployment to be statistically and economically larger in recessions. A state-contingent forecast error variance decomposition analysis confirms that the contribution of EPU shocks to the volatility of unemployment at business cycle frequencies is markedly larger in recessions.

1. Introduction

Baker et al. (2016) construct an index of economic policy uncertainty (EPU) and find that an unexpected increase in such index is associated to a significant and persistent drop in real activity in the US and a number of other countries. This paper shows that the response of the US unemployment rate to an EPU shock is asymmetric along the business cycle. We do so by fitting monthly post-WWII US data with a Smooth Transition VAR (STVAR) model in which EPU shocks are allowed (but not required) to exert a different effect on the unemployment rate in recessions and expansions. Results show that EPU shocks trigger a peak response of unemployment six times larger in recessions than in expansions. The contribution of EPU shocks to the volatility of the unemployment rate at business cycle frequencies is found to be markedly larger in bad times than in good ones.

Evidence in favor of the asymmetric evolution of the US unemployment rate along the business cycle is provided by Morley and Piger (2012) and the literature cited therein. Our paper shows that EPU shocks may be among the contributors to this asymmetric behavior. Our results complement those in Caggiano et al. (2014) and Nodari (2014). Caggiano et al. (2014) find the real effects of financial uncertainty shocks on US unemployment to be larger in recessions than what a linear model would suggest. Nodari (2014) shows that financial economic policy uncertainty shocks have state-dependent effects on unemployment. With respect to them, we (i) focus on EPU shocks; (ii) identify events associated with large realizations of the economic policy uncertainty index, which are likely to isolate exogenous shocks that are informative to estimate the real effects of economic policy uncertainty; (iii) directly estimate the key parameters of the STVAR model, i.e. the slope of the logistic function dictating the probability of being in a given state, and the threshold that identifies the two regimes; (iv) compute generalized impulse responses (GIRFs) à la (Koop et al., 1996), therefore enabling the economic system to switch from a state to another (e.g., from expansions to recessions) after a shock.

This paper is structured as follows. Section 2 offers a brief presentation of the EPU index and of our empirical model. Section 3 documents our empirical findings. Section 4 concludes.

2. EPU index and empirical framework

US EPU index. Baker et al. (2016) construct indices of economic policy uncertainty based on newspaper coverage frequency for the US and a number of other countries. Per each country, they

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consider a set of newspapers and count the number of articles that contain terms referring to three categories, i.e., the economy (E), policy (P), and uncertainty (U). They scale the raw count by the total number of articles in the same newspaper/month. Finally, they standardize the monthly series of scaled counts and average them across the newspapers they consider to obtain the monthly EPU index. Further details on the construction of this index can be found in Baker et al. (2016) and our Appendix A.

STVAR model. We identify the macroeconomic effects of uncertainty shocks during post-WWII US recessions by modeling some selected US macroeconomic series with a Smooth-Transition VAR framework. Formally, our STVAR model reads as follows:

$$\boldsymbol{X}_t = [1 - F(z_{t-1})]\boldsymbol{\Pi}_R(L)\boldsymbol{X}_t + F(z_{t-1})\boldsymbol{\Pi}_E(L)\boldsymbol{X}_t + \boldsymbol{\varepsilon}_t \tag{1}$$

$$\boldsymbol{\varepsilon}_t \sim N(0, \boldsymbol{\Omega}) \tag{2}$$

$$F(z_t) = \{1 + \exp[-\gamma(z_t - c)]\}^{-1}, \gamma > 0, z_t \sim d(0, 1) \tag{3}$$

where $\boldsymbol{X}_t$ is a set of endogenous variables which we aim to model, $F(z_{t-1})$ is a logistic transition function which captures the probability of being in an expansion and whose smoothness parameter γ regulates the rapidity of the switch from a regime to another (the higher γ, the faster the switch), z_t is a transition indicator, c is the threshold parameter identifying the two regimes, $\boldsymbol{\Pi}_R$ and $\boldsymbol{\Pi}_E$ are the VAR coefficients capturing the dynamics of the system during recessions and expansions (respectively), and $\boldsymbol{\varepsilon}_t$ is the vector of reduced-form residuals having zero-mean and variance–covariance matrix $\boldsymbol{\Omega}$. As regards the transition indicator z_t, we employ a standardized moving average of the growth rate of industrial production.[1]

Given z_t, we jointly estimate the parameters $\{\boldsymbol{\Pi}_R, \boldsymbol{\Pi}_E, \boldsymbol{\Omega}, \gamma, c\}$ of model (1)–(3) with conditional maximum likelihood as suggested by Teräsvirta et al. (2010). We model the vector of data $\boldsymbol{X}_t = [EPUD_t, \overline{\Delta IP}_t, u_t, \pi_t, R_t]'$. $EPUD_t$ refers to a 0/1 dummy identifying spikes in economic policy uncertainty (discussed below), $\overline{\Delta IP}_t$ stands for the six-term moving average of the monthly growth rate of industrial production (percentualized and annualized), u_t is the unemployment rate, π_t is CPI inflation (year-over-year percentualized growth rate of the monthly index), and R_t is the federal funds rate. All data were downloaded from the Federal Reserve Bank of St. Louis' website, except the EPU index, which was downloaded from the website http://www.policyuncertainty.com/. We focus on the sample 1954M7–2014M10. The beginning of the sample refers to the month in which the effective federal funds rate became available, while the end of the sample is due to the availability of the newspaper-based EPU historical index for the United States. Testing the null hypothesis of linearity versus the alternative of a STVAR specification as in Teräsvirta and Yang (2014) returns a value of the LM-test statistic of 58.14, with associated p-value equal to 0.0002.[2]

Construction of the EPU dummy. To construct the $EPUD_t$ 0/1 dummy, we first compute the cyclical component of the US EPU index via the Hodrick–Prescott filter. This is done to control for changes in the low-frequency component of this index over the post-WWII period which are possibly due to the increasing role played by fiscal components and political polarization in the US economic system (see Baker et al. (2014)). Second, we follow Bloom (2009) and isolate spikes in uncertainty by selecting realizations of the cyclical component of the EPU index larger that 1.65 times its standard deviation. This strategy helps us isolate realizations of uncertainty with a strong exogenous component and, therefore, identify the causal response of unemployment to movements in the EPU index.

Table 1 reports the dating of the non-zero realizations of the so-constructed EPU-dummy. Examples are historical events like wars, the dissolution of the Soviet Union, and 9/11, which can be seen as huge external shocks which cast doubts in agents' minds on the type of reaction policymakers would implement, as well as fiscal- or monetary-policy related events like discussions on the budget, the fiscal cliff, and large monetary policy adjustments, which are clearly specific to US economic policy decisions.

3. Empirical evidence

Orthogonalization of the EPU shock and computation of the GIRFs. To make sure that the EPU shock is orthogonal to the other stochastic elements in our VAR, we model the impulse vector responsible of the on-impact response of the variables in the vector $\boldsymbol{X}_t$ by employing a Cholesky-decomposition of the reduced-form variance covariance matrix $\boldsymbol{\Omega}$. This implies that, on impact, EPU shocks can affect the rest of the system, while the EPU dummy is assumed to be contemporaneously exogenous to the rest of the system. In light of the construction of this dummy discussed above, we believe this assumption to be reasonable. We then compute GIRFs à la Koop et al. (1996) and report the median response in recessions and expansions. Our Appendix A provides details on the computation of the GIRFs.

GIRFs. Fig. 1 depicts the dynamic responses of our variables to a one-standard deviation increase in the dummy. The evidence of nonlinear effects on EPU shocks on unemployment is clear. The peak response of unemployment in recessions reads 0.14%, seven times larger than the response in expansions (0.02%). The difference between the responses in recessions and expansions – plotted in Fig. A3 in our Appendix A – confirms that the response of unemployment in recessions is significantly stronger from a statistical viewpoint. This result is in line with the theoretical predictions by Cacciatore and Ravenna (2015). They develop a model of the labor market with matching frictions and an occasionally binding constraint on downward wage adjustment, and show that the negative effects of uncertainty shocks on labor market outcomes are magnified during recessions. We find that the larger response of unemployment to EPU shocks is robust to: (i) the employment of the EPU index (in lieu of our EPU dummy); (ii) controlling for financial uncertainty, as in Baker et al. (2016); (iii) the inclusion of the Baa–Aaa corporate bond spread to control for first moment financial shocks; (iv) the inclusion of a factor extracted from the large panel of US variables documented by McCracken and Ng (2016) to control for first moment macroeconomic shocks. Our Appendix A documents these robustness checks (Fig. A4).

It is important to notice that also industrial production and inflation react asymmetrically to an EPU shock. The peak response of industrial production in recessions (−1.10%) is four times larger than in expansions (−0.22%), while the peak deflationary impact in recessions reads −0.27%, compared to a peak response of −0.05% in expansions. Finally, the response of the federal funds rate in recessions is also larger, with a maximum decrease in the policy rate of about 23 basis points vs. 10 basis points in expansions. The asymmetric response of industrial production, inflation and the policy rate is statistically significant and is robust to the same controls discussed above—results are reported in Figs. A3 and A4 in the Appendix A.

FEVD. Table 2 documents the outcome of the state-dependent two-year ahead forecast error variance decomposition analysis à

1 We focus on a moving average of the month-over-month growth rate of industrial production involving six terms. Conditional on our sample, this moving average returns a higher correlation (in absolute value) with the NBER recession dummy (−0.60) than alternatives such as the simple monthly growth rate of industrial production (−0.48) and a moving average involving twelve terms (−0.51).

2 The STVAR features the number of lags selected for the linear version of the VAR(p) model, with $1 \leq p \leq 12$. The BIC and HQ information criteria point to the use of two lags. The estimated model is found to closely track the US recessions and expansions as dated by the NBER (evidence confined in our Appendix A).