Noise over the Business Cycle

Marco Brianti
Vito Cormun

Boston College

June 2018

Research Question

The key empirical question is how the effect of **noise** varies over the **business cycle**

We employ a **regime switching** econometric model where transitions across states (recession and expansion) are **smooth**

Econometric Procedure - Overview

We use a 2-step procedure

1. Estimate series of noise shocks orthogonal to any other exogenous source of fluctuations
2. Estimate a Smooth Transition Local Projection model (hereafter STLP) to estimate dynamic responses of key macroeconomic variables

Step 1 - Overview

We estimate a noise shock as a change in the expected growth rate of Real GDP which is orthogonal to

1. contemporaneous structural shocks
2. lagged principal components from a large dataset
3. past and future TFP

Step 1 - Estimation of Z_t

Data

- X_t is log of Real GDP at time t
- $X_{t+k|t} = E[X_{t+k}|I(t)]$ provided by Survey of Professional Forecasters

Procedure

$$Z_t = (X_{t+4|t} - X_{t|t}) - (X_{t+4|t-1} - X_{t|t-1})$$

where

- $(X_{t+4|t} - X_{t|t})$ is expected growth rate of Real GDP conditional on information set up to time t
- $(X_{t+4|t-1} - X_{t|t-1})$ is expected growth rate of Real GDP conditional on information set up to time $t-1$
- Z_t is a shock to the expectations of output growth rate

Step 1 - Estimation of $\tilde{Z}_t$

Problem. Z_t is correlated with current and future fundamentals such as fiscal policy, monetary policy, current and future TFP.

Solution. Estimate $\tilde{Z}_t$ as follows

$$Z_t = C + \sum_{j=-J}^{H} \delta_j \Delta TFP_{t+j} + \gamma SS_t + \mu PC_{t-1} + \tilde{Z}_t$$

where

- C is the constant
- ΔTFP_t is first difference of total factor productivity at time t
- SS_t is a vector of structural shocks at time t from the dataset of Caldara and Kamps (2017)
- PC_{t-1} is a vector of principal component at time $t-1$

$\tilde{Z}_t$ represents a change in expectations which is not related to any source of fundamental fluctuations, i.e. a **noise shock**.

Step 2 - Smooth Transition Local Projection

Following Auerbach and Gorodnichenko (2012), our basic specification is

$$Y_{t+k} = [1 - F(\eta_{t-1})]\Pi_E \tilde{Z}_t + F(\eta_{t-1})\Pi_R \tilde{Z}_t + u_t$$

where

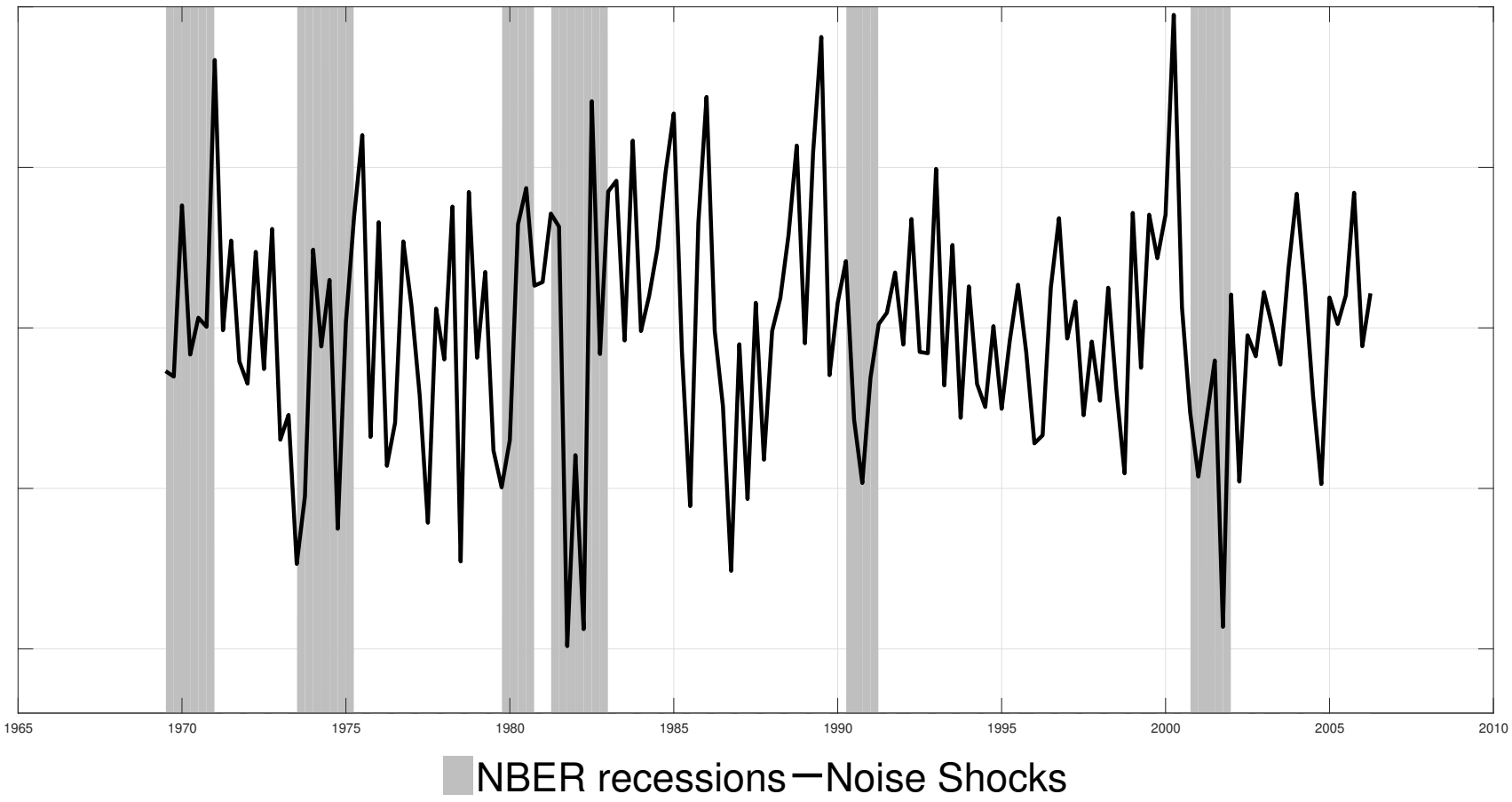
$$F(\eta_t) = \frac{\exp(-\gamma\eta_t)}{1 + \exp(-\gamma\eta_t)}, \quad \gamma > 0$$

and variables η_t is an index (normalized to have zero mean and unit variance) of the business cycle. [$\eta_t > 0 \Rightarrow$ expansion.]

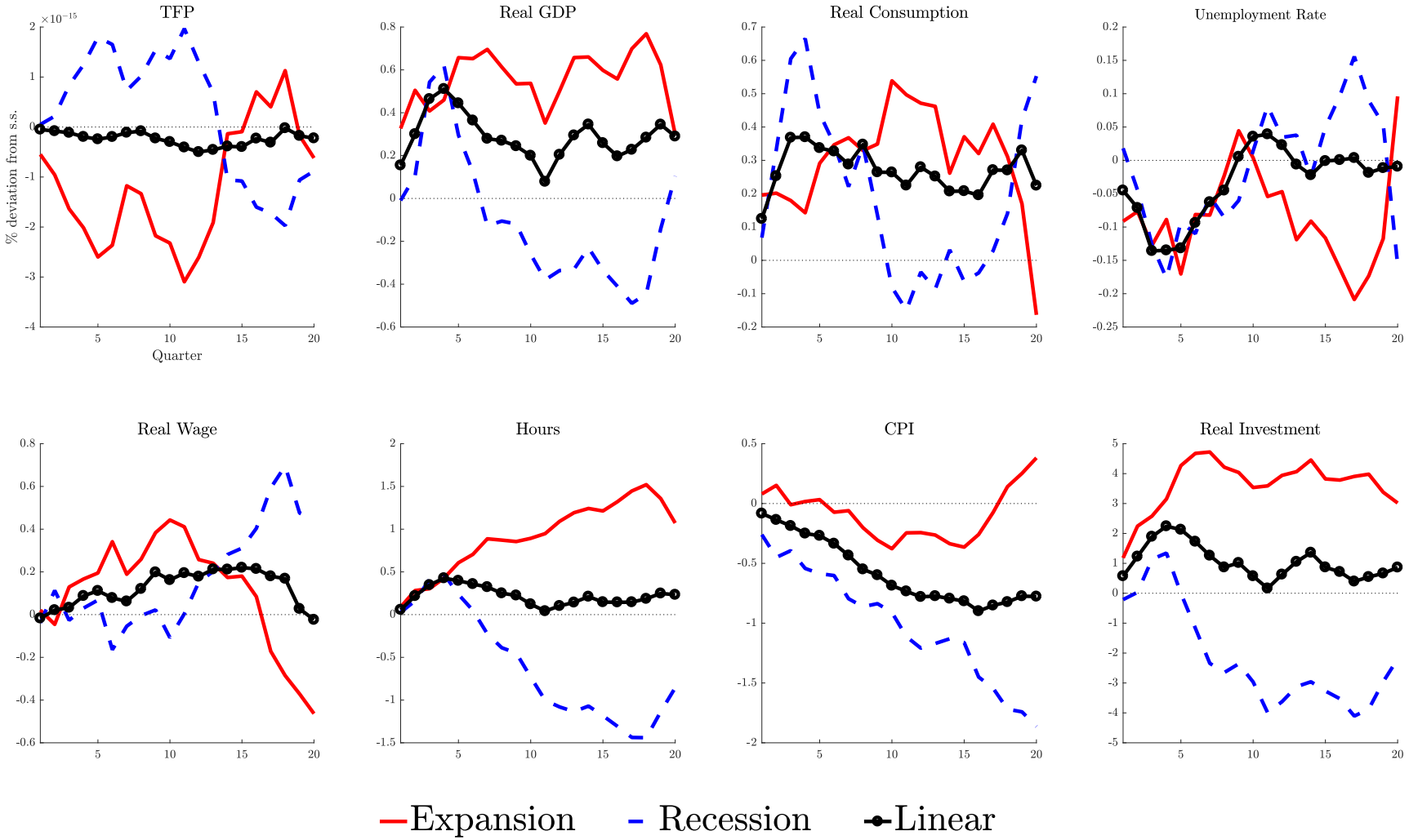
Note. We date the index η by $t - 1$ to avoid contemporaneous feedbacks of $\tilde{Z}_t$ on the underlying state.

Details

Noise Shocks $\tilde{Z}_t$



Local Projection using Smooth Transition



Main Issues

1. SPF information set may be different to the one of economic agents.
2. Forecast horizon of SPF may be to short to properly capture future beliefs.
3. Do we need to treat for possible trend in the data?
4. Need to set up a reliable procedure for the confidence intervals.
5. Need to allow for endogenous feedbacks of noise on η_t in the local projection.

Details on η_t and STPL procedure

η_t is defined as the seven-quarter moving average of the output growth rate.

- Notice that we can easily consider dynamic feedbacks from noise to the state of the regime.

Following Auerbach and Gorodnichenko (2012) we calibrate γ to 1.5 for now.

- Granger and Teravista (1993) suggest robustness checks procedure for γ.

Return