Project

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Sentiments Shocks and the Limit Cycle (I)

In a series of recent papers Beaudry, Galizia, and Portier show that

- cycles are driven by economy's internal forces that favor cyclical outcomes
- and not by series of persistent positive and negative shocks

Sentiments Shocks and the Limit Cycle (II)

Their model with **stochastic limit cycle** strongly rejects the relevance of persistence shocks to explain the business cycles.

- cycles are driven by internal forces that favor a continuum of **boom-and-bust outcomes**

The role of disturbances is to deviate the expected trajectory of the cycle implying the unpredictability of its path.

Our Contribution

Does it mean that we should discard the plethora of models that generate mean reverting IRFs?

The answer is no. In particular, we show that

- **Empirically**, cyclical patterns are only related to **sentiment shocks**
- **Theoretically**, we would like to rationalize this result with a model that displays
  - boom-and-bust patterns to sentiment shocks
  - mean reverting responses to technology, monetary and fiscal policies shocks

Econometric Procedure - Overview

We use a 2-step procedure

1. Estimate series of sentiment shocks using forecast revisions of GDP growth at 4 quarters horizon
2. Estimate IRFs via local projection à la Jorda (2005)

Step 1 - Overview

We estimate sentiment shocks as SPF forecast revisions of real GDP growth rate which are 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 SPF

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 an innovation 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 the residual of the following regression,

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

where

- C is a constant parameter
- ΔTFP_t is first difference of utility-adjusted total factor productivity at time t
- SS_t is a vector of structural shocks at time t possibly estimated via narrative approach
- PC_{t-1} is a vector of principal component at time $t-1$

Step 2 - Estimation of IRFs to $\tilde{Z}_t$

Define Y_t to be the BP-filtered log-transformation of an endogenous aggregate macroeconomic variable.

Using standard OLS techniques we estimate H regressions

$$Y_{t+h} = \Theta_h^Y \tilde{Z}_t + \epsilon_{t+h}$$

where $h = 1, 2, \ldots, H$ represent the forecast horizon.

$\Theta_1^Y,\ \Theta_2^Y,\ \ldots,\ \Theta_H^Y$ represent the path of the impulse response function of Y_t to a unit deviation of $\tilde{Z}_t$.

Bootstrapping Techniques

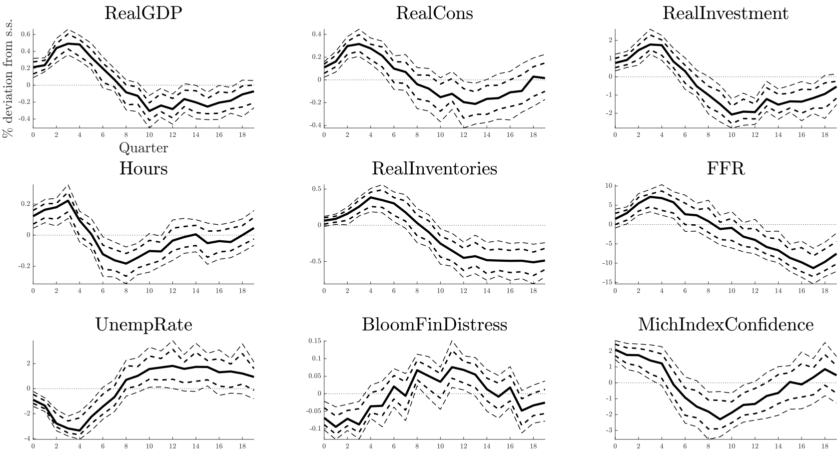
1. Consider the tuple $\Gamma_h^Y = \{Y_{t+h},\ T_t,\ \tilde{Z}_t,\ X_{t-1}\}$.

2. Divide Γ_h^Y over time t in smaller blocks and randomly reorder these blocks in order to form a new tuple $\Gamma_{h,Boot1}^Y$ of the same size of the previous one.

3. Estimate $\Theta_{h,Boot1}$ from $\Gamma_{h,Boot1}^Y$ using standards OLS techniques.

4. Redo (1)-(3) 2000 times and select confidence intervals.

Local Projection - Confidence Interval 68% and 90%



Testing the existence of cycles generated by structural shocks

Idea: given a structural shock a cycle emerges *iff* the shock induces a local peak in the spectral density.

Based on Canova (1996) and Beaudry Galizia Portier (2019) but applied conditioning on a shock
$\hookrightarrow$ Unlike them we compute the spectrum parametrically using truncated IRFs.

Under the null the shock generates a spectral density monotonically non decreasing in the periodicity
$\hookrightarrow H_0$: the IRF belongs to an AR(1) process with persistence of magnitude $\in [0, 1)$.

Implementation

1. Compute IRFs from data and bootstrap using Local Projections.
2. Compute the spectrum as
$$y_t = B(L)\epsilon_t \Rightarrow S_y(\omega) = B(e^{-i\omega})S_\epsilon(\omega)B(e^{i\omega})$$
Provided that the structural shock is a white noise,
$$S_y(\omega) = \frac{\sigma_\epsilon^2}{2\pi}B(e^{-i\omega})B(e^{i\omega})$$
3. Define D_1 as the average spectral density over some window around 25 quarters, and D_2 the average around 60 quarters. The test statistic is $D = D_1/D_2$.
4. $H_0 : D \leq 1$. Note that $D = 1$ under a white noise while it is smaller than one for an AR(1) with positive persistence.
5. Compute p-value using bootstrap.

Implications from findings

Results suggest a model where

- Sentiments are not correlated with TFP and policy shocks. Related, the model should not generate an invertibility issue.
- Sentiments generate boom-bust dynamics while fundamental shocks don't.
- Sentiments generate comovement in the real variables while they are non inflationary
- Sentiments explain only 12% of stock prices while they explain almost 40% of variations in real GDP

Model?

What are sentiment shocks?

- Preference shocks, expectational errors, self-fullfilling fluctuations

How do we obtain boom and bust dynamics after a shock?

- In a unique equilibrium framework with imperfect info resulting in overaccumulation due to expectational errors$\rightarrow$ What are the information assumptions that we can make?
- Steady state is a sink $\rightarrow$ all shocks would generate boom and bust(?) (Benhabib and Farmer 1994)
- Multiple steady states and equilibrium is (locally) unique $\rightarrow$ economy is temporarily in the proximity of the bad steady state after a shock (Boissay Collard and Smets 2016)

Questions raised

- What's the meaning of boom and bust? Look at this IRF, does it display a peak?
- Cycle emerges *iff* . . . is a definition or a result? A definition
- Doesn't the spectral density converges to zero by construction? No, because (?)
- Related, shouldn't the truncation horizon affect mostly the estimation of the spectral density at longer periodicities? No, it's the opposite, because (?)
- Why you do not search or compute the global maximum? Ok that you answer by saying that you follow the literature
- Ok that model with self-fullfilling shocks gives you the wrong movements in response to tfp shocks
- Try my model with Gaetano, sentiments shoould give you boom and bust while permanent tfp shocks should give you the right dynamics.

Rayan's view is that we could write a model in the spirit of Chahrour and Gaballo where after sentiment shocks the bust emerges because agents realize they were wrong. This implies that agents'information set is smaller than econometrician's info set. That agents do not know aggregate variables is consistent with Chahrour and Ulbricht.

However, in CG agents learn from prices. But in our model prices decrease after the shock, which is not consistent with the idea of having an improvement in the local conditions, we need to think hard about how to get the right price movement.