Evaluating the macroeconomic effects of the ECB's unconventional monetary policies

Sarah Mouabbi   Jean-Guillaume Sahuc

Banque de France

MMCN, Goethe University Frankfurt, June 20, 2017

Policy challenge

- Following the Great Recession, central banks lowered their rates to their effective lower bound (ELB).
- To provide additional stimulus, they introduced a number of unconventional policies (i.e., forward guidance, asset purchase programs, etc).
- How can we measure the macroeconomic effects of these policies?

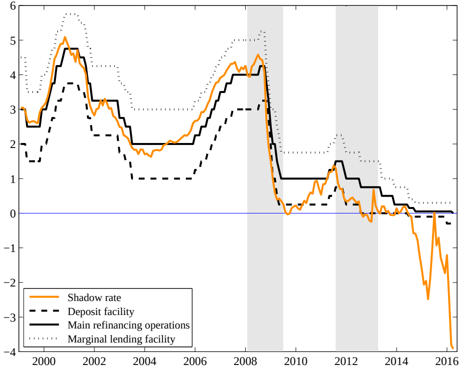
Our approach

- We use a DSGE model to study the effects of unconventional monetary policies since 2008.
- Within this framework we propose to use a shadow rate to assess the overall stance of monetary policy (i.e., summary measure of the total accommodation provided by conventional and unconventional policies).
- The shadow rate is the policy rate that would generate the observed yield curve had the ELB not been binding.

Shadow rate

- The shadow rate is obtained via a term structure model which accounts for the lower bound.
- It coincides with the policy rate in normal times and is unconstrained when the policy rate is stuck at the lower bound.
- Hence, the dynamic relationships between macroeconomic variables and monetary policy are preserved in any economic environment.
- The shadow rate incorporates both the effect of monetary policy measures on current economic conditions as well as market expectations about future policy actions.

Shadow rate and key ECB interest rates



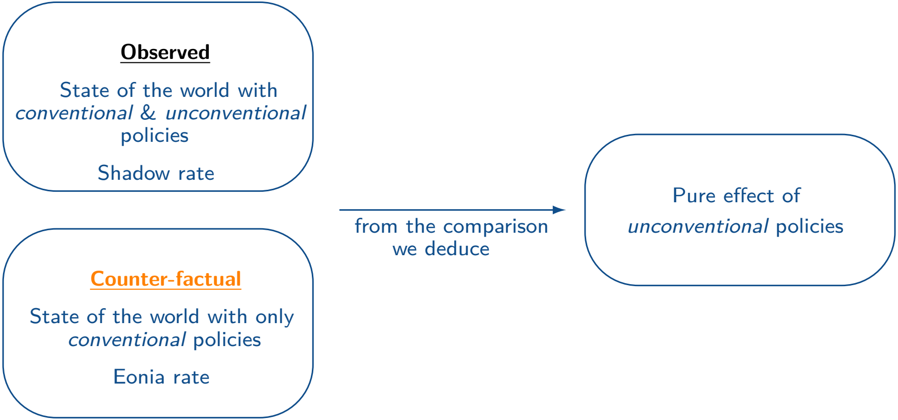
- Proxy for the total accommodation provided by conventional and unconventional monetary policies.

DSGE model description

- General equilibrium model à la Smets and Wouters (2007).
- Medium-scale model which has been successful in providing an empirically plausible account of key macroeconomic variables.
- Includes several shocks and real and nominal frictions.
- It features habit formation, investment adjustment cost, variable capital utilisation, monopolistic competition in goods and labor markets, and nominal price and wage rigidities.
- Estimation spans from 1980Q1 to 2016Q1.

Counter-factual analysis

- To assess the effects of unconventional policies, we build counter-factual scenarios which inform us about the state of the economy in the absence of such policies.

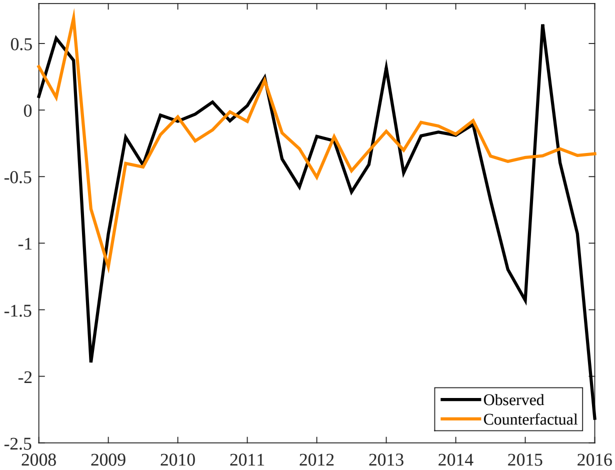


Counter-factual analysis

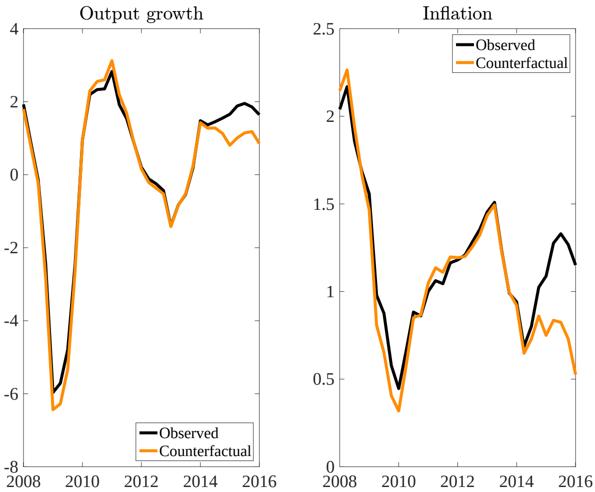
- In order to assess the effect of unconventional policies we build counter-factual scenarios which inform us about the state of the economy in the absence of such policies.

- We proceed as follows:
  1. We retrieve the monetary policy shock stemming from our estimation. These shocks are those from all monetary policy decisions ("observed").
  2. We re-estimate the standard deviation of the monetary policy shock by replacing the shadow rate by the usual Eonia rate, all other parameters staying fixed. These shocks are those that only come from the conventional part of monetary policy ("counter-factual").
  3. We compute the simulated time-paths for the observed variables from the estimated model with shadow rate using the first and the second set of monetary policy shocks.

Monetary policy shocks



Year-on-year output growth and inflation rates



Empirical results

Quantifying the macroeconomic effects of unconventional policies, we find that:

- Without unconventional measures, the euro area would have suffered:
  - a cumulative loss of output of around 19% of its pre-crisis level since the Great Recession,
  - deflation episodes in 2009Q1 and 2016Q1,
  - a slowdown in price increases in 2015 and 2016.
- This translates into year-on-year inflation and GDP growth that would have been on average about 0.3% and 0.5% below their actual levels over the period 2014Q1-2016Q1, respectively.

Robustness

Alternative shadow-rate measures

Cumulative loss

Variable	Measure				
	Benchmark	Kortela	Krippner	Lemke-Vladu	Wu-Xia
Output	19.44	18.74	37.57	7.36	21.46
Consumption	2.62	2.60	7.73	1.11	7.12
Investment	58.76	56.64	108.88	22.11	57.01
Hours worked	20.35	19.25	36.16	7.39	18.25
Real wage	2.57	2.86	7.64	1.23	5.82
Price level	8.84	9.53	23.57	5.50	17.82

The cumulative loss associated with the variable x_t is $\sum \left(\frac{x_t^c}{x_t^o} - 1 \right)$, where x_t^o is the observed level and x_t^c is the counterfactual.

Conclusion

- Through the lens of a DSGE model, we include the shadow rate to study the effects of unconventional monetary policies in the euro area.
- The shadow rate is used as a summary measure of the overall stance of monetary policy.
- Counter-factual analysis is conducted to study the state of the economy in the absence of the ECB's unconventional policies.
- We find that these policies have had positive macroeconomic effects, notably on output and prices.

Q & A Session

Thank you for your attention!

Appendix

Shadow rate

- Theoretically, nominal interest rates should not fall below the ZLB due to the option of holding cash.
- Black (1995) provides a way to compute the value of an option to hold cash at the ZLB.
- Despite the theoretical bound set at zero, episodes of negative policy rates have occurred in the euro area since June 2014.
- With an objective of fit in mind, one can consider rendering the lower bound time-varying.
- However, any variation in the lower bound can be problematic in gauging the monetary policy stance.
- We thus opt for a constant lower bound, set at zero.

Appendix

Shadow rate

Let X_t be the latent state variables, $y(t, T)$ the nominal yield at time t for maturity T, r_t be the short-rate and s_t the shadow-rate.

- Gaussian models (no ELB-constraint):
  - Short-rate:

$$r_t = a + bX_t$$

  - Yields are an affine function of X_t:

$$y(t, T) = c + dX_t$$

- Shadow-rate models (with ELB-constraint):
  - Short-rate:

$$r_t = max\{ELB, s_t\}$$
$$s_t = a + bX_t$$

  - Let $g(.)$ be a non-linear function; yields are a non-linear function of X_t:

$$y(t, T) = g(X_t)$$

Appendix
Shadow rate

Let $X_t = (L_t, S_t, C_t)'$ be the latent state variables.

- Short rates:

$$r_t = max\left\{0, s_t\right\}$$
$$s_t = L_t + S_t$$

- Transition equation:

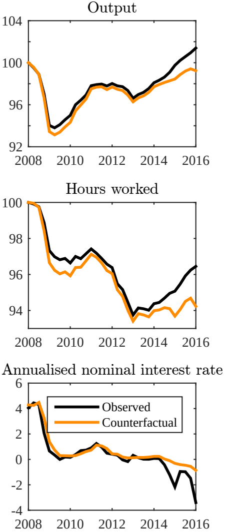
$$dX_t = \kappa^{\mathbb{P}}\left(t\right)\left[\theta^{\mathbb{P}}\left(t\right) - X_t\right] dt + \sigma dW_t^{\mathbb{P}}$$

- Measurement equations:

$$y(t,T) = \frac{1}{T-t}\int_t^T \left[f(t,s)\Phi\left(\frac{f(t,s)}{\omega(t,s)}\right) + \omega(t,s)\frac{1}{\sqrt{2\pi}} exp\left(-\frac{1}{2}\left[\frac{f(t,s)}{\omega(t,s)}\right]^2\right)\right] ds$$

Appendix

Observed series and counter-factual estimate



Appendix

Monetary policy measures in the euro area and the shadow rate