The optimal duration of the forward guidance at the zero lower bound

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Presentation Outline

1. Intro and related literature
2. Research question and our approach
3. The model
4. Optimal forward guidance.

Introduction

- In recent years the nominal interest rate has hit the zero lower bound, thus limitating the ability of the monetary policy to facilitate the real economy recover after a slump.
- Forward guidance, i.e., the practice of communicating the future path of monetary policy instruments, seems to be an effective tool to restore monetary policy efficacy.
- By announcing its intentions about the future monetary stance, the central bank is thus able to manipulate private sector expectations' and leading to a gradual recovery of the economic conditions.
- A growing number of central banks around the world have adopted forward guidance as a monetary policy tool to accomplish two goals: stimulating the economy and restoring monetary policy efficacy when the zero lower bound is hit.

Related literature

- Eggertsson and Woodford (2003) show that negative shocks causing the economy to hit the zero lower bound induce a powerful deflation and a severe economic downturn. The recession can be overcome by committing to hold the interest rate at zero for a few additional periods.
- Gurkanyak, Sack and Swanson (2005) find that FED announcements accounts for more than three-fourths of the explainable variation in the movements of five- and ten-year Treasury yields around FOMC meetings.
- Campbell *et al.* (2012) show that "open-mouth operations" can improve current macroeconomic outcomes, by altering current expectations of future inflation and output.
- Woodford (2012) argues that forward guidance can be more effective when it has an element of commitment or at least a promise about future policy rates instead of just providing forecasts.

Forward guidance puzzle

- Del Negro *et al.* (2015), show that standard DSGE models tend to grossly overestimate the impact of forward guidance on the macroeconomy (forward guidance puzzle, FGP henceforth).
- These effects grow in the horizon of the forward guidance (McKay *et al.*, 2016).
- Thus, macroeconomic predictions of the forward guidance effects can be altered by this puzzle.

Research question and our approach

- Our aim is twofold:
  1. Solving the forward guidance puzzle;
  2. Investigating for how many periods should be optimal to pursue forward guidance.
- We propose an alternative approach to solve the FGP, assuming that expectations are formed according to a mechanism of bounded rationality (Branch and McGough, 2009).
- Then, we use our model to study what is the optimal duration of forward guidance when the zero lower bound is hit.

The model setup

- We consider a simple generalization of the standard small–scale New Keynesian DSGE model to account for bounded rationality.
- Our economy is populated by two kind of agents, who differ in the way they form their expectations.
- A fraction α of them have rational expectations; the remaining $1 - \alpha$ fraction form expectations according to a mechanism of bounded rationality.
- Apart from the heterogeneity in the expectation formation, the heterogeneous expectations (HE) model is standard, i.e., it is characterized by monopolistic competition in the goods market and the presence of nominal price rigidities.

The HE model

- The HE–DSGE model can be represented as follows:

$$\begin{aligned} y_t &= \mathcal{E}_t y_{t+1} - \frac{1}{\sigma}\left(i_t - \pi_{t+1}\right) \\ \pi_t &= \beta \mathcal{E}_t \pi_{t+1} + \kappa y_t \end{aligned}$$

  where the operator $\mathcal{E}_t$ indicates the average expectation.
- In general, average expectations at t for any variable x at $t+1$ are defined by the weighted average of expectations of rational ($\mathcal{R}$) and boundedly rational agents ($\mathcal{B}$), i.e.,

$$\mathcal{E}_t x_t = \alpha \mathcal{E}_t^{\mathcal{R}} x_{t+1} + (1-\alpha)\, \mathcal{E}_t^{\mathcal{B}} x_{t+1}$$

- Rational agents form their expectation as

$$\mathcal{E}_t^{\mathcal{R}} x_{t+1} = E_t x_{t+1}$$

- Non-rational agents form expectations according to the following rule

$$\mathcal{E}_t^{\mathcal{B}} x_{t+1} = \theta^2 x_{t-1}$$

  where θ is the adaption parameter.

Expectations formation and the effects of forward guidance

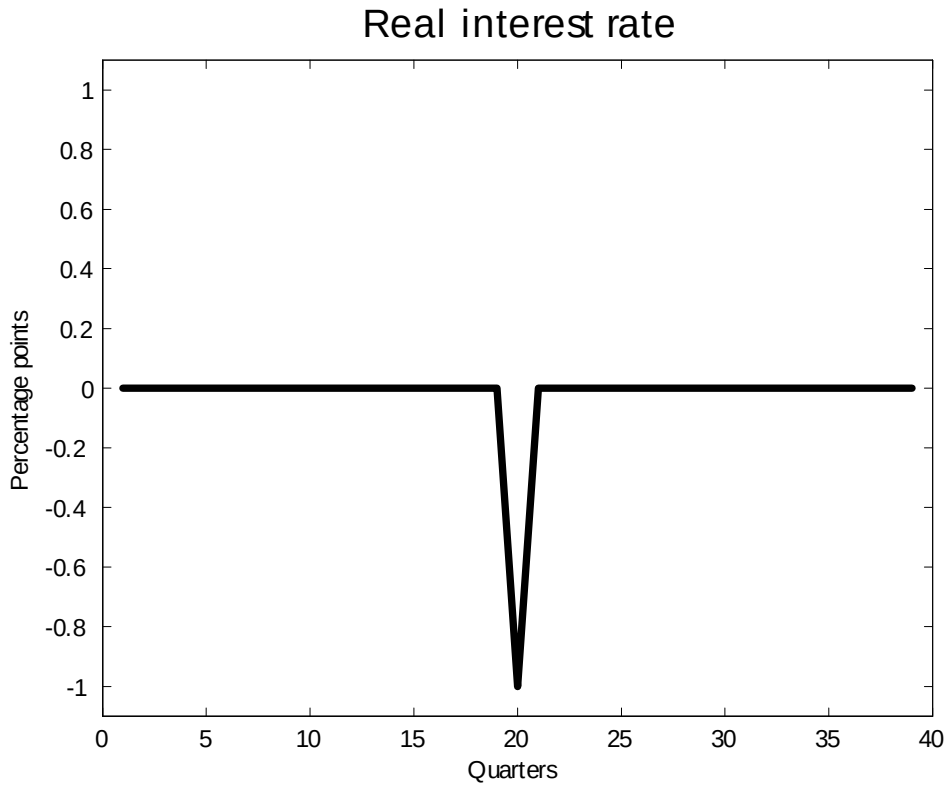
- In order to quantify the effects of our analytical results on FGP we use numerical simulations.
- The parameters governing the expectation-formation process, α and θ, are calibrated to fit the relationship between ex-post mean forecast errors and ex-ante mean forecast revisions.
- Empirical estimation of the expectation-formation process suggest a model consistent share of fully rational agents α equal to 0.77 and an adaption operator θ equal to 0.95.

Table 1 – Model calibration

		Common	Scenario	
			RE	BR
β	discount factor	0.99		
κ	Phillips curve slope	0.056		
α	degree of bounded rationality		1.00	0.77
θ	adaption parameter		1.00	0.95

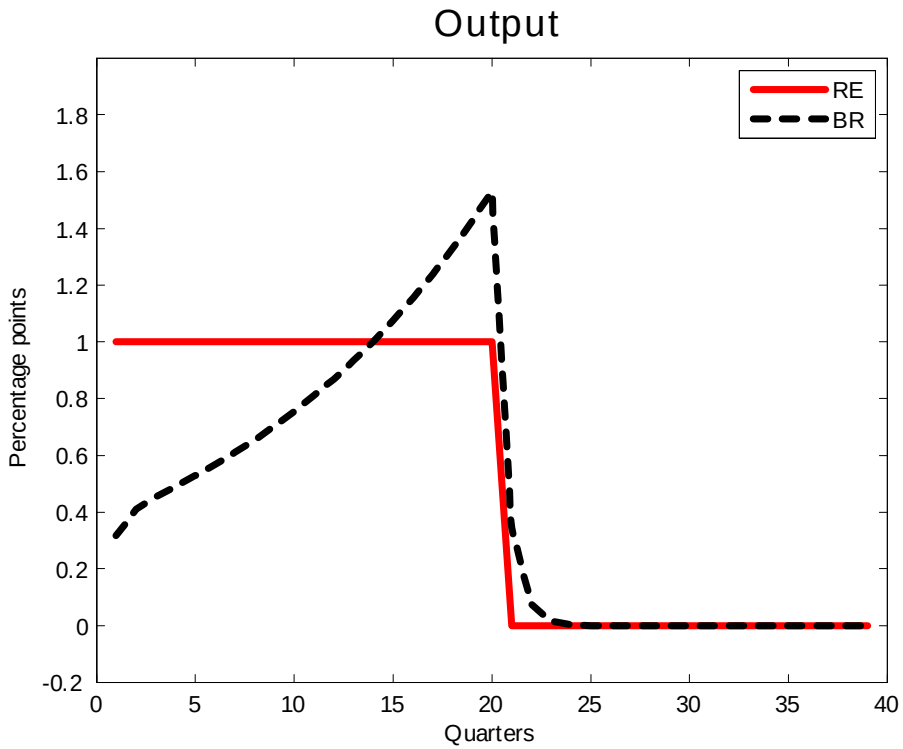
Policy experiments

- The central bank announces a certain path for the policy rate rate.
- We assume that the announced path for the policy rate is designed such as the real interest rate will drop of 1% after 5 years.
- In other words, the announcement is designed such as the real interest rate will be lower by 1% for a single quarter 5 years in the future.



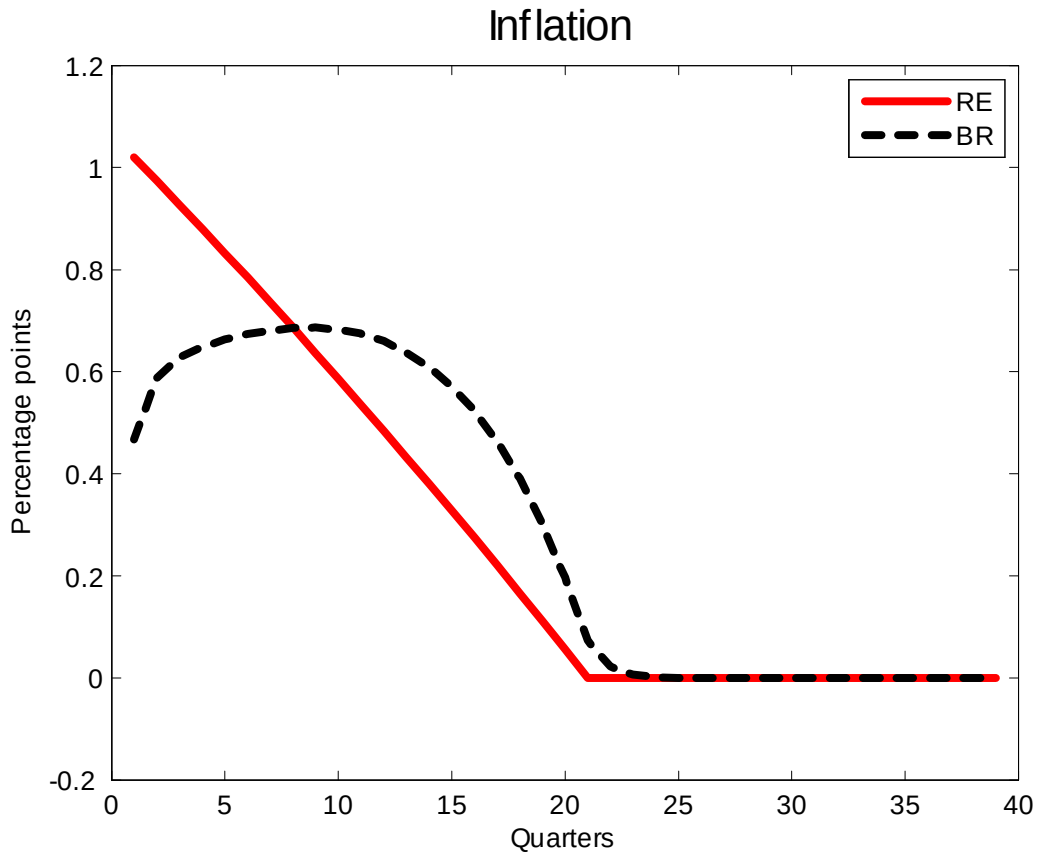
Forward guidance effects on output

- In the basic NK scenario, the IRF is a step function. Output jumps up immediately by 1% and return to the steady state after 5 years.
- When bounded rationality is considered, output gradually rises. Hint: (some) agents understand the effects of the announcements about policy rates as far as the time of the planned cut in the real interest rate occurs (i.e., period 20).



Forward guidance effects on inflation

- In the RE scenario inflation jumps immediately and, after the interest rate cut, goes back to the equilibrium. In the BR scenario, the response of inflation is hump shaped with a peak about the period when the real interest rate falls.

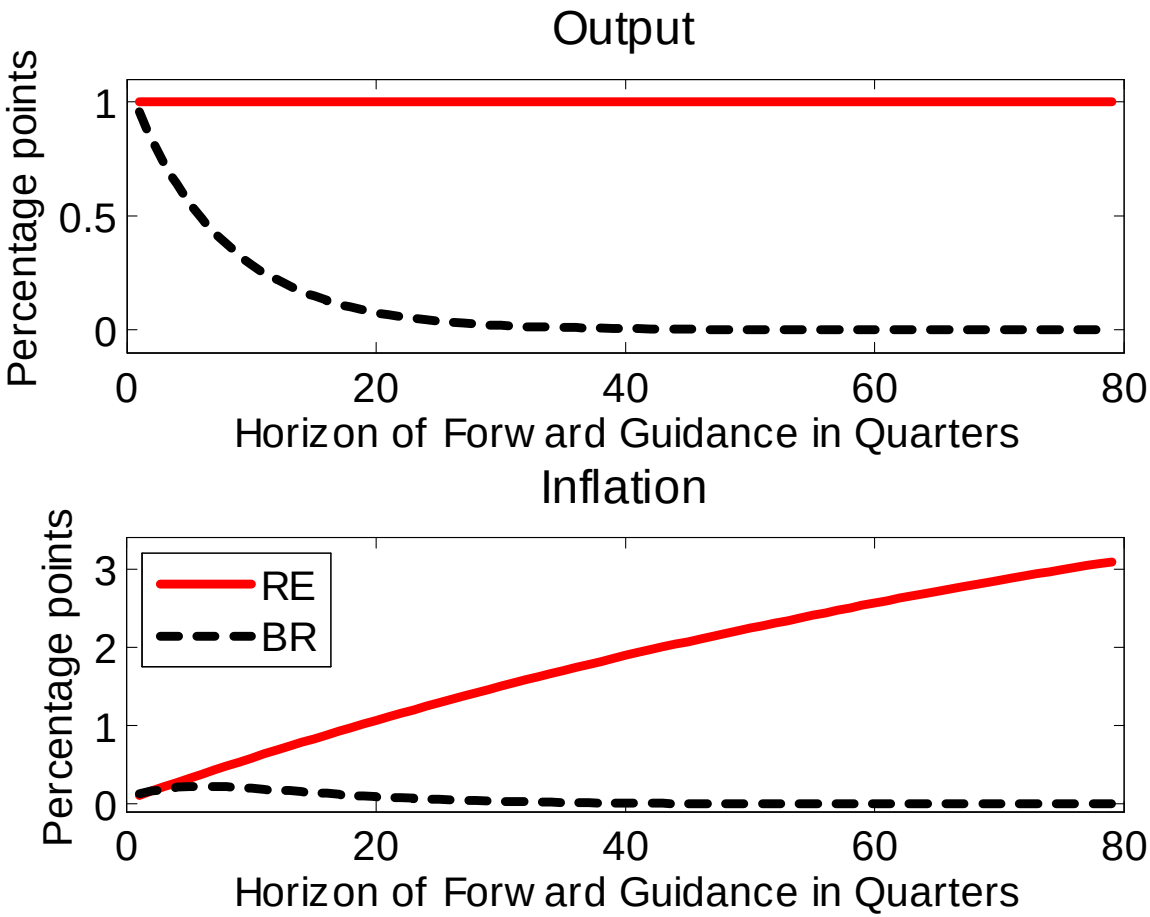


Comments

- The different paths depend on expectations. Sticky prices in both cases imply that firms in setting their prices should account for future marginal costs (measured by inflation expectations).
- In the baseline model, firms anticipate the increase when the real interest rate falls, but they will also anticipate the anticipations.
- In other words, at quarter 19, the increase in prices is unnecessary if prices were flexible, but firms understand that they may be not able to raise prices at quarter 20 (when marginal cost increases) and partially anticipate the price increase.
- Nevertheless, at quarter 18, in a similar manner, they anticipate the increases in quarter 19 and 20, and so on.
- In a HE context, firms still set prices according to their expectations, but now these are smoothed by the bounded–rationality mechanism and, thus, their effects on current outcomes are not magnified.

Forward guidance at different horizon

- Response of current output and inflation to forward guidance about interest rates at different horizons (deviations from the steady state).



Comments

- RE case: due to the sticky prices, inflation is anticipated, and anticipations are anticipated as well. Thus, the current impact of forward guidance on current inflation is magnified by the forward guidance horizon.
- BR case: the impact of forward guidance on current output and inflation is mild and falls in its horizon.
  - As a fraction of agents do not perfectly smooth consumption, output behaves as though there is a discount factor on future consumption in the Euler equation that tempers the effects of real interest rate changes more and more the further in the future.
  - Inflation *is anticipated* and anticipations *are anticipated* as well due to price stickiness, but now expectations of the fraction of boundedly rational price–setters are adaptive; as a consequence, they smooth the aggregate inflation dynamics.

Recession and ZLB

- To study how the economy responses change when forward guidance is implemented we assume that a negative shock to the preferences hits the economy and brings down both inflation and output gap.
- If the ZLB is not binding, the recession can be contrasted by simply lowering the nominal rate. This entails a decrease in the real rate favouring the economic recovery.
- When the zero lower bound becomes binding, the central bank can decrease the nominal interest rate but not as much as required by the negative economic conditions.
- Monetary policy looses its efficacy in helping the economy to recover from the recession, causing a longer and deeper fall of the output gap and inflation. It is observed an increase of the real rate, entailing a drop of the private consumption.

Forward guidance policy

- To overtake the problems arising under a binding ZLB, the central bank, through its announcements and statements, can commit to keep the nominal interest rate to zero for a longer period.
- If the announcement is credible, the monetary authority may influence the private sector expectations' about the future level of the policy rates.
- Rational agents will incorporate this information in their information set and adjust their forecast accordingly.
- Moreover, as current inflation mainly depends on expectations on future inflation, lower future interest rate will entail higher inflation in the future, involving, in turn, higher inflation today.
- The real rate increases less and the recession is mitigated.

Simulation

- Our aim is to reproduce this environment. We assume that a negative preference (demand) shock hits the economy and the ZLB is hit for 4 periods. We simulate our model under three different scenario:
  1. ZLB not binding;
  2. Presence of the ZLB constraint;
  3. Forward guidance for two more periods with respect to the duration of the ZLB.

Monetary authority

- The central bank adjusts the nominal interest rate i_t according to a Taylor rule:

$$i_t = \rho_i i_{t-1} + (1 - \rho_i)(\delta_\pi \pi_t + \delta_y y_t)$$

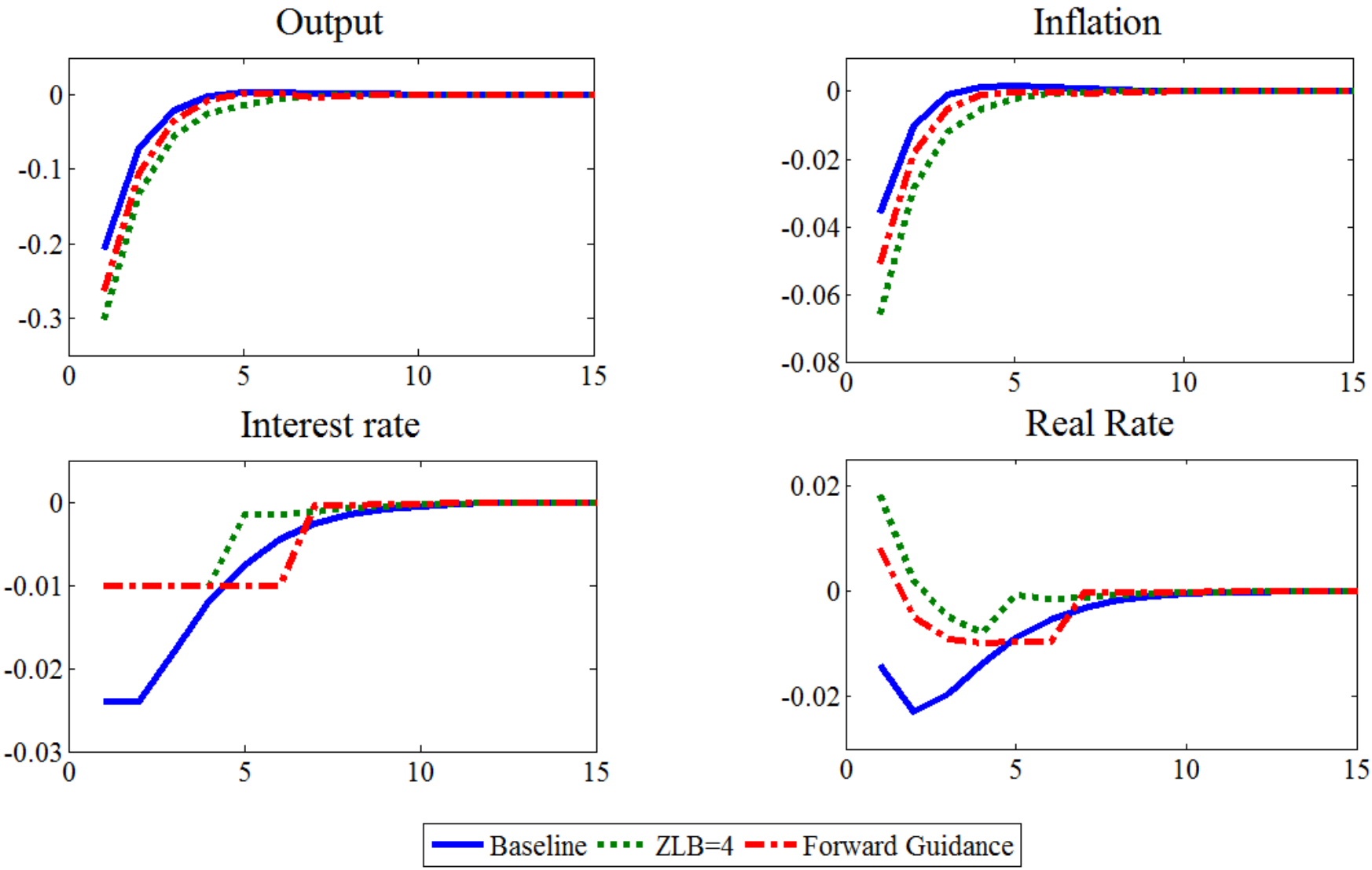
- As in our framework the zero lower bound is binding, we add the following constraint to the nominal interest rate:

$$i_t = \max(0, i_t^*)$$

  with i_t^* denoting the shadow rate, i.e., the rate that would prevail in absence of the zero lower bound.

- Thus, there is a floor, represented by zero, under which the nominal interest rate cannot fall.

Model dynamics



Comments

- Credible announcements about lower policy rates have the power to mitigate a recession when the zero lower bound is hit.
- Nonetheless, keeping the interest rate at zero for a period too longer than required can destabilize the economy.
- Too low interest rates can put upward pressure to inflation; accordingly agents adjust their forecast expecting also for the current period high inflation.
- Thus, we want to investigate what should be the optimal duration of the forward guidance.

Welfare analysis

- The loss function evolves as:

$$\mathcal{L}_t = \frac{1}{2} E_0 \sum_{t=0}^{\infty} \beta^t \left[\pi_t^2 + \lambda y_t^2 \right]$$

  where λ measures the relative weight of output gap stabilization with respect to inflation stabilization.

- Again, it is assumed that a negative demand shock hits the economy. In absence of a binding ZLB the nominal rate should fall under zero for four periods.

Forward guidance and welfare losses

Table 2 - Forward guidance and welfare losses

Model	Welfare loss
ZLB	0.671
FG=1 periods	0.573
FG=2 periods	0.427
FG=3 periods	0.273
FG=4 periods	0.176
FG=5 periods	0.251
FG=6 periods	0.692

- When the central bank implements the forward guidance it is able to obtain significant welfare improvements.
- Nonetheless, keeping the policy rate at zero for longer can be harmful, as it could generate a too high variability of inflation and output gap, involving high welfare losses.

Conclusions

- We have shown that allowing for bounded rationality in the expectations formation mechanims solve the FGP.
- When the zero lower bound is binding, the forward guidance is effective to reduce the welfare losses associated with a negative demand shock.
- Nonetheless, forward guidance is an instrument that should be used with attention: in fact, keeping nominal rates at zero for too long periods can create more damages than benefit as it puts upward pressure on inflation, thus generating a strong inflationary spiral and destabilizing the economy.

Thank you for your attention!!!