16TH JACQUES POLAK ANNUAL RESEARCH CONFERENCE
NOVEMBER 5–6, 2015

Monetary Policy, Incomplete Information, and the Zero Lower Bound

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Paper presented at the 16th Jacques Polak Annual Research Conference
Hosted by the International Monetary Fund
Washington, DC─November 5–6, 2015

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Motivation

If the Fed wants to see full employment of capital and labor resources (which, of course, it does), then its task amounts to using its influence over market interest rates to push those rates toward levels consistent with the **equilibrium rate**, *or–more realistically–its best estimate of the equilibrium rate, which is* **not directly observable**.

– Ben Bernanke's Blog 3/30/2015

Monetary Policy, the ZLB, Imperfect Information

In our New Keynesian model, the monetary authority:

- Faces incomplete information about the equilibrium real rate
- Is constrained by the zero lower bound

We analyze:

- Optimal policy under discretion
- Simple policy rules

Preview of the Results

Optimal policy:

- *Attenuates* the responses to noisy signals about the current state of the economy
- Near the ZLB, this attenuation is magnified because of *asymmetric risks*

Simple rules:

- Taylor-type rules approximate optimal policy if:
  - The intercept varies with the best estimate of the equilibrium real rate
  - Responds *aggressively* to deviations of both output and inflation from targets
- First-difference rules:
  - Carry forward misperceptions about the state of the economy

Literature Review

Optimal monetary policy and the ZLB

- Eggertsson and Woodford (2003), Adam and Billi (2007), Nakov (2008), Levin *et al.* (2010), Evans *et al.* (2015)

Optimal monetary policy and imperfect information

- Svensson and Woodford (2003, 2004), Aoki (2003)

Simple interest-rate rules

- Taylor (1993, 1999), Orphanides and Williams (2002), Boehm and House (2014)

The Model

A parsimonious New Keynesian model

$$\begin{aligned} x_t &= E_t\{x_{t+1}\} - E_t\{i_t - \pi_{t+1} - r_t^e\} \\ \pi_t &= \beta E_t\{\pi_{t+1}\} + \kappa[x_t + \mu_t] \\ i_t &\geq ZLB \end{aligned}$$

- r_t^e corresponds to the real rate in the economy with flexible prices and without monopolistic distortions
- μ_t as well as the ZLB introduce a tradeoff between inflation and output stabilization (no "divine coincidence")
- It will not be optimal to pursue a policy in which the real rate equals the efficient real rate

Optimal Policy and Imperfect Information

Central bank problem:

$$\min \frac{1}{2} \sum_{t=0}^{\infty} \beta^t \mathbb{E} \left\{ \pi_t^2 + \lambda x_t^2 | \text{CB Info} \right\}$$

taking private sector expectations as given.

Information structure:

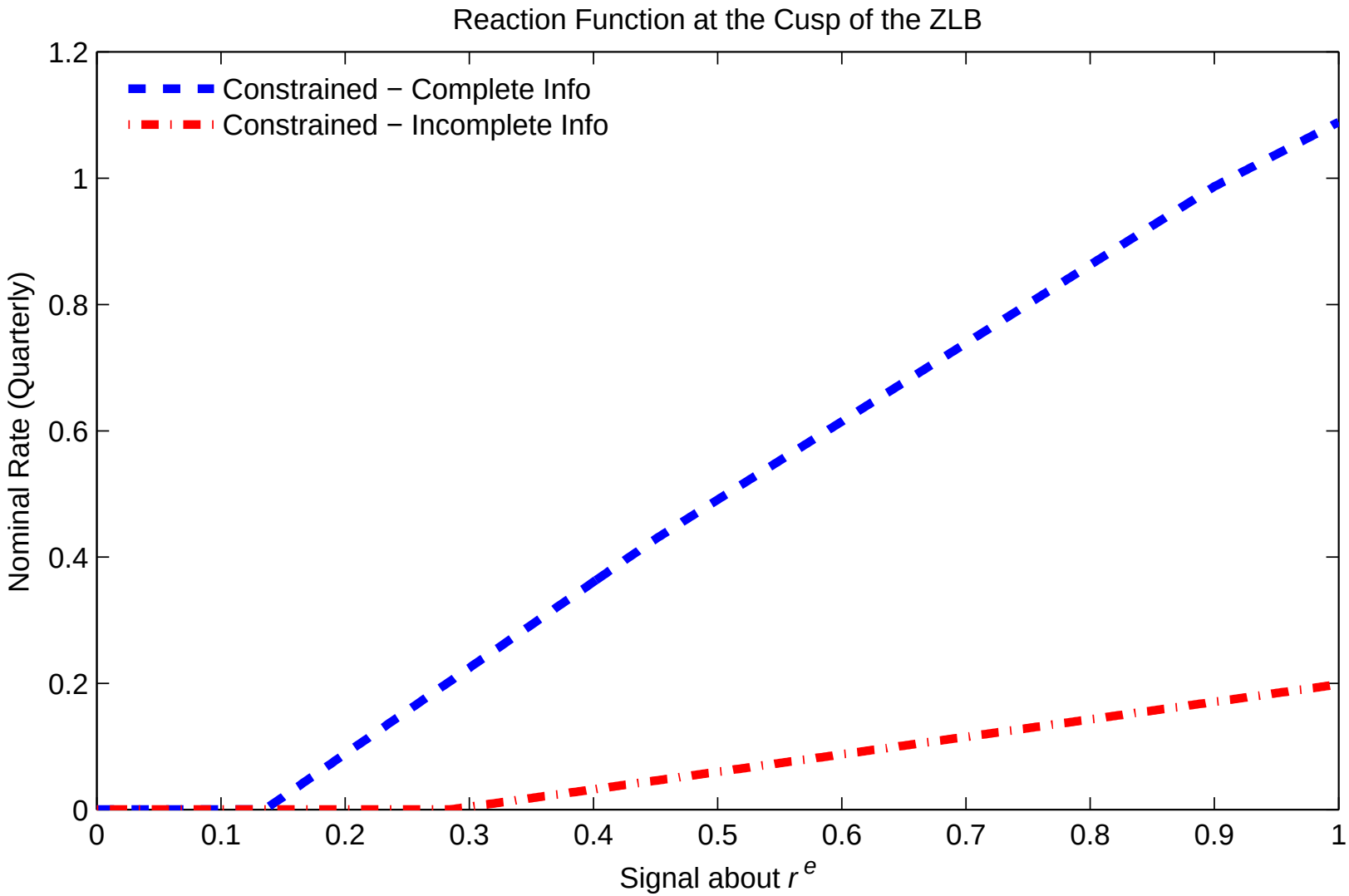
- Private sector sees all shocks up to time t
- CB sees all shocks up to time $t-1$ and noisy signals at time t
  - A now-casting problem
  - Sequential decision making in which CB goes first (infrequent meeting dates)
  - Uncertainty about r_t^e, μ_t, **and** π_t, x_t

Optimal Interest Rate and Imperfect Information

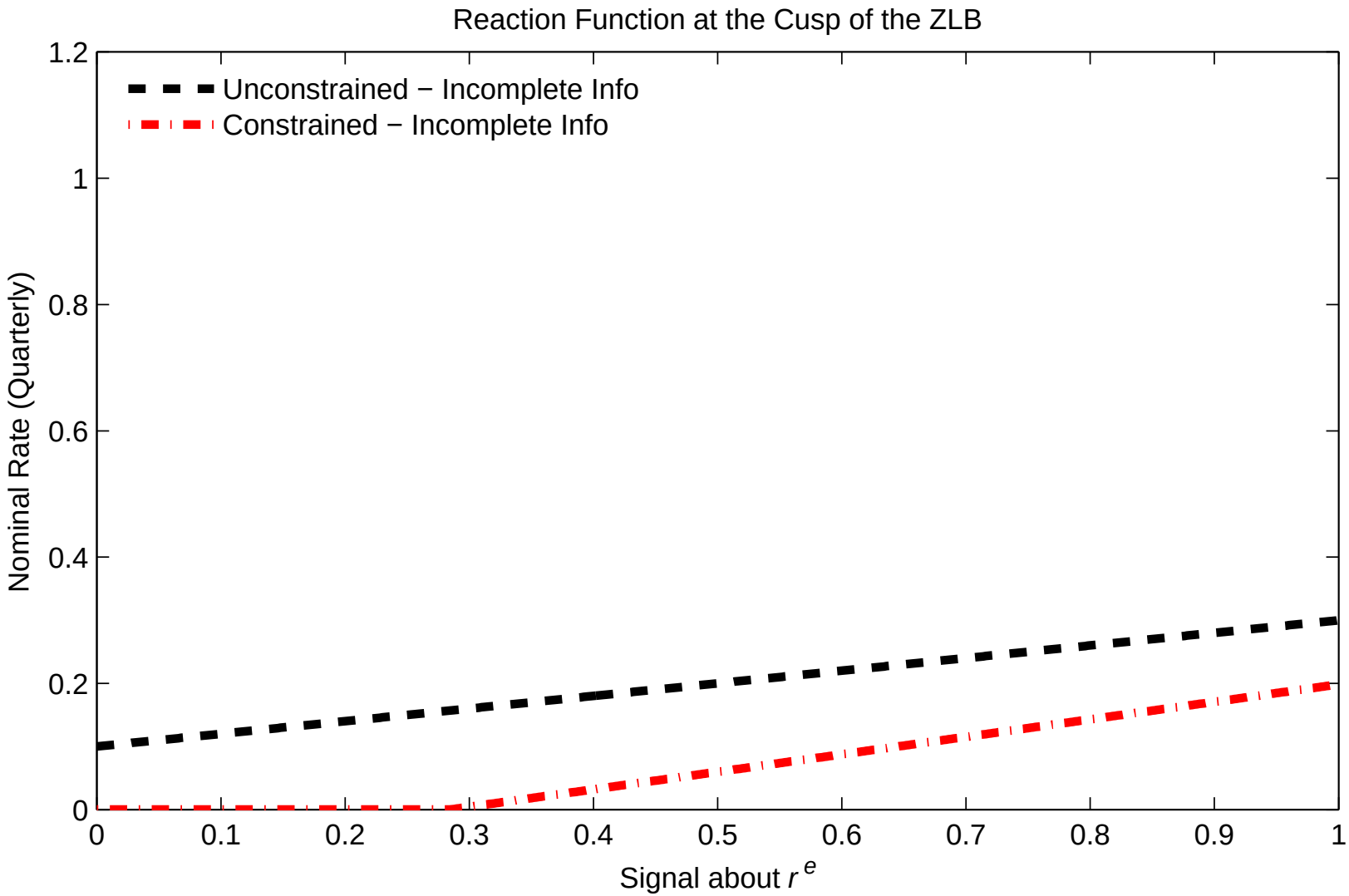
$$i_t = \max\left\{ZLB,\ \mathbb{E}\left\{r_t^e + E_t\{x_{t+1}\} + E_t\{\pi_{t+1}\} + \frac{\kappa}{\lambda}\pi_t | \text{CB Info}\right\}\right\}$$

- The central bank needs to form expectations about private-sector expectations
- Changes in the expected equilibrium real rate translate one-by-one to changes in the policy rate

Optimal Discretion with Imperfect Information



The ZLB and Optimal Discretion

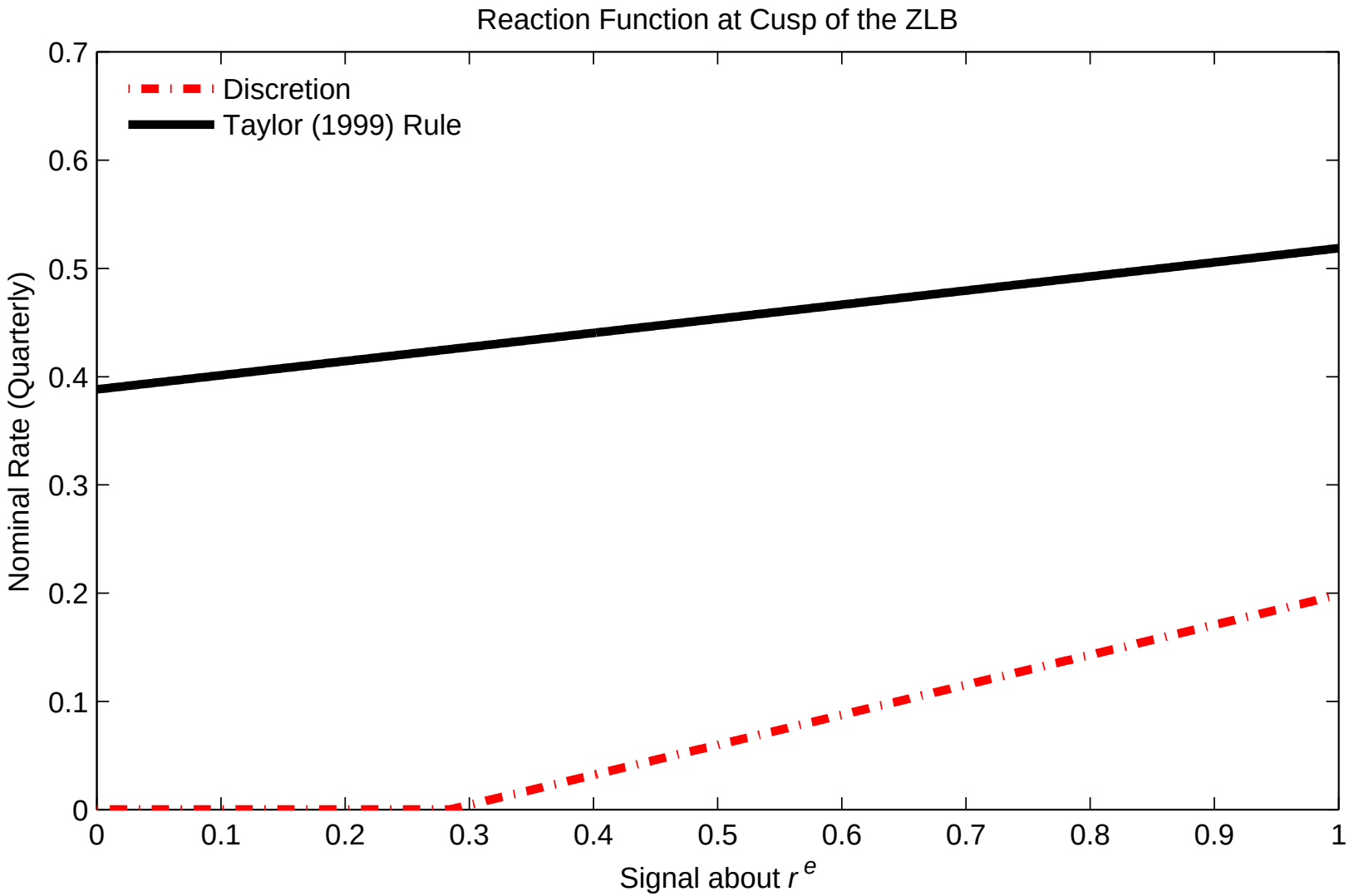


Taylor-type Rules

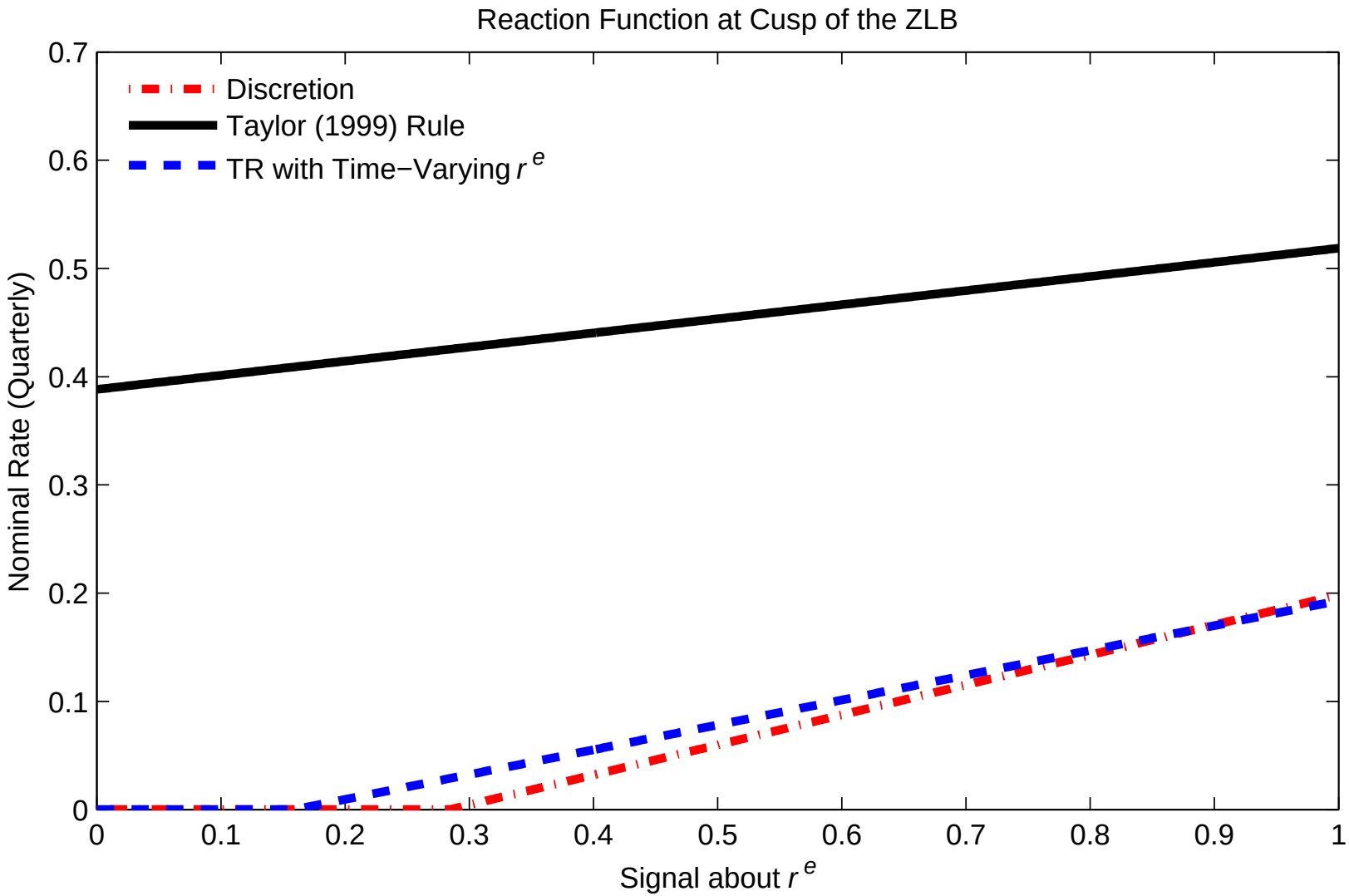
$$i_t = \max\{ZLB,\ \mathbb{E}\{\alpha r_t^e + \gamma_\pi \pi_t + \gamma_x x_t | \text{CB Info}\}\}$$

- $\alpha = 0$ corresponds to the standard case
- $\alpha = 1$ introduces a time-varying intercept in the rule
- CB responds to its *best estimate* of r_t^e, π_t, and x_t

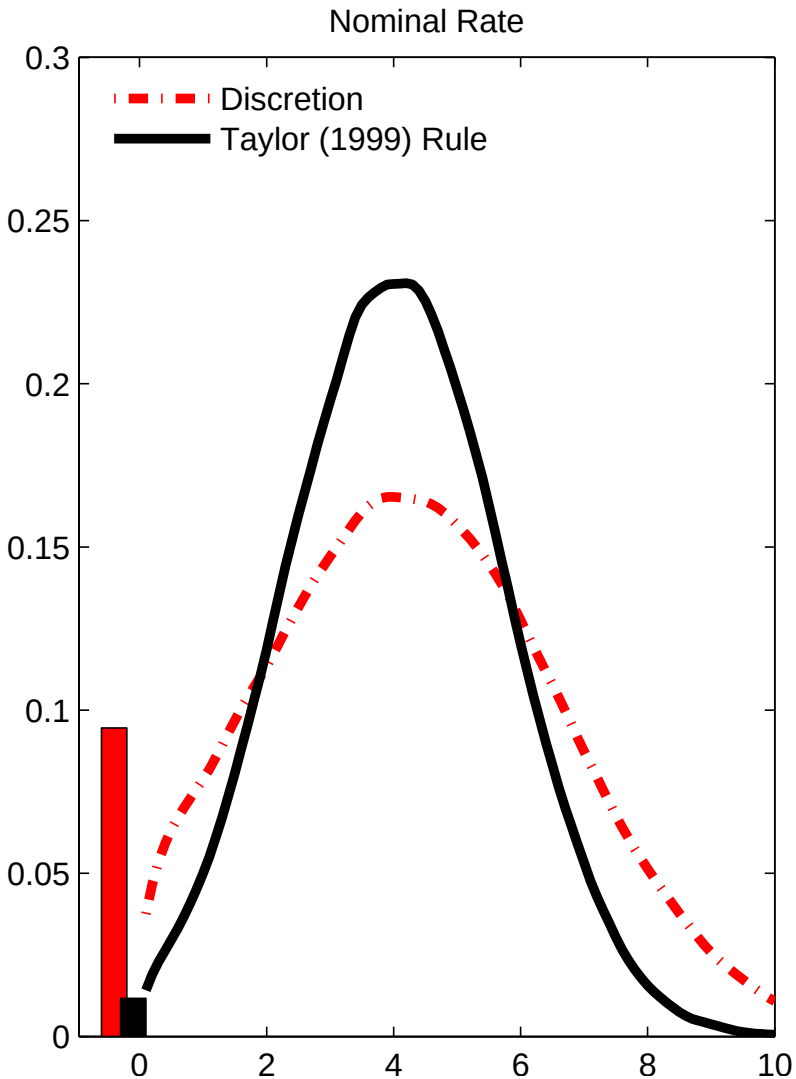
Taylor Rules and the ZLB

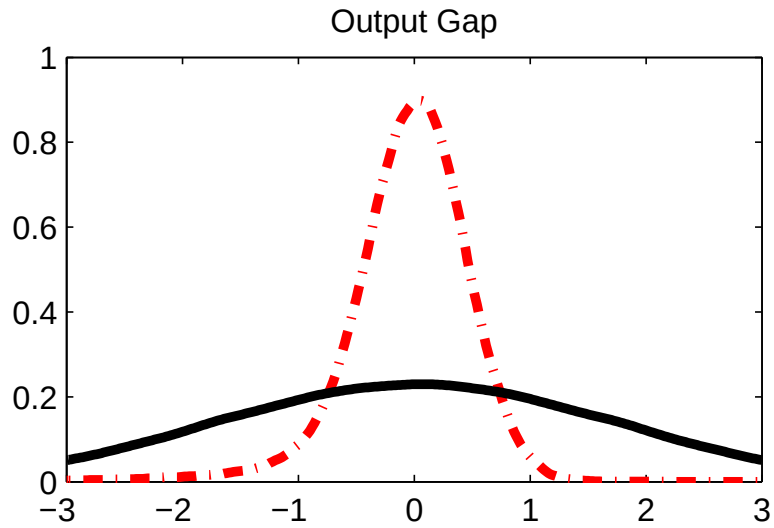


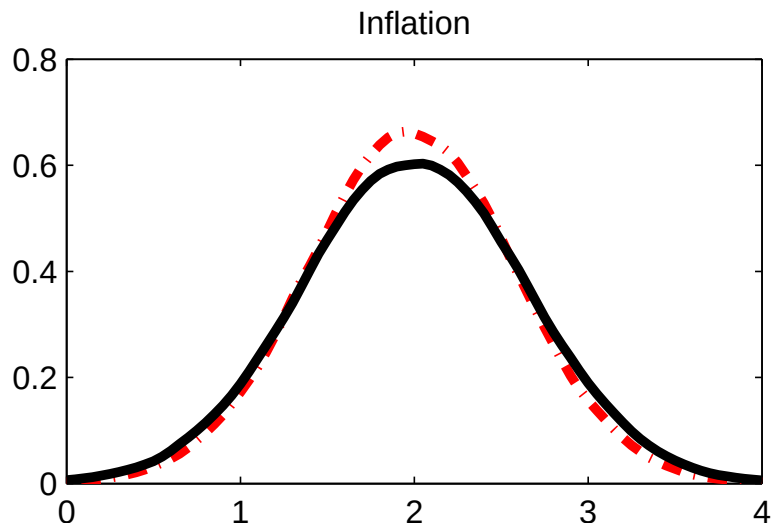
Taylor Rules and the ZLB



Outcomes under Alternative Taylor rules







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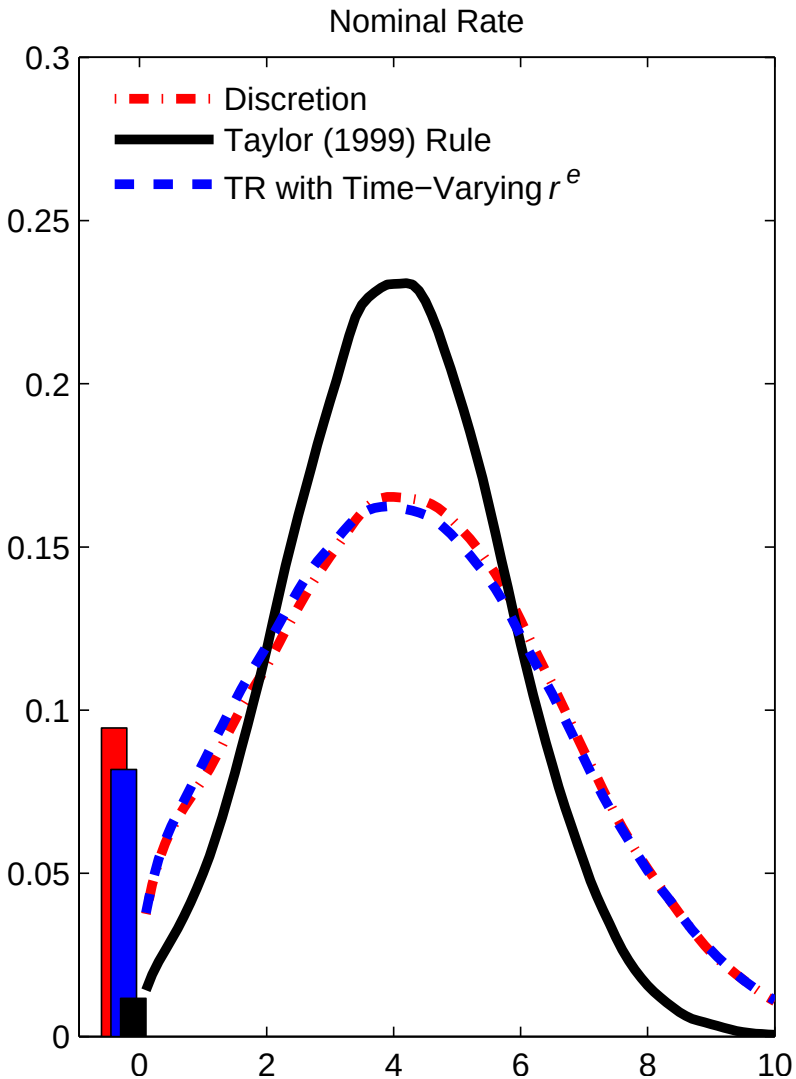

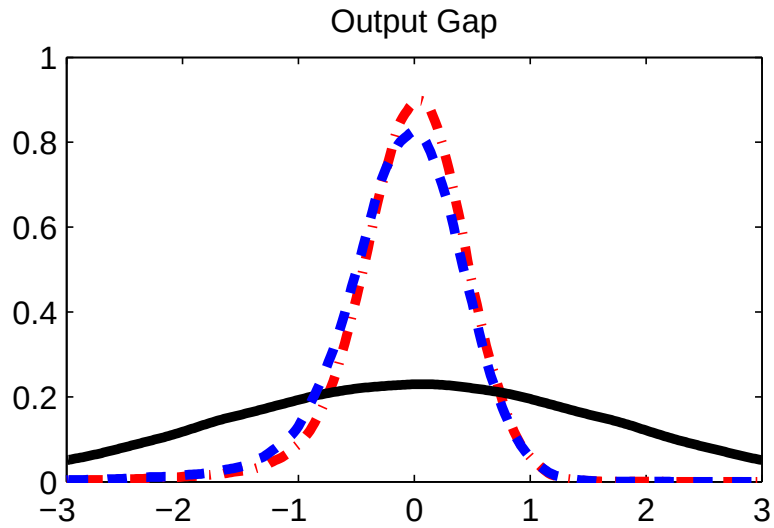

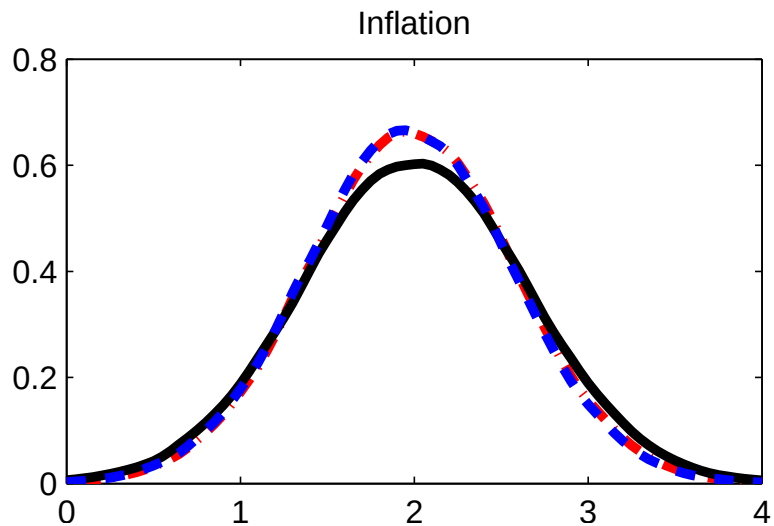

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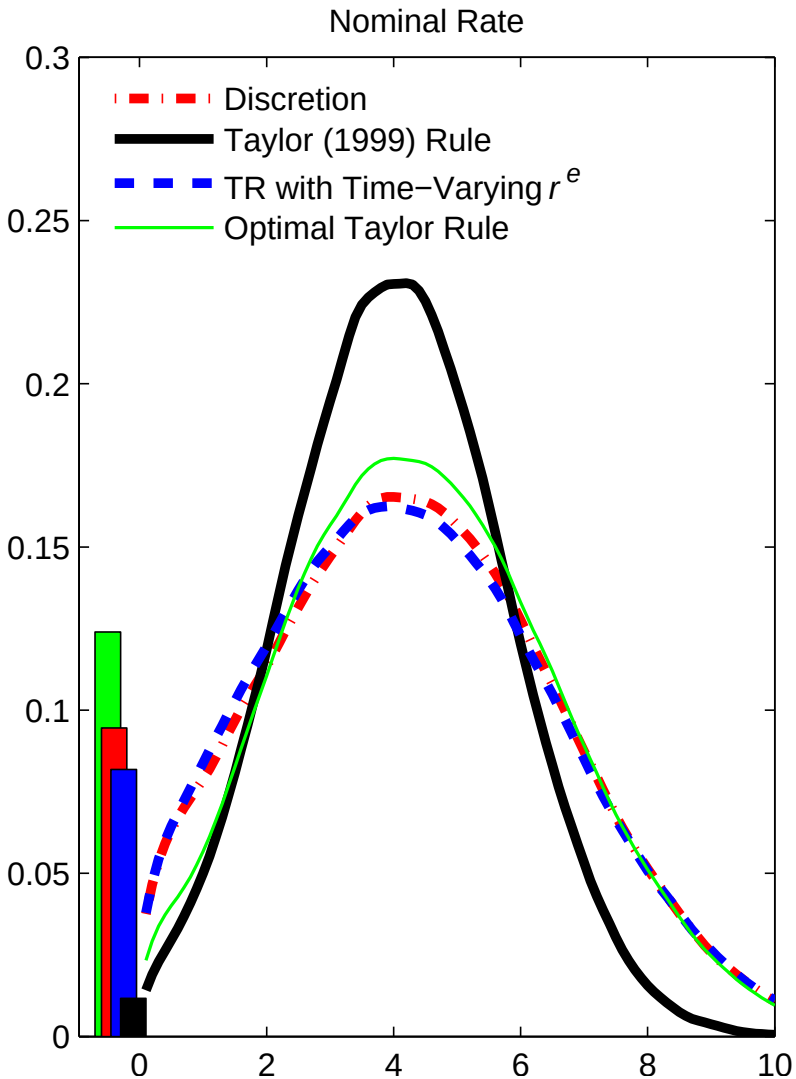
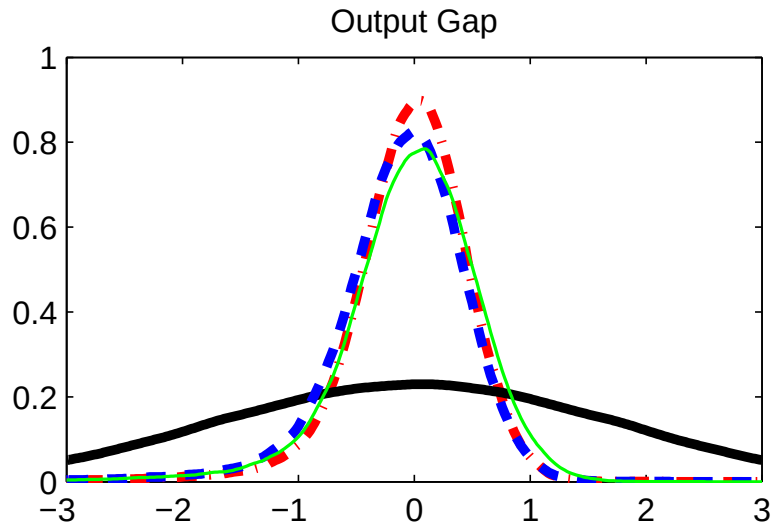
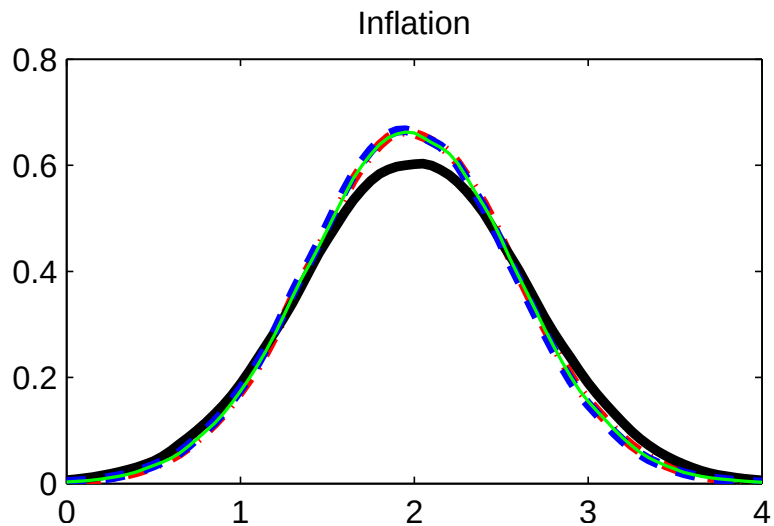




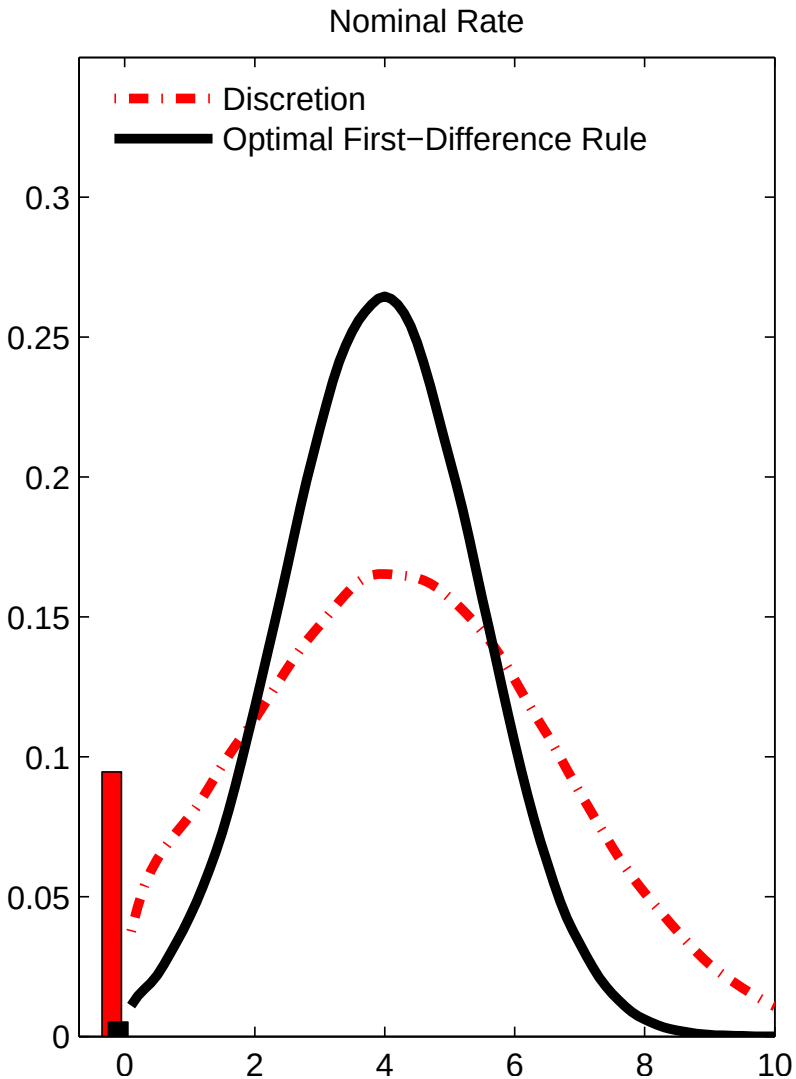


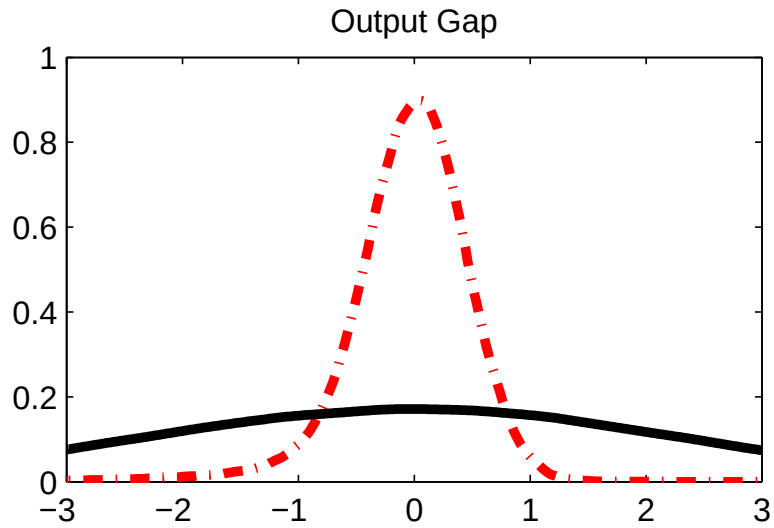
First-Difference Rule

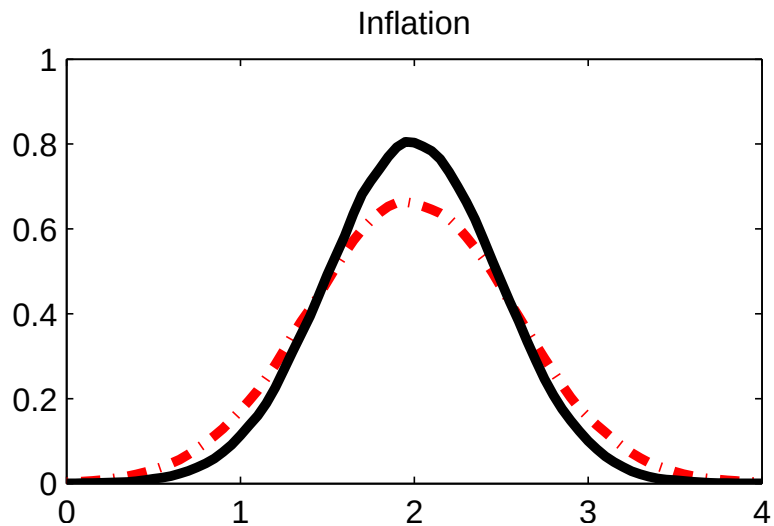
$$i_t = \max\left\{ZLB,\ i_{t-1} + \mathbb{E}\left\{\gamma_\pi \pi_t + \gamma_y (y_t - y_{t-1}) \middle| \text{CB Info}\right\}\right\}$$

- Policy rate does not directly depend on r_t^e
- Current policy moves one-by-one with previous policy rate
- As a result, i_t fully carries forward now-casting mistakes

Outcomes under First-Difference Rule







Conclusions

- Relative to normal times, the ZLB *attenuates* the optimal response to noisy signals because of *asymmetric risks*
  - *Risk-management* approach that insures the economy against undesirable (*ex-post*) outcomes
  - Our model calls for a *cautious response* to incoming information
- *Taylor-type rules* approximate optimal policy by *aggressively* responding to deviations of both output and inflation from targets
- *First-difference rules* carry forward misperceptions about the state of the economy