Discussion:
A Shadow Rate New Keynesian Model

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Outline

1. Brief Summary
2. Comments

Monetary Policy

- Monetary policy is nominal spending or aggregate demand control.
  - Quantity Theory of Money

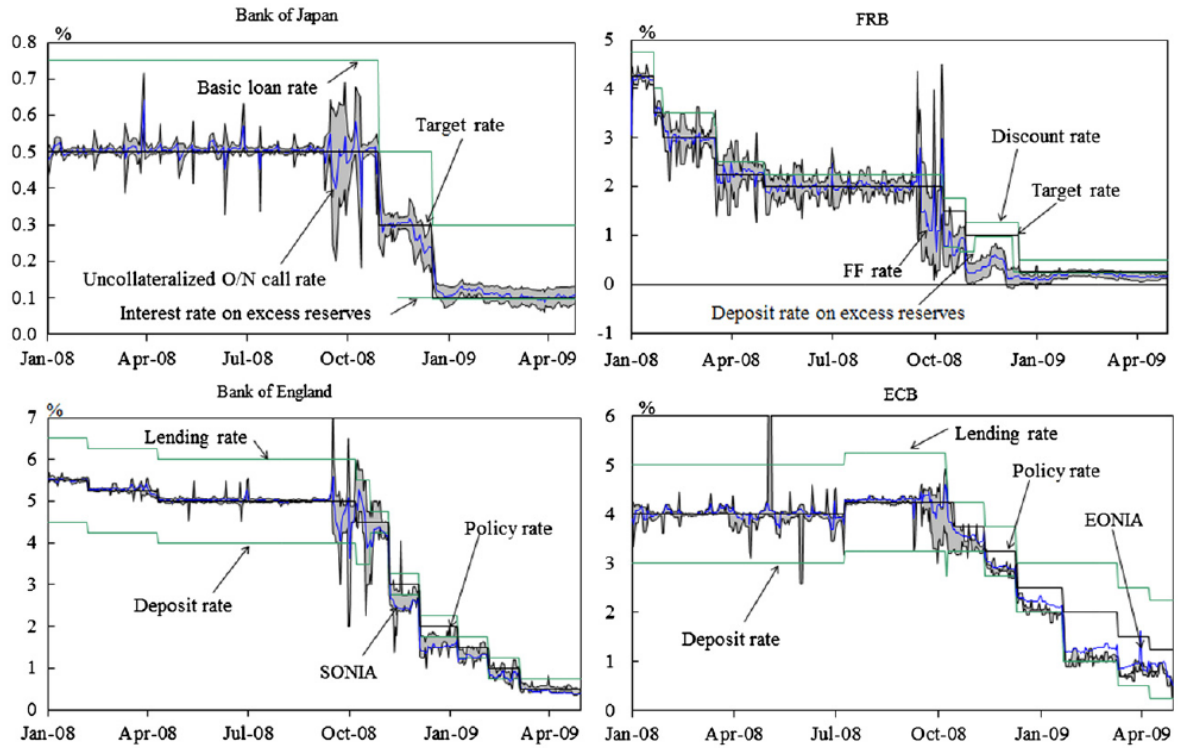
$$M_t V_t = P_t Y_t.$$

  - New Keynesian Model (log utility)

$$\beta (1 + i_t) = \frac{P_{t+1} C_{t+1}}{P_t C_t}.$$

- When nominal interest rates are constrained at zero, monetary policy loses its effectiveness.

(Global) Liquidity Trap



Fujiwara and Ueda (2013)

New Keynesian Model (NKM)

- Dynamic IS Equation (Euler Equation):

$$x_t = x_{t+1} - \sigma \left(i_t - \pi_{t+1} - r_t^n \right).$$

- New Keynesian Phillips Curve:

$$\pi_t = \beta \pi_{t+1} + \kappa x_t + e_t.$$

- Monetary Policy:

$$i_t = \max \left[0, \rho i_{t-1} + (1-\rho) \left(\alpha_\pi \pi_t + \alpha_x x_t + u_t \right) \right].$$

- In a standard new Keynesian model, it is usually assumed that
  - consumers (or private agents) borrow and lend with policy interest rates,
  - or expectation hypothesis holds.
- As a result, monetary policy is not effective with binding zero lower bound of nominal interest rates.

Shadow Rate

- a shadow rate
  - "as the coherent summary of monetary policy: the shadow rate is the federal funds rate when the ZLB is not binding; otherwise, it is negative to account for unconventional policy tools."
  - "as the monetary policy stance for policy analyses."

Shadow Rate New Keynesian Model (SRNKM)

- Dynamic IS Equation (Euler Equation):

$$x_t = x_{t+1} - \sigma \left(s_t - \pi_{t+1} - r_t^n \right).$$

- New Keynesian Phillips Curve:

$$\pi_t = \beta \pi_{t+1} + \kappa x_t + e_t.$$

- Monetary Policy:

$$s_t = \rho s_{t-1} + (1 - \rho) \left(\alpha_\pi \pi_t + \alpha_x x_t + u_t \right).$$

- Rationals behind the shadow rate new Keynesian model are
  - Private agents face different interest rates from policy rates, which may not be constrained by the zero lower bound.
  - Central bank can still control aggregate demand (nominal spending) via unconventional monetary policy.

Microfoundations for SRNKM

- Wu and Zhang (2017) offer two microfoundations for SRNKM:
  - QE with endogenous risk premium

$$s_t = i_t + rp(\overset{\ominus}{b_t^G}).$$

  - Lending Facilities through tax (subsidy) and borrowing constraints

$$s_t = f(\overset{\ominus}{B_t}),\ B_t = B(\overset{\oplus}{\tau_{t-1}}, \overset{\oplus}{M_t}),$$

with

$$\begin{aligned} C_t + B_t &= \frac{(1+i_{t-1})\,B_{t-1}}{(1+\tau_{t-1})\,\Pi_t} + W_t L_t + T_t, \\ B_t &\leq M_t \mathbb{E}_t \left(\frac{K_t \Pi_{t+1}}{1+i_t} \right). \end{aligned}$$

Contributions

- "At the zero lower bound, we establish empirically the negative shadow rate summarizes unconventional monetary policy with its resemblance to private interest rates, the Fed's balance sheet, and Taylor rule."
- "Our shadow rate model proposes a compelling solution to this challenge. It does not incur a structural break at the ZLB whether we work with a linear or non-linear model. Therefore, it restores the traditional solution and estimation methods' validity."
  - Aggregate demand control reacting such macro economic conditions as inflation rates and output gap still exists.
  - Monetary policy is effective even under the zero lower bound.

- As a natural consequence of no structural break, unorthodox results under liquidity trap as reported by Eggertsson, Ferrero and Raffo (2014), such as positive stimulus from a negative supply shock or unusually high fiscal multiplier, disappear.
  - "We show this conterfactual implication of the standard model is due to the lack of policy interventions at the ZLB. Our model restores the data-consistent implication by introducing unconventional monetary policy through the shadow rate."
  - "In a standard model without unconventional monetary policy, this multiplier is much larger at the ZLB. This larger multiplier also disappears in our model."
- A nice paper with nice contributions!

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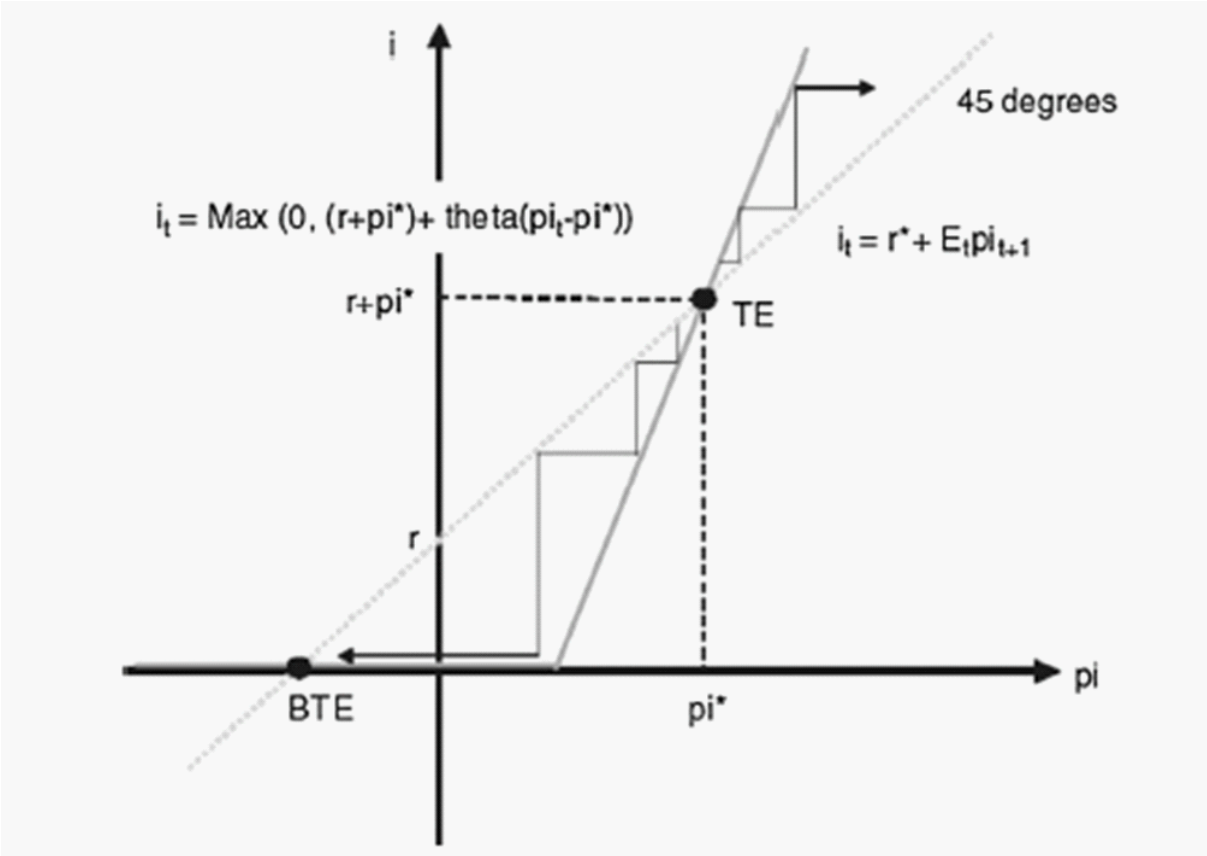
Comments

- Dissapearance of unorthodox results from zero lower bound *a la* Eggertsson, Ferrero and Raffo (2014) seems to be obvious from no structural break.
- Therefore, let me comment from following perspectives:

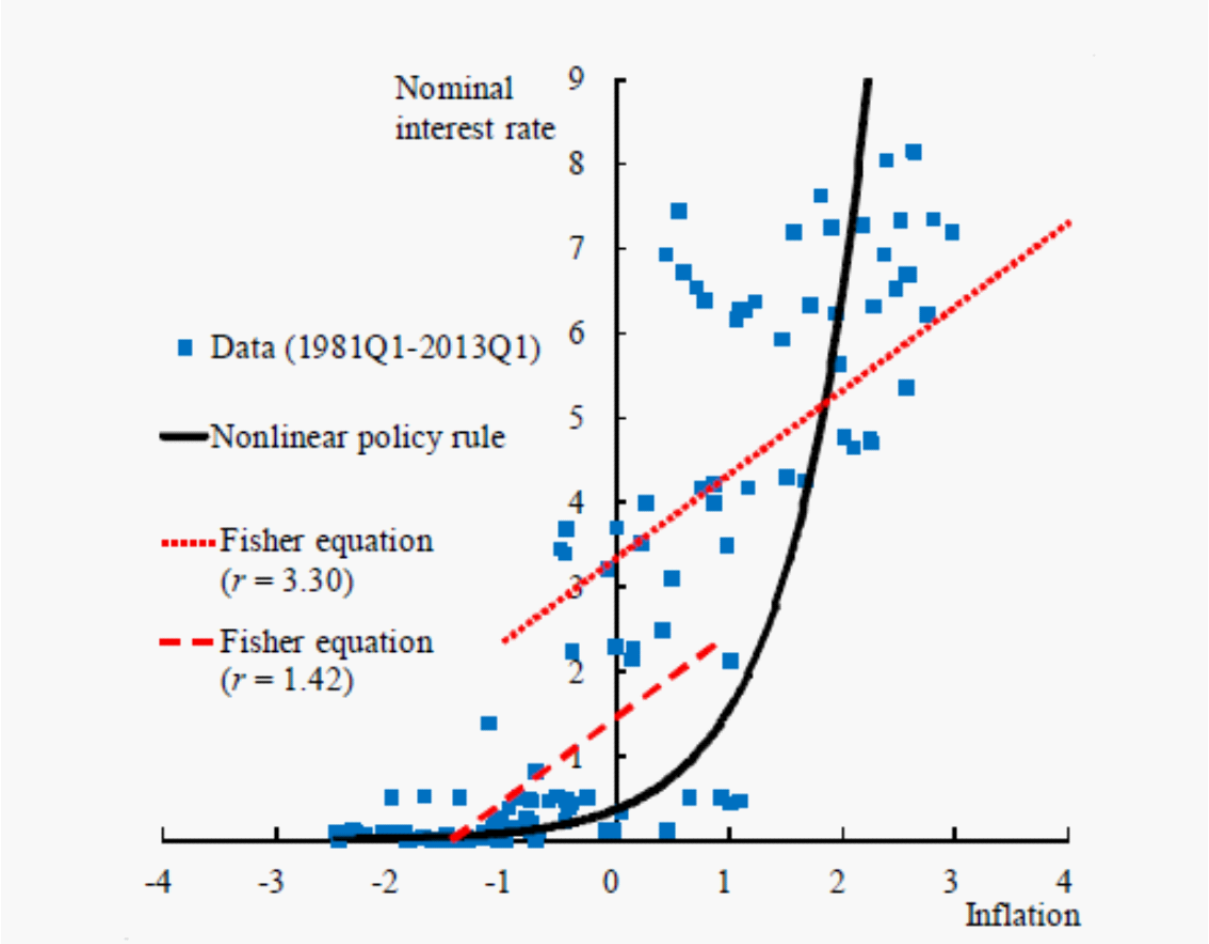
1. Structural Break vs Indeterminacy vs No Structural Break
2. Previous Studies
3. Other Countries

Structural Break vs Indeterminacy

- Gust, Herbst, Lopez-Salido and Smith (2016)
  - Nonlinear Bayesian maximum likelihood estimation
  - "the interest-rate lower bound was a significant constraint on monetary policy that exacerbated the recession and inhibited the recovery, as our mean estimates imply that the zero lower bound (ZLB) accounted for about 25 percent of the sharp contraction in U.S. GDP that occurred in 2009 and an even larger fraction of the slow recovery that followed."
- Aruoba, Cuba-Borda and Schorfheide (2017)
  - Nonlinear Bayesian maximum likelihood estimation with explicit consideration to multiple equilibria explored in Benhabib, Schmitt-Grohe and Uribe (2001)
  - "Japan shifted from the targeted-inflation regime into the deflation regime in 1999 and remained there until the end of our sample. The U.S., in contrast, remained in the targeted-inflation regime throughout its ZLB episode, with the possible exception of the first part of 2009, where the evidence is more mixed."



Fujiwara, Nakazono and Ueda (2015)



Hirose (2014)

Neither Structural Break nor Multiple Equilibrium

- Wu and Zhang (2017) conclude that "Our shadow rate model proposes a compelling solution to this challenge. It does not incur a structural break at the ZLB whether we work with a linear or non-linear model. Therefore, it restores the traditional solution and estimation methods' validity."
  - This is checked only through the behavior of monetary policy shocks.

Kim and Pruitt (2014)

- In order to avoid the censoring problem, Kim and Pruitt (2014) estimate the monetary policy rule with forward rates, which can be interpreted as shadow rates.
- "Surveys by forecasters allow us to sidestep the problem and to use conventional regressions and break tests. We find that the Fed's inflation response has decreased and that the unemployment response has remained as strong, which suggests that the Federal Reserve's commitment to stable inflation has become weaker in the eyes of the professional forecasters."

Which Story is Right?

- I would like to see which of three stories about monetary policy under the ZLB is the most plausible.
- Is it possible to compare the marginal likelihood?
- Can we nest the models?
  - Whether determinacy or indeterminacy is already tested in Aruoba, Cuba-Borda and Schorfheide (2017).
  - Can we evaluate how macroeconomic variables are affected by actual or shadow rates with time-varying weight?

$$x_t = x_{t+1} - \sigma \left[\alpha_t i_t + (1 - \alpha_t) s_t - \pi_{t+1} \right].$$

- This evaluation should be crucially dependent on
  - How the shadow rate is different from policy interest rate.
  - How the shadow rate is reacting to inflation rates and output gap.
  - Whether the shadow rate is constrained by the zero lower bound on policy interest rates.

Incorporating Shadow Rate

- It is written that "Our paper differs from the existing literature in the follow respects."
  - "First, we use the shadow rate to provide one coherent framework for the ZLB period as well as for normal times, whereas models in the literature are specifically targeted for the ZLB."
  - "Second, rather than focus on a specific policy tool, we use the shadow rate as a summary for all unconventional monetary policy measures."
  - "Third, the shadow rate is not subject to a structural break at the ZLB, which makes the model tractable and alleviates numerical and computational issues."
- There exist several previous studies on these points with fully structural system estimation, which are not mentioned in the paper.

Kitamura (2010)

- "The framework employs a hypothetical DSGE model in which the nominal interest rate can be lowered below zero because, for instance, the central bank can impose a carry tax on currency. We call the model's nominal interest rate the shadow rate."
- "the estimated shadow rate is well below zero during the periods of zero interest rate. And the decline of the shadow rate is larger in the second zero-interest-rate period. This is consistent with the fact that in that period BoJ conducted a larger number of unconventional policy measures."
- Kitamura (2010) assumes nonlinearity in one observational equation and employs Bayesian maximum likelihood via particle filter:

$$i_t = \max\left[0, s_t\right].$$

Aoki and Ueno (2012)

- "We propose a simple and tractable method to estimate linear DSGE models with the zero lower bound on nominal interest rates."
- "Our method makes use of forward rate curves in order to take into account the effects of the zero lower bound on equilibrium endogenous variables without relying on nonlinear techniques for solving linear rational expectations equilibrium."
- "the Bank of Japan's zero interest policy and quantitative easing policy in these periods had expansionary effects by bull flatterning the yield curves."
- Aoki and Ueno (2012) estimate the linear DSGE model with Bayesian maximum likelihood.

Other Countries

- Since the long-term bond yields were high in the US, no structural break may not be found.
- Does the unconventional monetary policy still substitute the conventional monetary policy in other countries?
  - In Japan and some European countries, 10 years bond yields are constrained by the zero lower bound.
  - Negative interest rates only in interbank market should have limited impacts since they will not change borrowing and lending among private agents not much.