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Eliminating a deflationary trap through superinertial interest rate rules ☆

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Abstract

This paper demonstrates that, even in the presence of a zero lower bound on nominal interest rates, central banks can eliminate a deflationary trap by the conduct of interest rate rules that have superinertia.

Keywords: Deflationary trap; Superinertia; Taylor principle

JEL Classifications: E52; E58

1. Introduction

Our objective is to find a condition for monetary policy rules in order to avoid a deflationary trap that exists because of the zero lower bound (hereafter ZLB) on nominal interest rates. The previous literature on the deflationary trap can be categorized as (1) analyses of the deflationary trap when there are shocks large enough so that the ZLB becomes binding (e.g., Jung et al., 2005; Sugo and Teranishi, 2006) and (2) analyses of the deflationary trap as a self-fulfilling equilibrium in a model without shocks. Our paper stands as a contribution to the second branch.

The second branch of literature starts from Benhabib, Schmitt-Grohe and Uribe (2001, 2002) who demonstrate that the ineffectiveness of monetary policy because of the ZLB produces a deflationary trap as a self-fulfilling equilibrium. An economy becomes stuck there, resulting in deflation and a low output level. Stimulated by Benhabib et al.'s paper, they and many authors seek how to avoid the deflationary trap. For instance, Schmitt-Grohe and Uribe (2000) address the importance of non-Ricardian fiscal policy that prevents government liabilities from contracting. Eggertsson and Woodford (2003) propose a quantitative monetary easing rule that incorporates price-level targeting. These policies, however, are rather unorthodox. Our paper makes it clear that, even in the presence of the ZLB, a very simple interest rate rule can eliminate the deflationary trap. The most closely related work is that of Alstadheim and Henderson (2006). They develop a flexible-price model that has a deflationary trap and they present two kinds of monetary policy rules that can preclude the deflationary trap. One rule is not monotonic in the inflation rate; the other is an asymmetric rule under which the interest rate responds more strongly to expected future inflation if the current inflation rate is below the target rate. Our approach is different in that we provide a monotonic and symmetric interest rate rule. All we need is slight modification of a standard Taylor rule so that the rule has the property of superinertia described in Woodford (2003). Such a policy rule can lower people's expectation about future nominal interest rates and stimulate inflation expectation, through which the deflationary trap can be avoided. Our paper illustrates a less stringent condition for desirable monetary policy rules than an optimal policy rule. A merit of this is that the proposed rule is very simple, robust and easy to implement.

This paper is organized as follows. Section 2 introduces a model with an inertial monetary policy rule. Section 3 investigates the condition for the existence of the deflationary trap. Section 4 concludes the paper.

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2. The model

We present a simple flexible-price model. Consider an endowment economy populated by a large number of identical, infinitely lived households with preferences defined over consumption and given by the utility function as:

$$E_0 \sum_{t=0}^{\infty} \beta^t u(c_t),$$

where $\beta<1$ and c_t denotes a discount factor and consumption. The households' budget constraint is given by:

$$c_t + \tau_t + \frac{B_t}{P_t} = y_t + e^{i_{t-1}} \frac{B_{t-1}}{P_t}$$

where τ_t, B_t, P_t , y_t, i_t denotes real lump-sum taxes, nominal interest-bearing bonds, the price of goods, exogenous real endowment, and the nominal rate of return on bonds respectively. The first-order conditions for the households' optimization problems are:

$$u_c(c_t) = \lambda_t \quad (1)$$

$$\lambda_t = E_t\left[\lambda_{t+1}\beta \frac{e^{i_t}}{e^{\pi_{t+1}}}\right], \quad (2)$$

where we define $e^{\pi_t} \equiv \frac{P_t}{p_{t-1}}$.

Because we are interested in the analysis of steady states, we consider only the case of $\lambda_t = \lambda_{t+1}$ Defining a steady-state real interest rate $\bar{r}(>0)$ as $\beta = e^{-\bar{r}}$, we obtain the following Fisher equation:

$$i = \bar{r} + \pi. \quad (3)$$

Now, we turn to a monetary policy rule. We assume that the central bank conducts a certain interest rate rule, by which a desirable short-term nominal interest rate i_t^* is calculated. If i_t^* is negative, the nonnegativity constraint becomes binding, that is:

$$i_t = \max\left(i_t^*, 0\right). \quad (4)$$

We consider the following two monetary policy rules for i_t^*, both of which have policy inertia.

2.1. Smoothing interest rates

Let us first consider the following interest rate smoothing policy rule (Rule 1):

$$i_t^* = \bar{r} + \phi_\pi \pi_t + \phi_i\left(i_{t-1}^* - \bar{r}\right), \quad (5)$$

where $\phi_i \geq 0$. Except for the last term, this represents a standard Taylor rule. In other words, in the limiting case Of $\phi_i = 0$, Eq. (4), can be rewritten as:

$$i_t^{\text{Taylor}} = \max(\bar{r} + \phi_\pi \pi_t, 0). \quad (6)$$

In the limit of $\phi_i = 1$ this rule is comparable to that with price-level targeting, which is advocated, for instance, by Eggertsson and Woodford (2003).

2.2. Accumulating the past shortage of interest rate control

The second policy rule that we consider is the one that accumulates the past shortage of interest rate control. This rule is similar to that proposed in Reifschneider and Williams (2000). Define ψ_t as:

$$\psi_t \equiv i_t - i_t^*. \quad (7)$$

When the ZLB does not bind, $i_t^* = i_t$ *and* $\psi_t = 0$. When the ZLB binds, i_t^* becomes negative and ψ_t becomes positive. Hence, $\psi_t \geq 0$. This variable can be interpreted as a multiplier derived from a Kuhn–Tucker condition in Jung et al. (2005), though we do not solve the central bank's optimization problem explicitly.

Using ψ_t, we consider the following augmented Taylor rule (Rule 2):

$$i_t^* = \bar{r} + \phi_\pi \pi_t = \phi_\psi \psi_{t-1}. \quad (8)$$

where $\phi_\psi \geq 0$. The last term in Eq. (8) represents the inertia in terms of the past shortage. When nominal interest rates are zero, because ψ_t becomes positive, the desired interest rate i_t^* becomes even lower than that suggested by the standard Taylor rule, which lets a zero interest rate policy last longer. From Eqs. (7) and (8), we obtain:

$$\begin{aligned}\psi_t &= i_t = i_t^* \\ &= \max\left(0, -i_t^*\right) \\ &= \max\left(0, -(\bar{r} + \phi_\pi \pi_t) + \phi_\psi \psi_{t-1}\right).\end{aligned} \quad (9)$$

Therefore, the parameter ϕ_ψ represents the degree of monetary policy inertia.

These two rules are similar in that both of them have monetary policy inertia, either in the form of interest rates or multipliers. A difference is that Rule 2 has monetary policy inertia only when the economy is at the ZLB. In contrast, Rule 1 always has inertia irrespective of the level of nominal interest rates.

3. The elimination of a deflationary trap

The above model can potentially have two steady states.

1. A normal steady state
   This equilibrium is not constrained by the ZLB, and described as $i = \bar{r}$, $\pi = 0$, and in Rule 2, $\psi = 0$. This equilibrium always exists.
2. Deflationary trap
   If this equilibrium exists, it can be observed at $i = 0$. Such an equilibrium is characterized as $i^* < 0$ in Rule 1 and $\psi > 0$ in Rule 2.