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Determinacy and expectational stability of equilibrium in a monetary sticky-price model with Taylor rule ☆

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Abstract

Recent studies show that the Taylor rule possesses desirable properties in terms of generating determinacy and E-stability of rational expectations equilibria under sticky prices. This paper examines whether this policy rule retains these properties within a discrete-time money-in-utility-function model, employing three timings of money balances of the utility function that the existing literature contains: end-of-period timing and two types of cash-in-advance timing. This paper shows: (i) even a small degree of non-separability of the utility function between consumption and real balances causes the Taylor rule to be much more likely to induce indeterminacy or E-instability if this rule responds not only to inflation but also to output or the output gap; (ii) differences among the three timings strongly alter conditions for the Taylor rule to ensure both determinacy and E-stability.

JEL classification: E52

Keywords: Determinacy; E-stability; Monetary model; Taylor rule; Taylor principle

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1. Introduction

Since Taylor's (1993) pioneering work, simple policy rules have received much attention in monetary policy analyses.[1] An important aspect of this recent research is to examine whether a proposed policy rule generates a (locally) determinate (i.e. unique non-explosive) equilibrium in a variety of rational expectations (RE) models. This line of research also discusses the relationship between determinacy of RE equilibria (REE) and the Taylor principle, which suggests that the nominal interest rate should be raised more than the increase in inflation.

Many recent analyses assume implicitly that if a policy rule generates a determinate REE, all agents can coordinate on that REE. In the face of this widespread belief, Bullard and Mitra (2002) address the questions of how and whether such coordination would arise by investigating expectational (or E-)stability of fundamental REE,[2] a concept emphasized recently by Evans and Honkapohja (1999, 2001). Roughly speaking, E-stability asks whether, for sufficiently small expectation errors of agents, a policy rule can lead temporary equilibria under such non-rational expectations to adjust over time toward the associated REE.[3] Thus, E-stability as well as determinacy of REE is a requirement policy rules must meet, as Bullard and Mitra (2002) stress. These authors use a sticky price model without money, which is prominent in recent monetary policy analyses,[4] and conclude that the Taylor rule in which the nominal interest rate responds to the current inflation rate and output gap possesses desirable properties in terms of generating both determinacy of REE and E-stability of fundamental REE.[5]

This paper examines whether the Taylor rule retains these properties within a discrete-time money-in-utility-function (MIUF) model with sticky prices. As McCallum and Nelson (1999) and Carlstrom and Fuerst (2001) indicate, the existing literature with discrete-time MIUF models contains three timings of money balances of the utility function: end-of-period (EOP) timing and two types of cash-in-advance (CIA) timing.[6] Traditional literature starting from Brock (1974) has used EOP timing, which leads to the discrete-time analog to continuous-time MIUF models, while previous studies incorporating Clower's (1967) idea into MIUF models employ CIA timing, in which money balances held before consumption trading enter the utility function. With respect to timing of financial asset trading, CIA timing contains two approaches. One approach, whose idea is

[1] See Rotemberg and Woodford (1999), Benhabib et al. (2001), Carlstrom and Fuerst (2001, 2004), Bullard and Mitra (2002, 2003), Woodford (2003), among others.

[2] To distinguish two definitions of the minimal-state-variable (MSV) solution to linear RE models in the existing literature, which are given by McCallum (1983) and Evans and Honkapohja (1999, 2001), this paper refers to Evans and Honkapohja's MSV solutions as "fundamental".

[3] As Evans and Honkapohja (2001, Chapter 10) show for a broad class of linear stochastic models, if a fundamental REE is E-stable and non-explosive, it is least-squares learnable, i.e. stable under least-squares learning.

[4] See e.g. Rotemberg and Woodford (1999) and Woodford (2003, Chapter 4, Section 1).

[5] As McCallum (1999) argues, current values of inflation and the output gap are not available to actual central banks. Taking this into account, Bullard and Mitra suggest that rather than the one responding directly to them, the Taylor rule responding to current expectations about them is more practical, since these Taylor rules have the same properties in terms of generating both determinacy and E-stability.

[6] As McCallum and Nelson indicate, this paper suggests that none of these three timings are fully "accurate" and each of them is actually just an approximation or a metaphor designed for transaction-facilitating services of the medium of exchange.