International Review of Economics and Finance 20 (2011) 744–749

Contents lists available at ScienceDirect

International Review of Economics and Finance

journal homepage: www.elsevier.com/locate/iref

Interest rate rules and macroeconomic stability with transaction costs

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ARTICLE INFO

Article history:
Received 28 January 2010
Received in revised form 20 January 2011
Accepted 24 January 2011
Available online 31 January 2011

JEL classification:
E52
E31

Keywords:
Interest-rate feedback rules
Macroeconomic stability
Transaction costs

ABSTRACT

This paper analyzes the relationship between interest-rate feedback rules and macroeconomic stability in the presence of transaction costs. We show that with the Sims-type (1994) transaction-cost technology, a passive, rather than an active, interest-rate rule is more likely to generate a stabilizing effect against belief-driven fluctuations if both the intertemporal elasticity of substitution with respect to consumption and the sensitivity of the transaction costs with respect to the velocity of money are low. This result is valid under either an unbounded or a bounded transaction-cost technology. Of importance, our result is relevant under empirically plausible parameters, while it sharply contrasts with Taylor's (1993) prediction.

1. Introduction

The study of interest-rate feedback rules and macroeconomic stability has seen a renewed interest in monetary economics since the influential contribution of Taylor (1993). The driving force underlying this important issue originates from the stylized fact that most central banks in leading industrialized countries have used a monetary policy rule by operating on a target for a short-term nominal interest rate for guidance (Benhabib, Schmitt-Grohé, & Uribe, 2002a; Walsh, 2003; and Woodford, 2003). Taylor (1993) proposes a simple interest-rate feedback rule that responds to inflation by raising the nominal interest rate by more than (namely, an active interest-rate rule) or less than (namely, a passive interest-rate rule) the increase in inflation. Accordingly, he raises a proposition which now has been well-documented in the literature that while a passive rule destabilizes the economy by inducing belief-driven fluctuations (local indeterminacy), an active interest-rate rule stabilizes the economy by ensuring the uniqueness of equilibrium (local determinacy). Furthermore, Clarida, Galí, and Gertler (2000) use it to explain why in the United States inflation has been steadily low and output growth has become relatively stable since the early 1980s.

This paper shows that with the Sims (1994) transaction-cost technology, the determinacy result of an active interest-rate rule may be reversed. Under empirically plausible parameters, a passive interest-rate feedback rule, in effect, is more likely to lead to local determinacy. Recently, an increasing number of theoretical and empirical studies have challenged the validity of the Taylor rule.[1] Within the literature, Schmitt-Grohé and Uribe (2000) construct the cash-in-advance model with a balanced-budget requirement to investigate the relationship between price-level determination and alternative monetary policy rules. They

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[1] The related literature includes, for example, Leeper (1991), Woodford (1995), Taylor (1999), Clarida et al. (2000), Carlstrom and Fuerst (2001), and Dupor (2001). Furthermore, extended discussions of interest rate rules in both the history of economic thought and the modern analysis of theory can be found in Woodford (2003) and Lubik and Marzo (2007).

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doi:10.1016/j.iref.2011.01.002

establish that the price level is indeterminate for both low and high values of the inflation elasticity of an interest-rate feedback rule, and is determinate for intermediate values. Benhabib, Schmitt-Grohé, and Uribe (2001a, 2001b, 2002a, 2002b) utilize a monetary endowment economy with money-entering preferences and/or technology to examine the relationship between interest rate rules and aggregate stability. Their major conclusion is that an active interest-rate rule may generate equilibrium indeterminacy depending on how money affects the marginal utility of consumption and whether or not money serves as a productive input in technology.

It is well known in monetary economics that there are four approaches, namely, the money-in-the-utility function, money-in-the-production function, cash in advance, and transaction cost approaches, to introduce money to the economy.[2] While the aforesaid literature on interest rate rules and macroeconomic stability has focused on the money-in-the-utility function, money-in-the-production function, and cash in advance approaches, very little has been known about the link between interest-rate rules and aggregate stability under a framework where money holdings are motivated by transaction costs.[3] To the best of our knowledge, none of the previous works use the transaction-cost monetary framework to systematically investigate the relationship between interest-rate feedback rules and aggregate stability. To fill this void in the literature, the present study introduces money into the economy through the channel of the transaction-cost technology along the lines of Sims (1994) and Ljungqvist and Sargent (2000), and provides new implications for the (in)determinacy of equilibrium under interest-rate feedback rules.[4]

In essence, we extend the Sims (1994) framework to a continuous-time setting, as in Benhabib et al. (2001a, 2001b, 2002a, 2002b). With the Sims-type (1994) transaction-cost technology, it is found that the conditions for determining the relationship between interest-rate feedback rules and macroeconomic stability depend crucially on the intertemporal elasticity of substitution with respect to consumption and the sensitivity of the transaction costs with respect to the velocity of money. Our results suggest that, in sharp contrast to Taylor's (1993) prediction, a passive, rather than an active, monetary policy can stabilize the economy against belief-driven fluctuations. The passive monetary rule is more likely to generate such a stabilizing effect when both the intertemporal elasticity of substitution with respect to consumption and the sensitivity of the transaction costs with respect to the velocity of money are relatively low. Of particular importance, our analysis indicates that these conditions are empirically plausible. Besides, in line with Sims (1994), we also extend our analytical model from an unbounded transaction-cost technology to a bounded one in order to examine the robustness of our results. It turns out that, under empirically plausible parameters, a passive interest rate rule is more likely to have a stabilizing effect on the economy against belief-driven fluctuations in the model with a bounded transaction-cost technology than in the model with an unbounded one.

The remainder of the paper is organized as follows. Section 2 presents the analytical framework and characterizes the perfect-foresight equilibrium of the macroeconomic economy. Section 3 examines the relationship between interest rate rules and macroeconomic stability. Section 4 concludes our analysis.

2. The model

The analytical framework is essentially a modified continuous-time version of the Sims (1994) model. The economy consists of an infinitely-lived representative agent (household-producer) and a government (solely represented by the monetary authority). The agent derives utility from consumption and maximizes the discounted lifetime utility with perfect foresight. The monetary authority implements a Taylor-type interest rate rule which may be either active or passive. Time is continuous (the time index is suppressed throughout the paper).

2.1. Household–producer

The agent is endowed with a constant output y and seeks to maximize the following lifetime utility

$$\int_0^{\infty} \frac{\left(c^{1-\sigma}-1\right)}{(1-\sigma)} e^{-\beta t}\, dt, \tag{1}$$

subject to her/his budget constraint

$$\dot{a} = y + (R-\pi)a - Rm - [1 + f(v)]c - \tau, \tag{2}$$

where c = consumption, β = a constant rate of time preference, σ = the inverse of the intertemporal elasticity of substitution, $a \equiv m + b$ = total real wealth, $m \equiv M/P$ = real money holdings, $b \equiv B/P$ = holdings of real government debt, M = nominal money balances, P = the price level, B = nominal government debt, R = nominal interest rates, $\pi \equiv \dot{P}/P$ = the inflation rate, τ = lump-sum taxes, and $v \equiv c/m$ = the velocity of money. The constant-elasticity-of-substitution instantaneous utility function reported in

[2] Orphanides and Solow (1990) provide an excellent and detailed survey of these four approaches to money and capital accumulation.

[3] As is well-known in the literature on money and economic growth, alternative approaches to introducing money into the economy generate different implications for the real effects of monetary growth. A detailed explanation is provided by Wang and Yip (1992).

[4] Sims (1994) and Ljungqvist and Sargent (2000) use a model with transaction costs to examine price-level determination under alternative monetary policy regimes (a constant-money-growth policy and an interest-rate pegging policy). Similarly, Woodford (1994) employs a cash-in-advance model to study the relationship between price level determinacy and alternative monetary policies (a money growth rate peg and an interest rate peg).