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Monetary policy rules in an OLG model with non-superneutral money

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ABSTRACT

This paper considers an overlapping generations economy with capital accumulation and two outside assets (government bonds, fiat money) and compares the dynamic properties of two stylized monetary policy rules: (i) a constant money growth rule and (ii) an interest rate targeting rule which allows for an endogenous feedback to inflation. The results of this comparison depend strongly on whether under the overall monetary-fiscal regime long-run real interest rates are independent of inflation. If this is the case (i.e. superneutrality prevails) there exists in our model a unique and stable steady state under either monetary policy rule. By contrast, if superneutrality fails there is scope for much richer dynamics, characterized by multiple steady states and globally indeterminate dynamics. The paper offers a classification of such constellations and argues that under both monetary policy rules uniqueness and stability of steady states can be restored, provided the long-run inflation target and the feedback of the interest rate targeting rule are appropriately chosen.

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1. Introduction

Monetary policy rules are typically specified as sequences of the nominal money stock or, alternatively, of the nominal interest rate. In overlapping generations models with physical capital and two outside assets (government bonds, fiat money) simple specifications of such rules may well lead to multiple steady states and globally indeterminate dynamics. Specifically, such a constellation may obtain under a money growth rule, as shown by Schreft and Smith (1997), Boyd and Smith (1998), Bhattacharya and Kudoh (2002), and Nikitin and Russell (2006). Similarly, such a constellation may obtain under an interest rate peg, as discussed in Schreft and Smith (1998). Such analytical findings may seem surprising, in view of the prominent role assigned to simple rules of this type in various policy debates.

Against this background, the purpose of this paper is twofold. First, the paper identifies conditions which are conducive to a constellation of multiple steady states and globally indeterminate dynamics under simple monetary policy rules. These conditions distinguish between genuinely fiscal aspects of OLG models and features which do depend on the particular design of monetary policy rules. In particular, it is argued that constellations in which the long-run real interest rate varies with the long-run inflation rate (such that money becomes non-superneutral) are particularly vulnerable to the occurrence of steady-state multiplicity and globally indeterminate dynamics. Second, the paper argues that such a constellation is far from inevitable. It can be avoided if monetary policy rules appropriately account for the underlying long-run relationship between the real interest rate and the inflation rate.

To illustrate this reasoning, we use a tractable Diamond-type OLG economy with capital, government bonds and return-dominated money. Economies of this type may well exhibit multiple steady states, characterized by different levels of government bonds and real interest rates. We exploit this feature and consider three seemingly similar fiscal regimes,

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each leading, however, to a distinctly different long-run constellation in which money may or may not be superneutral.¹ For each of these regimes the paper analyzes properties of (i) a money growth rule and (ii) an interest rate targeting rule (which specifies the nominal interest rate endogenously as a function of an inflation target, similar to Woodford (2003)) and shows how such rules can be designed to establish a unique steady state with stable dynamics. Throughout it turns out that both types of monetary policy rules (which are crucial reference points for modern policy debates, as discussed in Section 2.1) generate similar dynamics, provided the long-run inflation target and the feedback of the interest rate targeting rule are appropriately chosen.

In more detail, the results can be summarized as follows. First, the benchmark fiscal regime considers a debt targeting rule which fixes the ratio between real government bonds and output. This assumption turns out to be sufficient to ensure superneutrality, i.e. long-run real interest rates are independent of inflation. In such environment, the model displays a unique steady state under the constant money growth rule with stable and determinate adjustment dynamics. This steady state is also unique under the interest rate targeting rule, and stable and determinate adjustment dynamics are consistent with active and passive feedback coefficients on inflation.² Second, we consider a modified fiscal targeting rule which generates a Keynesian environment, in the sense that superneutrality fails and the long-run real interest declines in the inflation rate, in line with Tobin (1965). In such environment, the constant money growth rule is still associated with a unique steady state. By contrast, the interest rate rule induces two steady states for a certain range of passive feedback coefficients, consistent with globally indeterminate dynamics (i.e. both steady states are dynamically approachable for given initial conditions). However, uniqueness of the steady state is ensured under active feedback coefficients, and local stability properties of the two rules around the unique steady state are similar.³ Third, richer types of non-superneutrality emerge, for example, under a fiscal rule which imposes a balanced primary budget. In such environment, superneutrality fails and the mapping from the inflation rate to the real interest rate is no longer single-valued. Multiple steady states may now not only occur under passive and active interest rate rules, but also under the constant money growth rule. Yet, under the constant money growth rule the second steady state vanishes for a sufficiently low inflation target because of the zero-bound restriction. Moreover, the remaining 'low inflation' steady state can be supported as the unique steady state under the interest rate rule if the feedback is mildly passive or mildly active.

This classification of different long-run constellations is not only of theoretical interest. It is motivated by the fact that the empirical literature on the long-run relationship between the inflation rate and the real interest rate is rather inconclusive. A number of empirical studies support the Keynesian notion of a negative long-run relationship between the inflation rate and the real interest rate, both from a time-series and a cross-sectional dimension.⁴ Yet, this result is certainly not uncontested. In particular, for episodes of low and stable inflation identification problems make it typically difficult to discriminate between such scenario and our benchmark scenario of superneutrality.⁵ Moreover, multiple equilibria in line with the third regime are often cited to explain the evidence on persistent development traps under fragile financial systems and high inflation rates.⁶

While a discussion of policy-related issues is left for the next section, three more general comments are worth making. First, going back to Sargent and Wallace (1981), inflation may not always be under the control of central banks. We address this insight by imposing that all three fiscal regimes respect monetary dominance such that, for a given monetary policy rule, fiscal policy supports the intended steady-state inflation rate. Second, it should be stressed that the three fiscal regimes are introduced for analytical convenience to generate the desired types of (non)-superneutrality. The paper does not discuss their relative empirical merits. Third, in related OLG work, Nikitin and Russell (2006) offer a different approach to conceptualize departures from superneutrality. Focusing on a constant money growth rate and a particular choice of a fiscal rule, they consider a flexible specification of preferences which nests superneutrality as a special (but non-generic) outcome.⁷ Also in an OLG context, Sorger (2005) compares constant money growth rules with various feedback rules, expressed as flexible money growth rules. Yet, a direct comparison with our results is difficult, since Sorger studies an endowment economy.

The paper is structured as follows. Section 2 offers selected policy links and a graphical preview of the main findings. Section 3 introduces the model. Section 4 summarizes the competitive equilibrium conditions. Section 5 describes the monetary and fiscal arrangement. Section 6 analyzes the benchmark economy, characterized by superneutrality. Section 7 extends the analysis to an environment of Keynesian non-superneutrality. Section 8 indicates how to extend the analysis to richer types of non-superneutrality. Section 9 concludes. All proofs are delegated to the Appendix.

¹ In line with the two-step modeling strategy of Sargent and Wallace (1981) we consider a logarithmic utility set-up to generate a strict quantity-theory demand for money with constant velocity, facilitating thereby the characterization of dynamic equilibria. The working paper by von Thadden (2010) shows that all qualitative results of this paper can be generalized to a forward-looking money demand specification in which real balances depend on the nominal interest rate.

² The interest rate rule is called active (passive) if the real interest rate rises (falls) in the inflation rate, in line with Taylor (1993).

³ Under the constant money growth rule dynamics are always locally determinate. Under active interest rate rules dynamics are locally determinate, provided the feedback is not overly aggressive, in the spirit of Bernanke and Woodford (1997).

⁴ See, in particular, King and Watson (1997), Coppock and Poitras (2000), Monnet and Weber (2001), and Rapach (2003).

⁵ See, among others, Mishkin (1992), Weber (1994), Bullard and Keating (1995), and Lee et al. (1998). From a theoretical perspective, see, in particular, Alvarez et al. (2001).

⁶ See, in particular, Azariadis and Smith (1996) and Schreft and Smith (1997, 1998).

⁷ Moreover, in the analysis of Nikitin and Russell superneutrality can come together with multiple steady states. Espinosa and Russell (1998, 2003) consider OLG-frameworks in which departures from superneutrality are linked to the dynamic (in)efficiency of steady states.

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