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ScienceDirect
Research in Economics 62 (2008) 57–63
RESEARCH IN ECONOMICS
www.elsevier.com/locate/rie

Indeterminacy with constant money growth rules and income-based liquidity constraints☆

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Received 28 November 2007; accepted 18 April 2008

Abstract

We study the implications of constant money growth rules on the stability properties of the equilibrium, in economies where the agents are subject to a partial cash-in-advance constraint applying simultaneously to consumption and investment purchases. By reference to similar models in which the liquidity constraint applies only to consumption, we show that the inclusion of investment has dramatic, but contrasting, effects on the range of values giving rise to indeterminacy. First, it increases strongly a *lower bound* on the share of purchases requiring cash, below which the steady state is always indeterminate. Second, it creates a *higher bound* on this share, above which the steady state is always determinate. In this context, the steady-state value of the velocity of money becomes a crucial parameter for gauging whether constant money growth rules may be stabilizing or destabilizing for the economy.

Keywords: Cash-in-advance; Indeterminacy; Business cycles

1. Introduction

Money non-neutrality is a feature of a world characterized by a degree of market imperfection. When monetary policy affects the real sphere, it is not unworthy to address the issue of whether and how economic dynamics could be perturbed by the policy rule. In the last decades, a growing literature has focused on the risk of economic fluctuations associated to the implementation of a wrong rule. Rules based on a quantity or a price control such as, respectively, a constant money growth rule or an interest rate pegging, have been observed through the prism of stability. More recently, more sophisticated policies such as the Taylor rule have been criticized as potential sources of economic instability.[2]

☆ We would like to thank Francesco Magris for very helpful comments and suggestions. We also thank participants to conferences and seminars where this paper was presented. All remaining errors are our own. This work was supported by a French National Research Agency Grant (ANR-05-BLAN-0347-01).

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[2] See, among others, Benhabib et al. (2001) for a global bifurcation analysis. A survey of this literature can also be found in Benhabib and Farmer (1999).

1090-9443/$ - see front matter
doi:10.1016/j.rie.2008.04.002

Before choosing a policy rule according to any welfare-maximizing criterion, we need to know as a matter of priority whether the rule introduces multiple equilibria and expectations-driven fluctuations. Of course, the answer mainly depends on the kind of market imperfection that accounts for the existence of money. In that respect, Calvo (1979) and Matsuyama (1990) were among the first to demonstrate the possibility of sunspot equilibria in dynamic monetary models with money in the utility function (MIUF). Subsequently, Woodford (1994) extended the analysis to simple economies with cash and credit goods, in the spirit of Lucas and Stokey (1987). One puzzling feature which emerged from this early literature is that the results on indeterminacy appeared to be strongly dependent on the way money was introduced into the model. Hence no easy, clear-cut conclusion seemed to be drawable about the desirability of money growth targeting rules as a way to ensure dynamic stability.

Recently, Carlstrom and Fuerst (2003) took a step forward in order to unify these heterogeneous results. Resting on the functional equivalence emphasized by Feenstra (1986), they revisit the dynamic consequences of a cash-in-advance constraint on consumption purchases as a case of perfect complementarity between consumption and real balances in the utility function. Their formulation is more convincing as money demand depends not only on consumption, as in the standard cash-in-advance model, but also on the nominal interest rate, which is a desirable feature from an empirical point of view. They prove that, with constant money growth rules, indeterminacy soon disappears as the interest-elasticity of money demand increases. As the equilibrium is determinate under realistic estimates of this elasticity, Carlstrom and Fuerst (2003) conclude that money growth targeting rules are likely to promote stability.

Our paper is not intended to address the sensitivity issue of indeterminacy results in CIA economies when allowing for a non-zero elasticity of money demand with respect to interest rates. But it recognizes that the domain of validity of Feenstra's functional equivalence, so central in Carlstrom and Fuerst (2003), unfortunately reduces to the case of a cash-in-advance constraint applying *only* to consumption purchases. From an empirical perspective, assuming that liquidity constraints concern only consumption purchases may be seen as implausible as considering a zero interest-elasticity of money demand. Since the seminal paper of Fazzari et al. (1988), the empirical literature on investment strongly emphasized that investment expenditures of many firms are positively correlated with their cash flow, and this is typically interpreted as reflecting the presence of liquidity constraints.[3] But as soon as liquid assets are also needed to finance investment expenditures, Feenstra's functional equivalence and results derived in a MIUF context no longer apply to economies with liquidity constraints.

For these reasons, the paper attempts to check the robustness of equilibrium determinacy emerging under constant money growth rules when a liquidity constraint limiting agents behavior applies to a *fraction* of both consumption and investment expenditures. We study how strongly the inclusion of investment in the liquidity constraint modifies the range of parameters values giving rise to indeterminacy by comparison with the economy characterized in Bosi and Magris (2003), in which a partial CIA constraint applies only to consumption purchases, and that studied in Abel (1985), in which the liquidity constraint applies to the totality of consumption and investment expenditures.

Our results show that taking into account investment in the liquidity constraint has substantial effects on the stability properties of the model, but that these effects are contrasted for the indeterminacy region. More precisely, we show that the *share* of consumption and investment expenditures to be financed with liquid assets has a strong influence on the stability properties of the steady state, and we prove that when this share is low (below a certain threshold), the steady state is always indeterminate. By contrast, when the share is large (above a second threshold), the steady state is always determinate. Between the two thresholds, indeterminacy emerges for specific values of the structural parameters, namely a sufficiently low elasticity of intertemporal substitution.

Hence, the stabilizing or destabilizing properties of constant money growth rules in cash-in-advance economies appear to depend crucially on the strength of the liquidity constraint — a parameter which, in the model, can also be interpreted as the (inverse of) the velocity of money. Empirical estimates of this parameter suggest that the US economy was in the determinacy region during recent decades. However, the observed upward trend of money velocity in the US may quickly lead to a reversal of this conclusion.

The remainder of the paper is organized as follows. Section 2 sets up the model economy, derives the intertemporal equilibrium and characterizes the (unique) steady state. Section 3 provides the stability analysis, and discusses the conditions for local indeterminacy. Section 4 concludes.

[3] See, for instance, Hubbard (1998) for a survey. Quoting Fazzari et al. in a more recent paper (see Fazzari et al. (2000, p. 701)), "financially constrained firms will rationally maintain some buffer stock of cash to protect against having to cancel or delay investment projects".