# Are non-fundamental equilibria learnable in models of monetary policy? ☆

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## Abstract

Recent models of monetary policy can have indeterminacy of equilibria, which is often viewed as a difficulty of these models. We consider the significance of indeterminacy using the learning approach to expectations formation. We employ expectational stability as a selection criterion for different equilibria and derive the expectational stability and instability conditions for forward-looking multivariate models, both without and with lags. The results are applied to several monetary policies.
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## 1. Introduction

In recent years, there has been a large amount of research studying the performance of alternative monetary policies in dynamic macroeconomic settings; for example, see the survey (Clarida et al., 1999) and the papers in the 1999 Special Issue of the *Journal of Monetary Economics* and in the volume (Taylor, 1999). A difficulty has emerged in this literature: many recent models of monetary policy are plagued by the problem of indeterminacy, i.e. there are multiple, even continua of rational expectations equilibria (REE).[1]

The issue of indeterminacy can be important from a practical point of view. Pursuit of optimal monetary policy on the part of the central bank, or flexible inflation targeting in the sense used by Svensson (1999), implies that the instrument of monetary policy, the short-term nominal interest rate, should respond to inflation forecasts; see Clarida et al. (1999). Clarida et al. (1998) provide evidence that monetary policy in a number of industrialized countries (like Germany, Japan, and the U.S.) has been forward-looking since 1979.[2]

A number of theoretical studies have considered the issue of indeterminacy, with interest rate rules and different views been taken on this problem. Bernanke and Woodford (1997) have argued against inflation forecast targeting on the basis of indeterminacy—these rules may lead to too much volatility in inflation and output which any central bank ought to avoid; see also Woodford (2003a, b). At the other end of the spectrum, indeterminacy is viewed as an unimportant curiosum. For instance, in McCallum (2001a, b, 2003), the use of the minimal state variable (MSV) solution is advocated for applied analysis. To fix terminology, we will use the terms *fundamental vs. non-fundamental equilibria* to distinguish between the MSV and other REE.

A recent paper taking indeterminacy as an empirically relevant possibility is Clarida et al. (2000). They estimate a forward-looking policy reaction function for the postwar U.S. economy, both before and after the appointment of Paul Volcker as Fed Chairman in 1979. They conclude that monetary policy in the pre-Volcker era was compatible with the possibility of bursts of inflation and output that resulted from self-fulfilling changes in expectations of the private sector. In this way, monetary policy of the Federal Reserve contributed to the high and volatile inflation of the 1960s and 1970s. Analytically, the pre-Volcker period is modelled as a non-fundamental REE. In contrast, monetary policy in the Volcker–Greenspan era is compatible with the existence of a unique fundamental equilibrium delivering low and stable inflation.

In this paper, we take a new perspective on the problem of indeterminacy induced by monetary policy by introducing a selection criterion among the REE to narrow

[1]These include bubbles or sunspots, see e.g. the discussions in Kerr and King (1996), Bernanke and Woodford (1997), Woodford (1999), Clarida et al. (1999), Bullard and Mitra (2002), and Carlstrom and Fuerst (2000). See Evans and Honkapohja (2003a) for a review.

[2]Recent evidence by Alesina et al. (2001) also suggests that the European Central Bank (ECB) may have been forward-looking. Moreover, a number of inflation-targeting central banks like those in England, Canada, and New Zealand are forward-looking in practice.