



# Regime changes, learning and monetary policy

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## Abstract

Monetary policymakers should be concerned with potential changes in regime. In the model presented here, increasing returns in production creates the possibility of multiple expectationally stable steady states. The policymaker tries to achieve the two goals of smoothing fluctuations around the high output steady state, while trying to prevent the economy from slipping to the inferior, low output steady state. Agents use a learning rule to make forecasts and a key parameter in the rule provides an indication of the credibility of the policymaker. The greater the magnitude of the shocks and the lower the credibility of the policymaker, the more emphasis should be placed on stabilizing output.

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## 1. Introduction

Theoretical models with multiple equilibria have been used to address important issues in economics such as the causes of the great depression and the nature of development traps.<sup>1</sup> Results from empirical methods such as Markov switching models, introduced in

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<sup>1</sup> Cooper and Corbae (2002) model the great depression as a loss of confidence in the financial sector. Their paper is one of the few where monetary policy has a direct effect in a model with multiple equilibria. Romer (1986) uses increasing returns in production to explain why some developing economies remain in a low growth state. Cooper (1999) provides a thorough survey for topics related to multiple equilibria in macroeconomics.

Hamilton's (1989) study of GDP growth, imply that the economy does not necessarily fluctuate around a unique equilibrium, but could switch between multiple steady states. Diebold and Rudebusch (1996) stress that ignoring the possibility of regime shifts could lead to very poor policy recommendations, and they appeal for more applied work focusing on multiple equilibria. However, much of the literature on monetary policy concentrates on unique, rational expectations equilibria,<sup>2</sup> possibly due to the modeling difficulties involved with multiple equilibria.

The goal of this paper is to determine optimal monetary policy in an environment with potential regime shifts. The model presented here includes increasing returns in production that can lead to multiple steady states, similar to the approach of Evans and Honkapohja (1993, 2001). For a given steady state we define the associated linear model and compute optimal policy under rational expectations. Simulations of the model with multiple steady states are then used to determine optimal policy in the non-linear case.

In a model with multiple steady states, agents' formation of expectations raises many subtle issues. Expectations should be able to respond quickly, if there is a regime shift, but they should also approach the equilibrium values associated with a steady state if the economy does not experience such drastic changes. To model such behavior, this paper uses the *endogenous gain* learning mechanism of Marcet and Niccolini (2004). The gain parameter shows the emphasis agents place on recent information when forming expectations and is allowed to vary depending on the state of the economy. Furthermore, the gain parameter provides an indication of the credibility of the policymaker.

The monetary policymaker strives to stabilize the endogenous variables of the economy around the steady state with the highest level of output. Simulation results show that optimal policy depends on the magnitude of the shocks in the model and the credibility of the policymaker. For larger shocks and lower credibility, there is a greater danger of a shift to the neighborhood of a low output steady state. Hence, the policymaker should place more emphasis on output stabilization to minimize this possibility. For sufficiently small shocks and high credibility, optimal policy can be computed with the associated linear model under rational expectations, but for larger shocks and lower credibility this method is misleading.

The model has full micro foundations. A money-in-the-utility function setup determines expectations-augmented IS and LM equations in the demand sector, similar to McCallum and Nelson (1999a). Increasing returns in the production function arise from productivity enhancing ideas, which depend on the aggregate quantity of labor. Firms maximize profits over labor but do not take into account the impact of their decision on aggregate labor. Therefore, the production externality is a possible source of multiple steady states.

In the generic case, there are three steady states at different levels of output, but not all of them are relevant to the dynamics of the model. We provide a condition for expectationally stability (see Evans and Honkapohja, 2001) and show that the steady state at the intermediate level of output does not meet the criterion. The expectationally stable steady states are at the high and low levels of output.

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<sup>2</sup> Clarida et al. (1999), for example, has been the basis of much recent research on monetary policy, though they suggest that work on transitions would be quite welcome.

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