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Learning and optimal monetary policy

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Abstract

To conduct policy efficiently, central banks must use available data to infer, or learn, the relevant structural relationships in the economy. However, because a central bank's policy affects economic outcomes, the chosen policy may help or hinder its efforts to learn. This paper examines whether real-time learning allows a central bank to learn the economy's underlying structure and studies the impact that learning has on the performance of optimal policies under a variety of learning environments. Our main results are as follows. First, when monetary policy is formulated as an optimal discretionary targeting rule, we find that the rational expectations equilibrium and the optimal policy are real-time learnable. This result is robust to a range of assumptions concerning private-sector learning behavior. Second, when policy is set with discretion, learning can lead to outcomes that are better than if the model parameters are known. Finally, if the private sector is learning, then unannounced changes to the policy regime, particularly changes to the inflation target, can raise policy loss considerably.

JEL classification: E31; E52; E58

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1. Introduction

We study an economy in which households and firms must learn an equilibrium law of motion to form expectations and the central bank must learn structural parameters, such as those governing the short-run trade-off between inflation and output, to conduct policy. Using a stylized New Keynesian business cycle model as a laboratory, we investigate whether a central bank can learn to set policy optimally while updating its knowledge of the economy's structural parameters in real time, and we examine whether the need for households and firms to learn materially affects the central bank's ability to learn to set policy optimally. Focusing on real-time learning, we assess how central-bank learning affects policy loss and optimal policymaking over time and how optimal monetary policies bear on the learning process, and we examine the speed of learning.

We apply simulation methods to study real-time learning dynamics in an economy in which private agents employ variants of least-squares learning (as in Tetlow and von zur Muehlen, 2001; Orphanides and Williams, 2005, 2006; Aoki and Nikolov, 2004; Cogley and Sargent, 2005). The real-time learning approach refrains from assuming a stationary environment where beliefs are never updated. Further, in contrast to the E-stability literature, which focuses on asymptotic results, real-time learning allows us to study the transition path to the rational expectations equilibrium. Unlike previous studies, which have concentrated on the impact of private agents' learning on monetary policy assuming the central bank has full information,[1] we consider an economy in which both private agents and the central bank must learn. In our model, although a full understanding of the economy eludes private agents and the central bank, a realistic assumption in our view, their learning focuses on different aspects of the economy. Private agents, knowing their own preference/technology parameters but needing to forecast future outcomes, must learn the economy's equilibrium law of motion, which takes the form of a vector autoregression. In contrast, the central bank, knowing its policy objectives but needing to set monetary policy, must learn the parameters in the equations that constrain its policy decision. Since both the central bank and private agents are learning, we can assess the extent to which the two learning problems interact, study the role of central-bank and private-sector learning on the policy performance, and examine whether private sector learning helps or hinders central-bank learning. Importantly, because the central bank endeavors to implement an optimal policy, and must learn structural parameters to do so, our analysis departs from least-squares learning and formulates central-bank learning in terms of a decreasing gain (generalized) instrumental variables estimator, similar to Evans and Honkapohja (2003a, b).

[1]For a partial overview of this literature, see Bullard and Mingitra (2002) and Evans and Honkapohja (2001, 2003a, b, 2006). Levin et al. (2006), Levin and Williams (2003), and Levin et al. (2003) study the performance of monetary policy rules when the central bank employs competing reference models. Walsh (2005) examines the welfare impact of misspecified parameters in the model the central bank uses to compute the optimal policy.