Journal of Monetary Economics 72 (2015) 131–147

Contents lists available at ScienceDirect

Journal of Monetary Economics

journal homepage: www.elsevier.com/locate/jme

Optimized Taylor rules for disinflation when agents are learning

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ARTICLE INFO

Article history:
Received 25 June 2012
Received in revised form
11 February 2015
Accepted 12 February 2015
Available online 23 February 2015

Keywords:
Inflation
Monetary policy
Learning
Policy reforms
Transitions

ABSTRACT

When private agents learn a new policy rule, an optimal simple Taylor rule for disinflation differs substantially from that under full information. The central bank can reduce target inflation without much difficulty, but adjusting reaction coefficients on lagged inflation and output is more costly. Temporarily explosive dynamics emerge when there is substantial disagreement between perceived and actual feedback parameters, making the transition highly volatile. The bank copes by choosing reaction coefficients close to the private sector's prior mode, thereby sacrificing long-term performance in exchange for achieving lower transitional volatility.

1. Introduction

Imagine a newly appointed central bank governor who inherits high inflation from the past. The bank has no official inflation target and lacks the political authority unilaterally to set one, but it has some flexibility in choosing how to implement a vague mandate. Suppose that the new governor's preferences differ from those of his predecessor and that he wants to disinflate. He seeks an optimal Taylor-type rule and takes learning into account when choosing policy parameters.

Sargent (1982) studies an analogous problem in which the central bank not only has a new governor but also undergoes a fundamental institutional reform. He argues that by suitably changing the rules of the game, the government can persuade the private sector in advance that a low-inflation policy is its best response. In that case, the central bank can engineer a sharp disinflation at low cost. Sargent discusses a number of historical examples that support his theory, emphasizing the institutional changes that establish credibility.

Our scenario differs from Sargent's in two ways. We take institutional reform off the table, assuming instead just a change of personnel. We also take away knowledge of the new policy and assume that the private sector must learn about it. This is tantamount to assuming that the private sector does not know the new governor's preferences.

Our scenario is more like the Volcker disinflation than the end of interwar hyperinflations. Erceg and Levin (2003) and Goodfriend and King (2005) explain the cost of the Volcker disinflation by pointing to a lack of transparency and credibility. Erceg and Levin contend that Volcker's policy lacked transparency, and they develop a model in which the private sector

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http://dx.doi.org/10.1016/j.jmoneco.2015.02.003
0304-3932/

must learn the central bank's long-run inflation target. In their model, learning increases inflation persistence relative to what would occur under full information, thereby raising the sacrifice ratio and producing output losses like those seen in the early 1980s.[1] Goodfriend and King claim that Volcker's disinflation lacked credibility because no important changes were made in the rules of the game. Because the private sector was initially unconvinced that Volcker would disinflate, the new policy collided with expectations inherited from the old regime and brought about a deep recession.

The analysis of Erceg, Levin, Goodfriend, and King is positive and explains why the Volcker disinflation was costly. In contrast, our question is normative and focuses on how learning alters the central bank's choice of policy. Our problem is motivated by the Volcker disinflation, and a stylized version of that episode serves as the vehicle for our analysis, but our objective is not to explain the Volcker disinflation. On the contrary, our goal is to illustrate a force that arises when a new policy must be learned and to describe how it affects the bank's choices.

The problem is studied in the context of a dynamic new Keynesian model modified in two ways. Following Ascari (2004) and Sbordone (2007), target inflation need not be zero. In addition, Bayesian learning replaces rational expectations. The central bank commits to a simple Taylor-type rule whose functional form is known but whose coefficients are not. Private agents learn those coefficients via Bayesian updating. The bank chooses policy-rule parameters by minimizing a discounted quadratic loss function, taking learning into account.

Our paper contributes to a literature on how to design monetary policy rules when agents are learning. Bullard and Mitra (2002) and Evans and Honkapohja (2003a,b) examine how to specify monetary policy rules so that learning converges to rational expectations and the rational-expectations equilibrium (REE) is determinate. In our model, both conditions are satisfied for the family of simple rules under consideration.[2] We refine the analysis by considering how transition dynamics affect the choice of policy coefficients.

Accounting for transition volatility substantially alters the bank's choice. Compared with the old regime, the optimal simple rule under full information has a lower long-run inflation target and a higher reaction coefficient on inflation. The optimal simple rule under learning reduces target inflation by almost as much but reacts much less aggressively to inflation. Indeed, the inflation reaction coefficient is only slightly higher than in the old regime.

The reason why the bank's choice differs under learning is that the equilibrium law of motion can be a temporarily explosive process, i.e. one that is asymptotically stationary but which has unstable autoregressive roots during the transition. When locally unstable dynamics emerge, the transition is highly volatile and dominates expected loss. The central bank's main challenge is to find a way to manage this transitional volatility.

As in Eusepi and Preston (2010), uncertainty about policy feedback parameters matters more than uncertainty about target inflation.[3] In our model, the bank always achieves low average inflation. Uncertainty about policy feedback parameters is more problematic because this is what creates the potential for temporarily explosive dynamics. Locally unstable dynamics emerge when there is substantial disagreement between actual and perceived feedback parameters. It follows that one way for the bank to cope is to adopt a policy that is close to the private sector's prior. By choosing feedback parameters sufficiently close to the private sector's prior mode, the bank can ensure that the equilibrium law of motion is nonexplosive throughout the transition, sacrificing better long-term performance for lower transitional volatility. For the model described below, this approximates the optimal strategy.

In this respect, our conclusions differ from those of Orphanides and Williams (2005). They and others examine new Keynesian models with adaptive learning and demonstrate that learning enhances inflation persistence.[4] Orphanides and Williams emphasize that central banks should take steps to counteract this increase in persistence, reacting *more* aggressively to inflation than they would under full information. Like us, Orphanides and Williams study optimal simple Taylor rules, but they only consider the consequences of alternative policies once the economy reaches its ergodic distribution.[5] Our conclusions differ because our loss function also penalizes transitional volatility. Concerns about locally explosive dynamics outweigh other considerations.

Our approach to learning differs from much of the macro-learning literature, in particular from the branch emanating from Marcet and Sargent (1989a,b), Cho et al. (2002), and Evans and Honkapohja (2001, 2003a,b). Models in that tradition typically assume that agents use reduced-form statistical representations such as vector autoregressions (VARs) for forecasting and that agents update parameter estimates by recursive least squares. In contrast, the agents who inhabit our model build structural models of the economy and update beliefs via Bayes' theorem. Our approach is useful for showing how a bank's policy choice depends on agents' priors, but otherwise it is not critical. Our insights are robust to other forms of learning.

[1] Schorfheide (2005) also develops a model in which agents must learn about target inflation. In his model, target inflation follows an exogenous Markov-switching process, and estimates confirm that learning is important for fitting data from the early 1980s. Andolfatto and Gomme (2003) explain the Canadian experience using a closely related model with high and low money-growth states.

[2] We have no theorem to this effect, but this is what happens in the simulations.

[3] For a model with least-squares learning, Eusepi and Preston (2010) study various communications strategies: the central bank credibly communicates (i) target inflation, (ii) the variables on which policy decisions are conditioned, or (iii) the precise details of policy. They demonstrate that the Taylor principle plus strategies (ii) or (iii) guarantees convergence to REE, while the Taylor principle plus (i) does not. Our scenario is like case (ii): our agents know the form and arguments of the policy rule, and estimates of policy coefficients converge to the true parameters.

[4] E.g., see Erceg and Levin (2003), Milani (2006, 2007), and Slobodyan and Wouters (2012).

[5] They consider a model with constant gain learning, so their agents never fully learn.