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Comment Seppo Honkapohja

Great Inflation and Imperfect Knowledge

There have been numerous attempts to explain and understand the period of rapid inflation in the United States in the second half of the 1960s and in the 1970s. The papers in this conference are welcome additions to this literature. One prominent set of arguments by one or both of the authors of this chapter has as its starting point the idea that monetary policy in this period was misguided because of imperfect knowledge about the Phillips curve and the natural rate of unemployment (or productivity growth). Monetary policy was not sufficiently tight because the estimates of the natural rate of unemployment were too low, so that higher actual unemployment was thought to indicate slack in the economy.[1]

Explanations of the Great Inflation that are based on imperfect knowledge and misperceptions by policymakers and/or private agents can be usefully formulated in terms of a learning model rather than a model relying on a rational expectations equilibrium (REE). There are already many learning models of the Great Inflation. The seminal contribution is the book by Sargent (1999) and an important subsequent paper is Cho, Williams, and Sargent (2002). Tom Sargent has recently proposed somewhat different explanations of the Great Inflation in some other papers, see, for example, Cogley and Sargent (2005) and Sargent, Williams, and Zha (2006). Other important papers using learning models of the Great Inflation include Bullard and Eusepi (2005), Orphanides and Williams (2005a, 2005b), and Primiceri (2006).

This chapter by Orphanides and Williams focuses on a further aspect of the discussion about monetary policy during the Great Inflation. The basic idea is to consider a counterfactual experiment. It is asked whether the Great Inflation could have been avoided if monetary policy had been based on optimal policy by a benevolent policymaker in an REE but ignoring misperceptions of the natural rate of unemployment.

This is an important question as it provides new perspectives on the practical usefulness of optimal monetary policy frameworks. I am happy to com-

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1. See, for example, Orphanides (2002), Orphanides (2003a, 2003b), and Orphanides and Williams (2002).

ment on the very nice chapter. My discussion has three parts. First, I provide some remarks outlining the basic ideas of learning models and suggest that the literature previously cited divides into two main strands. Second, I try to provide some intuition for the obtained results from the viewpoint of what we know about properties of learning models of monetary policy. Third, I make some comments and questions about the analysis.

Basic Ideas in Learning Models

Models of adaptive learning have three important building blocks.[2] The starting point in the learning approach is the assumption that agents and policymakers have imperfect knowledge and try to learn (i.e., improve their knowledge over time as new data becomes available). The beliefs of economic agents are formulated in terms of models with parameters, which are estimated from existing data. Expectations of the agents in any period are based on the estimated model and the parameters of the model are updated over time using standard econometric techniques. In any period these expectations feed into decisions by the agents and consequently to actual outcomes.

Because economic outcomes depend on the forecasts, the economy is seen as a self-referential model. If the forecasting models of the agents are compatible with an REE, then learning dynamics may converge over time to the REE of interest. The REE is then a fixed point of the dynamical system describing learning and the economy. This convergence takes place provided the economy satisfies an expectational stability criterion. Recently, ideas of learning have been widely applied in models of economic policy, and the literature on learning and monetary policy is growing rapidly.[3] A useful implication of this literature is that good policy facilitates convergence of learning by private agents.

The basic models with learning rely on some fairly strong assumptions. These are (a) the functional form of agents' forecasting models is correctly specified relative to the REE of interest, (b) agents accurately observe all relevant variables, and (c) the economic environment is perceived to be fairly stationary. There are papers that relax one or more of these assumptions.[4]

Relaxing assumption (a) leads to models with asymptotic misspecification and some of the papers on the Great Inflation in the aforementioned literature indeed consider learning dynamics with misspecified beliefs. The resulting dynamics can then exhibit occasional rapid movements known

2. Evans and Honkapohja (2001) provide a treatise on the analysis of adaptive learning and its implications in macroeconomics. Sargent (2008) and Evans and Honkapohja (2009b) are recent surveys of the field.

3. For surveys of the literature see Evans and Honkapohja (2009a), Bullard (2006), and Evans and Honkapohja (2003a).

4. The literature has also explored other ways of relaxing the basic setting. One avenue is based on the assumption that agents entertain multiple forecasting models and make the most use of models that have performed well in the past.

as escape dynamics. Sargent (1999) and Cho, Williams, and Sargent (2002) are studies of these escape dynamics. If instead assumption (b) and/or (c) is relaxed, perpetual learning dynamics evolve near an REE after a transition period, provided the expectational stability condition is satisfied. The second strand of the literature on learning and the Great Inflation takes this approach and focuses on so-called perpetual (constant-gain) learning. The earlier work by Orphanides and Williams as well as the current chapter use standard persistent learning dynamics, not escape dynamics in modeling the Great Inflation.

Understanding the Main Results

I focus on the analytical part of the chapter, which is a counterfactual exercise based on an estimated model (though there are also elements of calibration in the model formulation). The main idea of the chapter is to assess the performance of two types of policies using the 1970s experience as a "testing ground." One set of policies are based on optimal control in an REE while the other type of policies employ a simple first-difference rule and assume that the economy evolves in accordance with learning dynamics. One can take either a positive or a normative view about the comparisons. According to the former, a good model should be able to explain the Great Inflation and the subsequent period, while according to the latter it is useful to find a policy rule that would have avoided the Great Inflation.

The main results in the chapter are, first, that a policy rule based on optimal control when agents are assumed to have rational expectations does not anchor inflation expectations if in fact private agents are learning and there are misperceptions about the natural rate of unemployment. There is also a corollary to this result: the optimal rule with all weight on inflation (the policymaker is an "inflation nutter") delivers anchoring of inflation expectations in the 1960 to 1970s. The second main result of the chapter is that there is an alternative simple "first-difference" policy rule that would have worked well in the sense that the Great Inflation would not have occurred under that rule. The latter rule also has good empirical performance in the subsequent period.

The estimated model has only three equations but there are lagged variables. It is then difficult to formulate a good intuition for these results. Let me try to provide some intuition by looking at the properties of the rules and how these kinds of rules perform in somewhat simpler New Keynesian models.

Starting with the basic optimal rule, there are three important properties: (a) interest-rate inertia; (b) the response to (lagged) inflation is fairly weak, certainly weaker than to unemployment gaps; and (c) unemployment gaps are defined with respect to estimated natural rate, which deviates a lot from the true rate (see figure 5.2 in the chapter). Property (a) is conducive to determinacy and learning-stability, but (b) suggests the possibility of big fluctuations and combining it with (c), it is evident that poor anchoring of inflation can be the outcome.

Considering the optimal control policy rule of an inflation nutter, it is evident that the weight of unemployment in the rule is smaller than in the basic case. This also means that estimated natural rate plays a small role in the rule, which contributes to the anchoring of inflation, and inflation expectations indeed remain anchored. More generally, figure 5.2 shows a lot of variation in the real-time estimates of the natural rate in the 1970s, so that imprecise knowledge about natural rate is the underlying reason for nonanchoring in the base case. These considerations confirm that the imprecise estimation of the natural rate of unemployment is central for these results in the chapter.

Let me next discuss the preferred optimal simple rule proposed in the chapter. According to this rule, the change in interest rate responds strongly to deviations of inflation (expectations) from the inflation target and to changes in observable unemployment. The preferred rule can be thought of as a version of a price-level targeting rule with a time-varying price level target. Let me write the rule in general terms as

$$i_t = i_{t-1} + \theta_\pi(\overline{\pi}^e_{t+3} - \pi^*) + \theta_{\Delta u}(u_{t-1} - u_{t-2}).$$

Here π^* is a target for inflation. For the inflation term in the rule we have

$$\overline{\pi}^e_{t+3} - \pi^* = \overline{p}^e_{t+3} - \overline{p}^*_{t+3} - (\overline{p}^e_{t+2} - \overline{p}^*_{t+2}),$$

where $\overline{p}^*_{t+3} = \overline{p}^*_{t+2} + \pi^*$. This means that the rule is a differenced version of a "price-level Taylor rule"

$$i_t = \theta_\pi(\overline{p}^e_{t+3} - \overline{p}^*_{t+3}) + \theta_{\Delta u} u_{t-1} + K,$$

which incorporates a moving price-level target. It is known that in the standard New Keynesian model price level rules tend to keep inflation under control and contribute to stability, including learning-stability, provided the E-stability condition is satisfied. See, for example, Evans and Honkapohja (2006, 2013). It should also be noted that this preferred rule does not depend on the estimated natural rate. This also helps with anchoring of inflation.

Further Comments and Questions

In this last section, I want to make further comments and note some questions.

First, the focus on the chosen form of the optimal control rule is potentially problematic. It is well-known that in the standard New Keynesian model a similar "fundamentals-based" formulation runs into problems with determinacy and learning-stability. This problem is alleviated if an interest-rate smoothing motive is postulated (see Duffy and Xiao 2007). Moreover, in standard New Keynesian models there can be problems of stability under constant gain learning with backward-looking (or "operational") form of such rules (see Evans and Honkapohja 2009c). It would be worthwhile to check whether the E-stability condition fails for the optimal control rule.

The chapter suggests that policy should be based on the simple first-difference instrument rule rather than optimal control rules. This argument is limited, since it would be worthwhile to also explore the performance of more robust implementations of optimal policy than the just fundamentals-based rule. Some alternative optimal rules worthy of comparison would be the expectations-based optimal rules proposed in Evans and Honkapohja (2003b), Evans and Honkapohja (2006), and Preston (2008), as well as the optimal rules that are obtained if the policymakers know learning rules of private agents (see Gaspar, Smets, and Vestin 2006; Molnar and Santoro 2010). The performance of these optimal policy frameworks ought to be compared with the performance of the first-difference rule preferred by the authors.

I am also a little bit puzzled about the main empirical conclusion of the chapter. According to the results, the Great Inflation could have arisen because either (a) best-practice policy under rational expectations was employed when private agents were in fact learning, or (b) the policy objective put too much weight on unemployment stabilization when in fact REE prevailed in the inflationary episode. The chapter does not sufficiently contrast these alternatives as a positive empirical conclusion. Looking at the narrative discussion in section 5.2, my guess is that the authors would favor the suggestion (a). The highly variable natural rate in the Great Inflation episode (see figure 5.2 of the chapter) and other structural changes in the 1970s suggest that expectations may not have been rational. However, the discussion in section 5.2 also focuses a lot on the importance of measuring the natural rate of unemployment and, in the period beginning in the 1990s, the empirical performance of the OC policy with very small weight on unemployment is roughly comparable to that of the simple robust rule (compare figures 5.5 and 5.6). Could this period be viewed as a case for assessing more generally relative merits of the REE and learning approaches?

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Discussion

Christopher Sims had technical comments. Constant gain learning is easier to analyze in a theoretical model than in one with constant parameter change, but there is no excuse in this empirical exercise to use it instead of a Kalman filter with an explicit model for parameter change. The Kalman