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Comments on Marvin Goodfriend and Robert G. King, "The Great Inflation Drift"

Lars E.O. Svensson*
Sveriges Riksbank, Stockholm University, CEPR, and NBER

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1 Introduction

This paper provides an interesting explanation of the Great Inflation. It starts with the assumption that the Fed objectives were to stabilize the output gap and maintain "continuity" of the interest rate" and then presents a model where inflation becomes a stochastic trend. In particular, inflation increases with negative innovations in potential-output growth. Fed monetary policy is seen as switching between "business as usual" and "inflation fighting."

2 Model

There is a New Keynesian Phillips curve,

$$\pi_t - \bar{\pi}_t = \beta \mathrm{E}_t(\pi_{t+1} - \bar{\pi}_{t+1}) + h(y_t - y_t^*),$$

where $\bar{\pi}_t$ denotes an inflation trend that is assumed to follow a random walk (martingale),

$$\bar{\pi}_t = \mathrm{E}_t \bar{\pi}_{t+1}.$$

There is an aggregate-demand relation that relates the output gap between output, y_t, and potential output, to the real interest-rate gap between the real interest rate, r_t, and the natural interest rate,

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r_t^*,

$$y_t - y_t^* = \mathrm{E}_t(y_{t+1} - y_{t+1}^*) - \frac{1}{\sigma}(r_t - r_t^*),$$

where σ is the reciprocal of the intertemporal elasticity of substitution. Potential-output growth follows an AR(1) process,

$$\Delta y_t^* = \rho \Delta y_{t-1}^* + \nu_t,$$

where ν_t is a shock with zero mean. This implies that the natural interest rate follows

$$r_t^* - r = \sigma \mathrm{E}_t \Delta y_{t+1}^* = \sigma\rho\Delta y_t^* = \rho(r_{t-1}^* - r) + \sigma\rho\nu_t.$$

The nominal interest rate, R_t, is given by the Fisher equation,

$$R_t = r_t + \mathrm{E}_t \pi_{t+1}.$$

It is assumed that the model is known by the Fed and the private sector and that the Fed's monetary policy is both known by the private sector and fully credible. The authors examine rational-expectations equilibria with fully credible policies.

The Fed's monetary policy is characterized by output-gap stabilization and "continuity of the short rate" rather than low inflation. "Continuity" here actually means "predictability."

A first question is why monetary policy is not modeled as a loss function that is minimized, such as

$$L_t = (\pi_t - \pi_t^*)^2 + \lambda(y_t - y_t^*)^2 + \mu(R_t - \mathrm{E}_{t-1}R_t)^2.$$

Could then the Great Inflation then be explained by high weights on output-gap stabilization and interest-rate predictability, that is, high λ and μ, and a drifting inflation target π_t^*?

A second question is why the authors have chosen interest-rate *predictability*, focusing on $R_t - \mathrm{E}_t R_{t-1}$, rather than the more traditional interest-rate *smoothing*, focusing on $R_t - R_{t-1}$? The more standard loss function with interest-rate smoothing would be

$$L_t = (\pi_t - \pi_t^*)^2 + \lambda(y_t - y_t^*)^2 + \mu(R_t - R_{t-1})^2.$$

Does it matter whether the Fed focuses on predictability or smoothing of the short rate? Yes, it does, because smoothing will have to be state-dependent to be equivalent to predictability. In any case, a study of the FOMC's transcript might reveal whether the Fed was emphasizing predictability or smoothing.

3 Equilibria with zero output gaps

The authors focus on equilibria with zero output gaps, $y_t - y_t^* = 0$. Thus, by the Phillips curve, inflation is equal to trend inflation

$$\pi_t = \bar{\pi}_t = \mathrm{E}_t \pi_{t+1} = \mathrm{E}_t \bar{\pi}_{t+1}.$$

By the aggregate-demand relation, the real rate is equal to the natural rate,

$$r_t = r_t^*,$$

and, by the Fisher equation, the nominal rate is equal to the natural rate plus trend inflation,

$$R_t = r_t^* + \bar{\pi}_t.$$

What, then, is equilibrium trend inflation? Consider innovations, $R_t - \mathrm{E}_{t-1} R_t$, in the nominal rate and use $\mathrm{E}_{t-1}\bar{\pi}_t = \bar{\pi}_{t-1}$ in the Fisher equation to get

$$R_t - \mathrm{E}_{t-1} R_t = r_t^* - \mathrm{E}_{t-1} r_t^* + \bar{\pi}_t - \bar{\pi}_{t-1}.$$

Now, assume a given degree of predictability of the short rate ϕ, $0 \leq \phi \leq 1$, relative to the forecast error of the natural rate,

$$R_t - \mathrm{E}_t R_{t-1} = (1 - \phi)(r_t^* - \mathrm{E}_{t-1} r_t^*).$$

Setting these two expressions for the innovation in the nominal rate equal to one another leads to the equilibrium innovation in trend inflation,

$$\bar{\pi}_t - \mathrm{E}_{t-1}\bar{\pi}_t = -\,\phi(r_t^* - \mathrm{E}_{t-1} r_t^*) = -\,\phi\sigma\rho\nu_t.$$

Since trend inflation is a random walk, the equilibrium trend inflation is determined as

$$\bar{\pi}_t = \bar{\pi}_{t-1} - \phi\sigma\rho\nu_t. \tag{3.1}$$

Thus, trend inflation increases with negative potential-output growth innovations, more when there is high predictability of the short rate (when ϕ is large). This is the authors' main result and the basis for their interpretation of the Great Inflation.

The innovation in the natural interest rate and the potential-output growth innovation are related and proportional,

$$r_t^* - \mathrm{E}_{t-1} r_t^* = \sigma\rho(\Delta y_t^* - \mathrm{E}_{t-1}\Delta y_t^*) = \sigma\rho\nu_t.$$

Hence, we understand the main result directly from the Fisher equation, $R_t = r_t^* + \bar{\pi}_t$. If the nominal rate is more predictable, innovations in trend inflation have to cancel innovations in the neutral rate.

4 Implementation

How should we interpret trend inflation? One interpretation is that the Fed sets and announces an inflation target according to (3.1). Trend inflation then becomes a predetermined variable. We can then assume that the Fed follows an interest-rate rule given by

$$R_t = \bar{\pi}_t + r_t^* + \Omega(\pi_t - \bar{\pi}_t). \tag{4.1}$$

If we choose the coefficient Ω to be positive and sufficiently large, the above equilibrium will be unique. In equilibrium, the third term in (4.1) will be zero. But exactly how would the Fed implement this?

There is a simultaneity problem in implementing (4.1) in that π_t is a forward-looking variable and R_t and π_t will be simultaneously determined. The instrument rule (4.1) is what, in previous research, I have called an "implicit instrument rule." One can imagine that R_t and π_t are determined by some iteration during the announcement day, that is, when the Fed announces an R_t, the private sector responds with a π_t, the Fed responds with an new R_t, and so on, until the economy has converged on the equilibrium R_t and π_t before the end of the day. Obviously, this is not how monetary policy is implemented.

Another way for the Fed to implement the equilibrium would be to predict the equilibrium π_t, and set R_t accordingly. The Fed might predict π_t to depend linearly on the two predetermined variables r_t^* and $\bar{\pi}_t$ and satisfy

$$\pi_t = g_1 r_t^* + g_2 \bar{\pi}_t = \bar{\pi}_t,$$

that is, that the coefficients g_1 and g_2 satisfy $g_1 = 0$ and $g_2 = 1$. Substituting this prediction of π_t into the instrument rule implies

$$R_t = \bar{\pi}_t + r_t^* + \Omega(g_1 r_t^* + g_2 \bar{\pi}_t - \bar{\pi}_t) = \bar{\pi}_t + r_t^*.$$

This is a different instrument rule, which in previous research I have called an "explicit instrument rule," where the nominal rate only depends on predetermined variables. But this variant of the instrument rule has different determinacy properties. In this case, the predetermined variables are all exogenous, which means the nominal rate becomes exogenous. Then, in this model, there is indeterminacy and no unique equilibrium.

The authors assume that there is money, m_t, and a money demand,

$$\Delta m_t = \alpha \Delta y_t + \pi_t,$$

and that the Fed follows the money-supply rule

$$\Delta m_t = \alpha \Delta y_t^* - \phi\sigma\rho\nu_t + \alpha\rho\Delta y_{t-1}^* + \pi_{t-1}.$$

This implies

$$\alpha\Delta(y_t - y_t^*) + \Delta\pi_t = -\phi\sigma\rho\nu_t,$$

so if the output gap is zero the inflation innovation is consistent with (3.1). But is this equilibrium unique? And is $\bar{\pi}_t$ still determined by the Fed and predetermined?

In the section "How 'Business as Usual' Creates Inflation Drift", is the central bank implementing monetary policy without explicitly setting $\bar{\pi}_t$? Is $\bar{\pi}_t$ determined/inferred by the private sector? Is it a forward-looking variable? Is the equilibrium then unique?

Generally, for determinacy, "out-of-equilibrium" behavior by the policymaker must be specified, as discussed in some detail in Svensson and Woodford [1]. Above, the instrument rule (4.1) is an out-of-equilibrium commitment, in the sense that it specifies how the Fed would set the nominal interest rate if the inflation rate would deviate from the equilibrium level $\bar{\pi}_t$. However, the fact that the instrument rule is implicit implies that it has some implementation problems. Svensson and Woodford [1] discusses out-of-equilibrium commitments that do not have such problems.

5 Concluding comments and questions

If the Fed has specific objectives, why not specify a loss function and optimal policy for this loss function (under commitment or discretion)? The assumptions of a known model, credible policies, and rational expectations seem rather strong for the Great Inflation period. Nevertheless, that a major explanation for the Great Inflation could be a small weight on inflation stabilization and a drifting inflation target does not seem so far-fetched.

In the model presented, is trend inflation a predetermined inflation target determined by the Fed or a forward-looking variable determined by the private sector? It is not clear (at least not to me) that there is determinacy if trend inflation is not a predetermined variable. The eigenvalue configuration of the system needs to be clarified. A unit root is OK for a predetermined variable but not for a forward-looking variable. The assumption that trend inflation is a random walk seems to imply that the variable has a unit root, which means that it cannot be forward-looking variable determined by the private sector.

Generally, explicit out-of-equilibrium behavior by the Fed may be needed to ensure equilibrium. This is the case above when trend inflation is a predetermined variable. But if Fed's behavior is described by an implicit instrument rule, a simultaneity problem makes the implementation problematic.

References

[1] Svensson, Lars E.O., and Michael Woodford (2005), "Implementing Optimal Policy through Inflation-Forecast Targeting," in Bernanke, Ben S., and Michael Woodford, eds., *The Inflation-Targeting Debate*, University of Chicago Press, 19-83.