Journal of Macroeconomics 34 (2012) 419–428

Contents lists available at SciVerse ScienceDirect

Journal of Macroeconomics

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

Explaining inflation-gap persistence by a time-varying Taylor rule

Christian Conrad *, Thomas A. Eife [1]

Faculty of Economics and Social Studies, Heidelberg University, Bergheimer Strasse 58, 69115 Heidelberg, Germany

ARTICLE INFO

Article history:
Received 30 August 2010
Accepted 6 February 2012
Available online 22 February 2012

JEL Classification:
C22
E31
E52
E58

Keywords:
Inflation-gap persistence
Great moderation
Monetary policy
New Keynesian model
Taylor rule

ABSTRACT

In a simple New Keynesian model, we derive a closed form solution for the inflation-gap persistence parameter as a function of the policy weights in the central bank's Taylor rule. By estimating the time-varying weights that the FED attaches to inflation and the output gap, we show that the empirically observed changes in US inflation-gap persistence during the period 1975–2010 can be well explained by changes in the conduct of monetary policy. Our findings are in line with Benati's (2008) view that inflation persistence should not be considered a structural parameter in the sense of Lucas.

1. Introduction

The degree of US inflation-gap persistence varied considerably during the last 40 years (see Levin and Piger, 2004; Cogley and Sargent, 2005, Cogley et al., 2010).[2] While inflation-gap persistence was high during the 1970s, it fell sharply in the early 1980s and, thereafter, remained at a considerably lower level than in the 1970s. It is often informally argued that the observed changes in persistence are related to changes in the FED's monetary policy (see, e.g., Clarida et al., 2000). In particular, the strong decline in persistence in the early 1980s is associated with the Volcker disinflation. In this paper, we analyze the link between a Taylor rule for monetary policy and inflation-gap persistence in a simple New Keynesian type of model, which allows for a closed form solution of the persistence parameter as a function of the weights that the central bank attaches to inflation and the output gap.

Our model can be considered a closed-economy version of the model discussed in Clarida and Waldman (2008). It consists of three equations: a forward looking aggregate demand curve, a backward looking supply curve and a standard Taylor rule. In this setting, the reduced form representation of the inflation gap is a stationary autoregressive process of order one. The degree of inflation-gap persistence, which is given by the first order autoregressive coefficient, strictly decreases in the Taylor rule coefficient on the deviation of inflation from its target and strictly increases in the Taylor rule coefficient on the output gap. That is, our model predicts that the more aggressively the central bank reacts to deviations of inflation from its

* Corresponding author. Tel.: +49 (0)6221 54 3173.
E-mail addresses: christian.conrad@awi.uni-heidelberg.de (C. Conrad), thomas.eife@awi.uni-heidelberg.de (T.A. Eife).
[1] Tel.: +49 (0)6221 54 2923.
[2] The inflation-gap is defined as the difference between actual inflation and the central bank's inflation target.

0164-0704/$ - see front matter © 2012 Elsevier Inc. All rights reserved.
doi:10.1016/j.jmacro.2012.02.001

target, the faster does the inflation rate converge to the target. This central property of our model is then tested empirically for the US.

In a first step, we estimate a forward looking Taylor rule for a rolling window of 20 years of quarterly observations. The estimated weights on inflation and the output gap reveal substantial variation during the period 1975:Q1–2010:Q1. In particular, we find the highest weight on inflation during the early years of the Volcker era. For that period the output-gap coefficient was insignificant, but significantly positive thereafter. In a second step, we obtain rolling window estimates of the degree of inflation-gap persistence whereby we control for potential changes in the inflation target. We find evidence for two changes in the target: a first one in 1980:Q4 and a second one in 1992:Q2. Neglecting such changes leads to an overestimation of the true degree of persistence.[3] Interestingly, the estimated persistence was lowest in the period for which we estimated the highest values for the reaction coefficient on inflation. Also, inflation-gap persistence increased during a period in which the FED increased its weight on the output gap. A more formal test of our model's implications is performed by regressing the estimated inflation-gap persistence on the estimated reaction coefficients on inflation and the output gap. In line with the model's predictions, we find that a higher weight on inflation (on the output gap) significantly decreases (increases) persistence. Finally, we utilize the estimated reaction coefficients to generate a series of persistence measures as predicted by our theoretical model and then compare this series with the actually observed persistence. Again, the predictions of the model are confirmed by the observed data.

In summary, our empirical analysis strongly supports the hypothesis that the changes in US inflation-gap persistence can be well explained by changes in the conduct of the FED's monetary policy. Stated differently, the paper supports the view that inflation persistence is not inherent in the structure of the economy, but rather influenced by monetary policy (e.g., Benati, 2008). Our findings can be considered complementary to other recent evidence provided by, e.g., Levin and Piger (2004), Carlstrom et al. (2009), Davig and Doh (2009), and Kang et al. (2009).

The remainder of this article is organized as follows. In Section 2 we introduce the model and derive a closed form solution for the inflation-gap persistence parameter. Section 3 presents the data and the empirical analysis. A short discussion closes the paper.

2. Theoretical model

We consider a simple New Keynesian model consisting of three equations: aggregate demand, aggregate supply and a monetary policy rule that specifies how the central bank sets the interest rate as a function of the output gap and of deviations of inflation from its target. Our model is motivated by Clarida and Waldman (2008) and can be viewed as a closed economy version of their model. The simple structure of the model allows us to investigate how changes in monetary policy (changes in the weights in the monetary policy rule) affect the degree of inflation-gap persistence in the reduced form solution of the model.

Let aggregate demand be given by

$$y_t = \mathbf{E}_t\{y_{t+1}\} - (i_t - \mathbf{E}_t\{\pi_{t+1}\}) + u_t, \tag{1}$$

where y_t is the output gap, i_t the nominal interest rate, $\mathbf{E}_t\{\pi_{t+1}\}$ expected inflation, and u_t a demand shock which is assumed to be white noise. The nominal interest rate is linked to the real rate through the Fisher equation $i_t = r_t + \mathbf{E}_t\{\pi_{t+1}\}$. The forward looking aggregate demand equation (1) can be derived by log-linearizing the consumption Euler equation that arises from the household's optimal savings decision.[4] Following Clarida and Waldman (2008), aggregate supply is given by

$$\pi_t = \pi_{t-1} + y_t + e_t, \tag{2}$$

where e_t is a white-noise aggregate supply shock (''cost-push'' shock). Two comments are in order. First, we assume that the coefficients on lagged inflation and on the output gap are both equal one. This assumption simplifies our model but does not affect its qualitative predictions. We will discuss the implications of this assumption in more detail in Section 3.2. Second, the aggregate supply curve is assumed to be backward looking, that is, current inflation depends on lagged inflation. In the literature, both backward and forward looking aggregate supply curves are common. A purely forward looking aggregate supply curve is not appropriate for our setting because it does not generate the degree of inflation-gap persistence we typically observe in the data. A compromise would be a ''hybrid'' aggregate supply curve in which both lagged and expected inflation appear on the right hand side. The reason why we focus on a backward looking aggregate supply curve (sometimes called an ''accelerationist'' Phillips curve) is that it allows for a simple closed form solution of the inflation-gap persistence parameter.

We close the model by assuming that the central bank conducts monetary policy according to the following Taylor rule:

$$i_t = \gamma_0 + \gamma_\pi(\mathbf{E}_t\{\pi_{t+1}\} - \bar{\pi}_j) + \gamma_y y_t, \tag{3}$$

[3] This finding is in line with Cogley and Sbordone (2008) who argue that inflation itself is highly persistent because of changes in trend inflation. By controlling for such changes they also find that the inflation gap is less persistent.

[4] See, for example, Woodford (1996) or Bernanke et al. (1999).