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Price level targeting and risk management☆

Roberto M. Billi

Monetary Policy Department, Sveriges Riksbank, SE-103 37 Stockholm, Sweden

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ABSTRACT

The desirability of a nominal-level target during zero lower bound (ZLB) episodes has become a relevant topic for central bankers and academics. In such a context, this article studies the effects of uncertainty about the future state of the economy on the performance of strict-price-level targeting versus nominal-GDP-level targeting. These targeting frameworks are compared in a small New Keynesian model, which offers a clear illustration of the tradeoffs faced by the central bank. The analysis shows that uncertainty about the future hampers economic performance to a greater extent under nominal-GDP-level targeting, relative to strict-price-level targeting. The reason is that strict-price-level targeting induces greater policy inertia and, therefore, improves the tradeoffs faced by the central bank during ZLB episodes.

1. Introduction

As the outlook for the economy is uncertain, central banks should apply a risk management approach to monetary policy, to determine the appropriate timing and pace of the liftoff of the policy interest rate from its zero lower bound (ZLB).[1] Central banks face an asymmetric risk in setting monetary policy during ZLB episodes. On the one hand, if the economic recovery turns out to be stronger than anticipated, a central bank can raise earlier the policy rate or remove accommodation at a faster pace. On the other hand, if a central bank overstated the strength of the recovery, the room for lowering the policy rate to add monetary stimulus is limited by the ZLB constraint. On balance, as the economic outlook cannot be known with certainty, the liftoff from the ZLB should be gradual.

Risk management, thus, leads to the consideration of monetary-policy frameworks that can ensure a gradual liftoff from the ZLB, after taking appropriately into account that the outlook for the economy is uncertain. In such a context, this article studies the impact of outlook uncertainty on the economic performance of a central bank with a target for the price level or the level of nominal gross domestic product (GDP). Such nominal-level targets are viewed as conceptually appealing when facing a ZLB constraint, because the central bank then commits to make up for any past shortfalls from its target.

The two nominal-level targeting frameworks are compared in a small New Keynesian model, with the central bank operating under optimal discretion and facing a ZLB constraint. In the model, three types of shock buffet the economy. On the supply side of the model, technology shocks push output gaps and prices in the same direction, whereas cost-push shocks instead cause an inflation-output tradeoff. On the demand side, adverse demand shocks and the ZLB constraint create a tradeoff between stabilizing current and future output, because it is desirable for the central bank in a ZLB episode to promise to induce an economic expansion after the ZLB

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E-mail address: Roberto.Billi@riksbank.se.

[1] This article adopts the standard practice of referring to a zero lower bound for nominal interest rates, but the recent experience with negative nominal interest rates in Denmark, Japan, Sweden, Switzerland, and the eurozone suggests the effective lower bound is somewhat below zero. See Svensson (2010) for a discussion.

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episode.[2]

The stylized model offers a clear illustration of such tradeoffs in the evaluation of the policy frameworks. Before proceeding to the evaluation, the model is calibrated to recent U.S. data, with the conduct of monetary policy described by a simple rule often used in policy analysis, namely a version of the Taylor rule with interest-rate smoothing. In the calibration of the model, the shocks are persistent to generate propagation in the model as in the data. Also considered is the optimal commitment policy, to be used as a benchmark for the evaluation. The different policy frameworks are then ranked in terms of performance, based on the model's social welfare function.

This article introduces, into the stylized model, a risk management approach. To do so, two distinct economic environments are considered. In one environment, agents rationally account for the existence of uncertainty about the future state of the economy (rational expectations). In the other environment, even though future shocks buffet the economy, the future state of the economy is incorrectly assumed to be known in advance with certainty (non-rational expectations). The distinctive feature of these two environments is, precisely, whether agents account for the uncertainty over the economic outlook. Accounting for outlook uncertainty is potentially important for the performance of the different frameworks, as the central bank then applies a risk management approach during ZLB episodes.

Comparing the model outcomes from such distinct environments, the analysis produces two main results, related to the types of shock buffeting the economy. First, if the economy is only hit by supply shocks (that is, technology and cost-push shocks), economic performance is the same in the two environments. The reason is that supply shocks do not lead to ZLB episodes in this analysis.[3] Still, strict-price-level targeting is a superior targeting framework, because it transfers the burden of supply shocks onto output. In contrast, under nominal-GDP-level targeting, persistent supply shocks give rise to costly inflation fluctuations. But inflation volatility is even larger under the simple policy rule, if supply shocks are persistent in the model as in the data.

As a second main result, if the economy is hit by demand shocks, uncertainty over the economic outlook hampers the effectiveness of the central bank at stabilizing the economy during ZLB episodes. Under each of the policy frameworks, outlook uncertainty leads to an increase in both the frequency and duration of ZLB episodes. However, the deterioration in economic performance from outlook uncertainty is worse under nominal-GDP-level targeting, followed by the simple policy rule and then by strict-price-level targeting. The reason is that strict-price-level targeting induces greater policy inertia and, therefore, improves the tradeoffs faced by the central bank during ZLB episodes. At the same time, the simple policy rule leads to less frequent encounters with the ZLB.

1.1. Related literature

In the previous literature, the desirability of a price-level target when the ZLB is a constraint was stressed by Eggertsson and Woodford (2003), Svensson (2003), and Wolman (2005), before the financial crisis and Great Recession.[4] In the aftermath of the crisis, proponents of nominal-GDP-level targeting include Hatzius and Stehn (2011, 2013), Sumner (2011, 2014), Woodford (2012, 2013), and Frankel 2013.[5] But none of these articles compared a price-level target with a nominal-GDP-level target. Billi (2017) provided the first comparison of these two nominal-level targeting frameworks, accounting for the ZLB constraint. Relative to Billi (2017), the contribution of this article is that it shows how outlook uncertainty affects the liftoff from the ZLB and the performance of the nominal-level targeting frameworks.

Also other articles study the implications of uncertainty during ZLB episodes. Basu and Bundick (2017) show that uncertainty about the future can depress economic activity under simple policy rules. Nakata (2017) shows that uncertainty hampers economic performance under optimal discretionary and optimal commitment policies. Plante et al. (2017) estimate a negative relationship between uncertainty and economic growth under simple policy rules. Evans et al. (2015) and Seneca (2016) show that when there is uncertainty the liftoff from the ZLB should be gradual under optimal discretion and simple policy rules. Instead this article illustrates the impact of uncertainty and the ZLB constraint on the performance of strict-price-level targeting versus nominal-GDP-level targeting.

The article proceeds as follows. Section 2 describes the model and Section 3 introduces the monetary-policy frameworks. Section 4 describes the different economic environments, as regards the uncertainty over the economic outlook. Section 5 presents the model outcomes and policy evaluation. Section 6 concludes. The Appendix contains technical details on the model solution.

2. The model

I use a small New Keynesian model as described in Woodford (2010), but I take into account that the nominal policy rate occasionally hits the ZLB. The behavior of the private sector is summarized by two structural equations, log-linearized around zero inflation, which describes the demand and supply sides of the economy.

On the demand side of the model economy, the Euler equation describes the representative household's expenditure decisions,

$$y_t = E_t y_{t+1} - \varphi\left(i_t - r - E_t\pi_{t+1} - v_t\right), \tag{1}$$

where E_t denotes the expectations operator conditional on information available at time t. y_t is output measured as the log-deviation from trend. π_t is the inflation rate, the log-change of prices from last period, $p_t - p_{t-1}$. And $i_t \geq 0$ is the short-term nominal interest rate, which is the instrument of monetary policy and is constrained by a ZLB. $r > 0$ is the steady-state real interest rate.[6] $\varphi > 0$ is the interest elasticity of real aggregate demand, capturing intertemporal substitution in household spending. The *demand shock*, v_t, represents other spending, such as government spending, which has asymmetric effects on the economy due to the ZLB constraint. A positive demand shock can be countered entirely by raising the nominal interest rate, whereas a large adverse shock that leads to hitting the ZLB causes an economic downturn.

On the supply side, the Phillips curve describes the optimal price-setting behavior of firms, under staggered price changes à la Calvo,

$$\pi_t = \beta E_t\pi_{t+1} + \kappa x_t + u_t, \tag{2}$$

where $\beta \in (0,1)$ is the discount factor of the representative household, determined as $1/(1+r)$. The slope parameter $\kappa > 0$ is a function of the structure of the economy.[7] $x_t \equiv y_t - y_t^n$ is the output gap in the

[2] The promise is credible if the central bank commits to make up for past shortfalls from the target, as is the case under an inertial Taylor rule or under optimal discretion with a nominal-level target.

[3] Technically, under rational expectations, the mere possibility of hitting the ZLB, even when not yet binding, shapes expectations in the economy. Under non-rational expectations, the ZLB affects expectations only when actually binding. If the ZLB does not bind, the model displays certainty equivalence and the outcome is independent of whether the future is uncertain.

[4] Related to these articles, Svensson (1999), Vestin (2006), and Giannoni (2014) argued in favor of price-level targeting versus inflation targeting in the absence of the ZLB constraint.

[5] There is also an extensive literature on the notion of nominal income *growth* targeting, at first suggested by Meade (1978) and Tobin (1980) and then studied by Bean (1983), Taylor (1985), West (1986), McCallum 1988, Hall and Mankiw (1994), Jensen (2002), and Walsh (2003), among others.

[6] Thus, $i_t - r - E_t\pi_{t+1}$ is the real interest rate in deviation from steady state.

[7] In this model $\kappa = (1-\alpha)(1-\alpha\beta)\alpha^{-1}\left(\varphi^{-1}+\omega\right)(1+\omega\theta)^{-1}$, where $\omega > 0$ denotes the elasticity of a firm's real marginal cost. $\theta > 1$ is the price elasticity of demand substitution with firms in monopolistic competition, and thus the seller's desired markup is $\theta/(\theta-1)$. Moreover, $\alpha \in (0,1)$ is the share of firms keeping prices fixed each period, so the implied duration between price changes is $1/(1-\alpha)$.