



# Prudent monetary policy and prediction of the output gap

Frederick van der Ploeg\*

Department of Economics, University of Oxford, Manor Road Building, Oxford OX1 3UQ, United Kingdom

## ARTICLE INFO

### Article history:

Received 6 April 2007

Accepted 3 February 2009

Available online 20 February 2009

### JEL classification:

C6

D8

E4

E5

E6

### Keywords:

Prudence

Optimal monetary policy

Phillips curves

Commitment

Taylor rules

Measurement errors

Prediction

## ABSTRACT

Risk-adjusted LQG optimal control with perfect and imperfect observation of the economy is used to obtain prudent Taylor rules for monetary policies and cautious Kalman filters. A prudent central bank adjusts the nominal interest rate more aggressively to changes in the inflation gap, especially if the volatility of cost-push shocks is large. If the interest rate impacts the output gap after a lag, the interest also responds to the output gap, especially with strong persistence in aggregate demand. Prudence pushes up this reaction coefficient as well. If data are poor and appear with a lag, a prudent central bank responds less strongly to new measurements of the output gap. However, prudence attenuates this policy reaction and biases the prediction of the output gap upwards, particularly if output targeting is important. Finally, prudence requires an extra upward (downward) bias in its estimate of the output gap before it feeds into the policy rule if inflation is above (below) target. This reinforces nominal interest rate reactions. A general lesson is that prudent predictions are neither efficient nor unbiased.

© 2009 Elsevier Inc. All rights reserved.

## 1. Introduction

One of the most precious commodities of a modern capitalist economy is a stable price level or at least a low inflation rate. Central banks also try to avoid unemployment and steer towards near-zero output gaps. Such flexible inflation targeting gives rise to Taylor (1993) rules, which indicate how much the nominal interest rate should react to the inflation gap and output gap. But a central bank should also operate cautiously and prudently:

A prudent man (or perhaps, I should say a prudent Bayesian) carries an umbrella even when the forecast says there is only a small chance of rain. If there is no rain, he suffers the small inconvenience of carrying the umbrella. But if he does not bring the umbrella and it does rain, he may suffer the much larger inconvenience of being caught in a downpour. The prudent central bank should behave similarly, accepting a high probability of a small adverse outcome in order to avoid the small risk of a very serious bad outcome (Feldstein, 2003).

Feldstein argues that Greenspan's policy of lowering the federal interest rate at that time was prudent, because of the asymmetric nature of the risk faced. The potential upturn could lose steam and there was a risk of deflation, while an

\* Tel.: +44 1865281285; fax: +44 1865271094.

E-mail address: [rick.vanderploeg@economics.ox.ac.uk](mailto:rick.vanderploeg@economics.ox.ac.uk)

unnecessarily strong stimulus would do little harm. Most research on optimal monetary policy is based on the certainty equivalence principle, which says that uncertainty can be ignored. In calculating optimal interest rate rules future disturbances are set to their expected values. This approach is only valid under special conditions (i.e., linear models, quadratic preferences, normally distributed errors). It abstracts from prudence and thus bears little relation to the practice of central banking.

It is surprising that there is hardly any research on the behavior of prudent central banks. Most of the macroeconomics literature adopts a certainty-equivalent linear-quadratic-Gaussian framework (e.g., Svensson, 1997; Rudebusch and Svensson, 1999; Judd and Rudebusch, 1998; Rotemberg and Woodford, 1997, 1999; Woodford, 2001, 2003b). However, a recent approach explicitly recognizes that statistical properties and order of the processes driving the modeling disturbances are not known and derives robust (min–max) rules that perform well under different views of the world (e.g., Onatski and Stock, 2000; Giannoni and Woodford, 2003; Onatski and Williams, 2003; Hansen and Sargent, 2008; Leitemo and Söderström, 2008a,b). Another approach is to employ model averaging in a Bayesian context (Brock et al., 2003). Yet another approach advocates room for judgement of central bankers in deriving optimal monetary policy rules (Svensson, 2003).

Our approach is complementary. We study precautionary central banks and derive the resulting closed-loop monetary policy rules analytically. Central banks minimize the expected value of an exponential transformation of a quadratic welfare loss in terms of output and inflation, which allow for a constant Arrow–Pratt measure of absolute temporal risk aversion and also for prudence in the optimal policy rules. This leads to linear policy rules with reaction coefficients that depend on the covariance matrices of the stochastic process driving the modeling disturbances (cf., Jacobson, 1973; Speyer et al., 1974; Whittle, 1981). Effectively, a prudent policy maker downplays the power of its instruments if the volatility of shocks hitting the economy is large.

Monetary policy rules must recognize that national accounts consist of poor quality data with measurement errors and observation lags, especially for output data. Typically, ‘flash’ estimates of GDP appear quickly and are subsequently substantially revised. Measurement errors show up, because the raw data violate the national accounting identities. One can use subjective estimates of data reliability to adjust the data so that all accounting identities must be satisfied (e.g., Ploeg, 1982; Barker et al., 1984). Subjective variances of the raw data are provided by national accountants and then reduced by imposing the accounting restrictions. Unfortunately, they are seldom used in applied econometrics or in deriving optimal policy rules. Here we allow for measurement errors and lags in output data (cf., Orphanides, 2000). If the central bank adjusts its interest rate in reaction to changes in output gaps, it presumably does this less intensively if substantial measurement errors and lags in output data cause a deterioration of the signal-to-noise ratio (cf., Rudebusch, 2001). Taylor rules also allow for reactions to changes in inflation. However, inflation data are more readily and accurately available than output data.

We investigate how measurement errors and lags in output data affect the Taylor rule for the nominal interest rate. Pearlman (1986, 1992) demonstrated the use of the Kalman filter for predicting states of the economy in monetary models with forward-looking expectations. In backward-looking models and forward-looking models where policy makers and private agents have access to the same partial information sets, the Kalman filter calculations can be performed independently of deriving the optimal monetary policy rule. The separation of control and prediction is trickier in forward-looking monetary models with commitment and asymmetric information (cf., Svensson and Woodford, 2005).

We analyze how a prudent central banker takes account of incoming unreliable output data and use this in the Taylor rule with the aid of a modified separation principle (Whittle, 1981). The prudent Kalman filter depends on welfare preferences and yields biased predictions. In particular, a prudent policy maker gives less weight to new observations with large standard errors and that are less relevant for welfare. Conversely, to avoid costly mistakes prudence requires more weight to faulty data that are relevant for welfare. In the umbrella example a prudent person assigns a larger subjective probability of rain than the objective probability of rain, especially if he or she dislikes rain a lot.

Section 2 states the problem of risk-adjusted LQG control and prediction. Prudence implies that policy makers play a min–max game against nature. Policy makers hedge against undesirable outcomes by postulating that shocks damage its objectives even though statistically they do not hurt on average. The beauty is that this leads to linear feedback policy rules and a recursive scheme for prediction of state variables. The reader uninterested in these mathematical details can skip through Section 2. Section 3 shows how prudence affects the optimal inflation–output trade-off within the New Keynesian macroeconomic model (e.g., Galí, 2008) with commitment and no measurement errors and derives results closely related to Leitemo and Söderström (2008a). To focus on the intricacies of prudence in dynamic models, Section 4 considers short-run inflation–output trade-off in a macroeconomic model with an accelerationist Phillips curve. Considering first the case of no measurement errors and lags, we show that the optimal nominal interest rate of a prudent central bank reacts more aggressively to the inflation gap, especially if cost-push disturbances are volatile. We then derive a prudent Taylor rule for the case where the real interest rate impacts aggregate demand after one period and national income is measured without error. We demonstrate that the optimal interest rate again responds more aggressively to the output gap if prudence and volatility of cost-push shocks are large and also if there is substantial persistence in aggregate demand. We also show that more weight to output targeting weakens policy responses of the central bank, particularly if triggered by changes in the inflation gap. Section 5 analyzes the role of measurement errors for optimal monetary policy in the accelerationist model. It shows that the reactions of the nominal interest rate to the measured output gap are less vigorous, especially if incoming data are relatively unreliable. We also show that a prudent central bank attenuates these policy reactions and furthermore biases its estimate of the output gap upwards. This makes reactions of the central bank to the output gap more aggressive, particularly if cost-push shocks are volatile and output targeting is important. Finally, we show that a

متن کامل مقاله

دریافت فوری ←

**ISI**Articles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات