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Time-varying inflation targeting after the nineties ☆

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ABSTRACT

This paper provides empirical evidence on monetary policy making for the US, the UK and the EMU using the decomposition in persistent and transitory monetary shocks proposed in Andolfatto, Hendry, and Moran [Journal of Monetary Economics 55 (2008) 406–422]. We use the particle filter to overcome the non-optimality of the Kalman filter that arises as a consequence of the nonlinear dynamics for the time evolution of monetary shocks. This estimating procedure allows us to estimate all the parameters involved in the monetary policy, providing an alternative way to calibration. We present empirical evidence for the US, the UK and the EMU to show the potential applicability of our estimation method. Our findings show that the evidence of a regime change in US monetary policy making from 1997 to 2001 is weak. However, September eleven and the recession that started in the second quarter of 2001 emerge as events that probably led to regime shifts in US monetary policy making. Also the mortgage subprime crisis is another key event affecting the central bank's decisions worldwide. We show that the use of a Taylor rule with time-varying responses in accordance with a Markov-switching setting leads to empirical findings consistent with those obtained with the particle filter.

1. Introduction

Taylor's (1993) influential paper recognizes that monetary policy-making is purposeful and responds to the business cycle. Taylor's rule suggests that a central bank should adjust the short-term nominal interest rate in response to inflation deviations from target and output gap in order to stabilize the economy. This approach to the complex task of policy making, which involves a vast array of data, forecasts and suggestions from advisors, has proved to be a good reflection of Federal Reserve behavior since the early 1980s (Taylor, 1993, 1999; Orphanides, 2003).

A great deal of research has focused on estimating alternative Taylor rule specifications to empirically assess the central bank's reaction to changes in macroeconomic activity and deviations of inflation from target. To deal with this issue three important ideas have been incorporated in the literature: a) expectations play a central role in the determination of inflation and in consequence in the way in which central banks should adjust interest rates (see, for example, Clarida, Galí, & Gertler, 2000; Wilde, 2012), b) central banks beliefs could evolve in response to data releases and revisions (see Pruitt, 2008; Spanjers, 2008) and c) agents could learn about their economic environment and, instead of having rational expectations, they act as econometricians who have limited information at the time of decision-making (see, for example, Orphanides, 2001; Mark, 2009 among others).

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This paper joins with the growing body of recent literature on the role of expectations in monetary policy making. In particular, we show how to exploit the monetary framework proposed in Andolfatto, Hendry, and Moran (2008) to provide additional insights into monetary policy making based on an inertial Taylor-rule framework. Under such scheme, economic agents need to solve a signal extraction problem to decompose monetary shocks into the unobservable persistent (changes in the inflation target) and transitory (control errors) components. The existence of these unobservable components is similar in spirit to the presence of an opaque regime in which the central bank does not release its forecasts (Rhee & Turdaliev, 2013). The monetary scheme proposed in Andolfatto et al. (2008) considers that the unobservable component corresponding to the deviation of the current inflation target from its long term (time-invariant) mean is a variable that exhibits time-varying volatility. This is consistent with the suggestion made in Sims and Zha (2006): "It is time to abandon the idea that policy change is best modeled as a once-and-for-all, non stochastic regime switch. Policy changes, if they have occurred, have not been monotonic, and they have been difficult to detect. Both the rational public in our models and econometricians must treat the changes in policy probabilistically, with a model of how and when the policy shifts occur and with recognition of the uncertainty about their nature and timing". In a similar way, Fernández-Villaverde, Guerrón-Quintana, and Rubio-Ramírez (2010) do not find much evidence of a big difference in monetary policy among the tenures of Chairmen Arthur Burns, G. William Miller, and Alan Greenspan, being the differences attributable to the time-varying volatility of shocks.

Assuming that regime changes implemented by the monetary authority are not monotonic and easily detectable, at least two modeling approaches can be considered to identify changes in monetary policy making. The standard approach is to consider that the responses of the monetary authority to deviations of output and of inflation from their targets depend on the state of the economy. This implies that the reaction function of the policy maker is state contingent, and the Markov-switching approach is useful to estimate the parameters involved. Alternatively, researchers can consider that the monetary authorities' reaction function exhibits constant responses over time, but with changes in the inflation target in the short-run. Under such a framework, the unobservable inflation target could be inferred from the information content in the monetary shocks associated with the Taylor rule. This paper considers the second approach and uses the particle filter as the convenient econometric methodology to identify the nature of the time-varying inflation targeting during the nineties for the US, the UK and the Eurozone.

With respect to the Markov switching methodology, our approach presents two appealing aspects: i) regime changes are modeled in a more flexible manner through a continuous variable, and therefore not restricting the number of potential states of the economy; and ii) it is possible to jointly identify monetary control errors and deviations of the current inflation target from its long-run (time invariant) target.

To highlight the potential benefits of the time varying inflation targeting approach, we provide empirical evidence for the US, the UK and the EMU focusing on the period 1997:Q1–2011:Q1, that spans the Great Moderation and the subprime crisis. We show that the unexpected shock of September eleven, and the US recession that started in March 2001 are clearly affecting the updating of inflation targets, concerning not only the Fed, but also the European Central and the Bank of England. Moreover, after the Great Moderation, the most important event is the unexpected emergence of the mortgage subprime crisis.

Finally we check the robustness of our empirical findings by contrasting the time-varying inflation-target approach with a time-varying parameter approach. The monetary scheme proposed in Andolfatto et al. (2008) assumes constant parameters in the reaction function for the monetary authority that updates inflation target without providing specific information to economic agents. Alternatively, there is also empirical and theoretical work that proposes the use of time-varying parameters for the reaction function of the monetary authority, depending on the current state of the business cycle. Changes in the inflation target for the monetary authority will translate into changes of the coefficients in the policy rule, and they can be estimated by means of a 'regime-switching' specification (see for example, Canova & Gambetti, 2004; Kim & Nelson, 2004; Cogley & Sargent, 2005; Primiceri, 2005). Our empirical evidence suggests that both approaches lead to similar qualitative findings.

The rest of the paper is organized as follows: The next section outlines the monetary policy scheme and the specification of the Taylor rule. Section 3 describes the use of the particle filter as the estimation procedure. Section 4 presents empirical evidence for the US, the UK and the EMU. Finally Section 5 summarizes and provides concluding remarks.

2. The Taylor rule and the monetary setting

Following Andolfatto et al. (2008), let us consider the following Taylor rule:

$$i_t = (1-\rho)\left[r^* + \pi^* + \alpha(\pi_t - \pi_t^*) + \beta(y_t - y_t^*)\right] + \rho i_{t-1} + u_t, \tag{1}$$

where r^* is the long-run equilibrium real interest rate, π_t^* denotes the inflation target, $y_t - y_t^*$ is the output gap, ρ is the parameter accounting for monetary policy inertia and u_t represents the monetary shocks, which can be interpreted as errors underlying the central bank's control over the policy instrument. Also it is assumed that the imperfect control of the monetary policy rule expressed in Eq. (1) as a reaction to time-varying economic environment does not lead to highly persistent errors. Therefore, the time evolution of this shock can be represented as follows:

$$u_{t+1} = \phi u_t + e_{t+1}, 0<\phi<<1, e_{t+1} \underset{iid}{\sim} N\left(0, \sigma_e^2\right). \tag{2}$$

A second disturbance to monetary policy is considered. This noise represents the change in the proper rate of inflation the central bank should pursue as a consequence of changes in the economic outlook. We express these shifts as $z_t = \pi_t^* - \pi^*$, so that