



# On the informational role of term structure in the US monetary policy rule



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## ABSTRACT

This paper uses a structural approach based on the indirect inference principle to estimate a standard version of the new Keynesian monetary (NKM) model augmented with term structure using both revised and real-time data. The estimation results show that the term spread and policy inertia are both important determinants of the US estimated monetary policy rule whereas the persistence of shocks plays a small but significant role when revised and real-time data of output and inflation are both considered. More importantly, the relative importance of term spread and persistent shocks in the policy rule and the shock transmission mechanism drastically change when it is taken into account that real-time data are not well behaved.

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## 1. Introduction

There is currently a fast-growing body of the literature (see for instance, Hördahl et al., 2006; Rudebusch and Wu, 2008 and references cited therein) that aims to link the new Keynesian monetary (NKM) model dynamics with the term structure of interest rates.<sup>1</sup> Most papers in this literature assume a sort of dichotomy where the three-equation NKM model is solved first and independently from term structure, i.e. they consider no feedback from term structure to the macroeconomy. An exception is Nimark (2008) which considers that policy makers may take into account the information revealed by the term structure about the expectations of bond market participants on the future of the economy. In a similar vein and using little macroeconomic structure, Ang et al. (2005) consider a single latent factor interpreted as a transformation of Fed policy actions on the short-term rate. In their model, persistent policy shocks are allowed but policy inertia is not.

Another branch of literature (see for instance, Clarida et al., 2000) has found empirical evidence that the lagged interest rate is a key component in estimated monetary policy rules. Two alternative interpretations have been proposed in the

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<sup>1</sup> There is also a related body of the literature (see for instance, Ang and Piazzesi, 2003; Diebold et al., 2006) linking macro variables to the yield curve using little or no macroeconomic structure.

relevant literature. On the one hand, the significant role of the lagged interest rate may reflect the existence of a traditional concern of central banks for the stability of financial markets (see Goodfriend, 1991). On the other hand, Rudebusch (2002) argues that the significance of the lagged rate in estimated rules is due to the existence of relevant omitted variables. This is because it is hard to reconcile the lack of evidence on the predictive power of the term structure for future values of the short-term interest rate with the existence of policy inertia. Moreover, the existence of omitted variables may result in persistent monetary shocks in estimated rules.<sup>2</sup>

The aim of this paper is to analyze the role of the term spread in the US estimated policy rule by bridging the gap between these two branches of the literature. We build on the first branch by estimating the policy rule of an NKM model augmented with term structure using a classical structural approach based on the indirect inference principle suggested by Smith (1993).

Considering term structure in an otherwise standard NKM model introduces two types of feature. On the one hand, it allows us to consider the term spread, in addition to output and inflation, as a potential candidate for explaining the highly persistent dynamics of the short-term policy rate. A pure informational argument to motivate the inclusion of the term spread in the policy rule is the following: a central bank may consider that real-time data on inflation and output available at the time of implementing policy are not a rational forecast of revised data. Thus, a monetary authority may consider that the term spread, which is observed in real-time, may contain relevant information about true, revised data on inflation and output that real-time data do not provide.<sup>3</sup> Another related argument works as follows. In practice, the Fed uses much more information than that available on output and inflation as announced by statistical agencies. This additional information may contain information on revised output and inflation (and possibly information on market expectations about these variables). This additional information is also likely to be observable by private market participants and taken into account in pricing government bonds. By acknowledging the asymmetric problems faced by both private agents and policy makers, the Fed may then view the term spread as a noisy indicator of the additional information observed in real time on revised output and inflation which is not included in its initial announcements. On the other hand, in a similar vein to Nimark (2008), the model departs from the relevant literature by allowing a dynamic feedback from the term structure of interest rates to the macroeconomy. However, our paper differs from Nimark's in many aspects. Among others, we consider both revised and real time data available at the time of implementing monetary policy whereas Nimark (2008) uses only revised data.<sup>4</sup>

The timing and availability of data used in the empirical evaluation of monetary policy rules have now become important issues (see among others, Orphanides, 2001; Ghysels et al., 2002).<sup>5</sup> A general conclusion reached from the estimation of monetary policy rules based on real-time data is that it allows for the potential reduction of the effects of parameter uncertainty in actual policy setting, which is relevant when real-time announcements of macroeconomic variables are biased.<sup>6</sup>

The use of real-time data in the estimation of a structural DSGE model may look tricky because it is the decisions of private agents (households and firms) that determine the true (revised) values of macroeconomic variables, such as output and inflation, and they are not observable without error by policy makers in real time. This paper extends the NKM model to include revision processes of output and inflation data, and thus to analyze revised and real-time data together. This extension allows for (i) a joint estimation procedure of both monetary policy rule and revision process parameters and (ii) an assessment of the interaction between these two sets of parameters.

The empirical results based on revised data for output and inflation show that the term spread plays an important and statistically significant role in the monetary policy rule. Moreover, the policy rule is characterized by both strong policy inertia and persistent policy shocks. Policy inertia and the term spread remain important when using both revised and real-time data. However, the persistence of policy shocks becomes less important, but remains significant. Furthermore, the estimates of the revision process parameters show that the initial announcements of output and inflation are not rational forecasts of revised data for output and inflation. For instance, a 1% increase in the initial announcement of inflation leads to a downward revision in inflation of 0.58%. More important, the relative importance of term spread and persistent shocks in the policy rule and the shock transmission mechanism drastically change when it is taken into account that real-time data are not well behaved.

The rest of the paper is organized as follows. Section 2 introduces the log-linearized approximation of a standard version of the NKM model augmented with term structure. Section 3 describes the structural estimation method used in this paper, motivates its use and discusses how it relates to other estimation methods, such as the Bayesian estimation strategies used

<sup>2</sup> By using reduced-form estimation approaches some empirical studies, such as English et al. (2003) and Gerlach-Kristen (2004), have shown that both policy inertia and persistent shocks enter into the estimated monetary policy rule.

<sup>3</sup> Empirical evidence found by many researchers (see for instance, Estrella and Mishkin, 1997; Ang et al., 2005) points out that the term spread contains useful information concerning market expectations of both future real economic activity and inflation.

<sup>4</sup> Moreover, as discussed below, we estimate a Taylor-type policy rule instead of the parameters involved in a central bank loss function since one of our main concerns is the analysis of the importance of persistent shocks in the policy rule once the term spread is included in the rule.

<sup>5</sup> A pioneering study is that of Mankiw et al. (1984), who develop a theoretical framework for analyzing preliminary announcements of economic data and apply that framework to the money stock.

<sup>6</sup> Aruoba (2008) documents the empirical properties of revisions to major macroeconomic variables in the US and points out that they are not white noise. That is, they do not satisfy simple desirable properties, such as zero mean, which indicates that the revisions of initial announcements made by statistical agencies are biased, and that they are predictable using the information set at the time of the initial announcement.

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