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## Bond risk premiums and optimal monetary policy

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## ABSTRACT

The bond yield dynamics implied by a welfare-maximizing monetary policy and its credibility are explored in general equilibrium. Credibility is captured by a regime change from discretion to commitment. The policy determines the optimal output and inflation responses to a source of inflation risk. Bond yields contain compensations for this risk that depend on the policy. Credibility improvements reduce the exposure to inflation risk and bond risk premiums decline. A model calibration implies lower yield spreads, less volatile yields, and reduced deviations from the expectations hypothesis under commitment. The model suggests an explanation for changes in yield dynamics in the U.S. across different policy regimes.

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## 1. Introduction

Recent contributions to the term structure literature such as Dai and Singleton (2002) and Duffee (2002) provide models that successfully reproduce salient properties of bond yields. Upward-sloping yield curves, volatile long-term yields, and time-varying compensations for risk in bonds (risk premiums), can be captured by no-arbitrage affine term structure models. This achievement, however, has been mainly accomplished by specifying bond yields as functions of latent variables with no evident economic interpretation. That is, the economic sources of bond yield variation still need to be explained. Monetary policy, as an important determinant of economic performance, is a natural candidate to explain properties of bond yields. This paper analyzes the implications of optimal monetary policy on long-term bond yields. It asks how a welfare-maximizing policy and its credibility affect bond risk premiums, and shows that changes in monetary policy are a natural explanation for some of the observed changes in the dynamics of United States government bonds.

The empirical evidence in Section 2 shows that different regimes in U.S. monetary policy are characterized by different output, inflation and bond yield dynamics. In particular, the average difference between yield levels for long- and

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short-maturity bonds varies significantly across regimes. This suggests a potential link between monetary policy, economic performance, and risk premiums in long-term bonds. The link is explored with a theoretical model where monetary policy is conducted to maximize welfare and its regime depends on the policy's ability to affect agents' expectations.

The model builds on the standard framework for monetary policy analysis presented in Clarida et al. (1999) or Woodford (2003) and extends it to price long-term bonds. Simplified and extended versions of the model are presented in Sections 3 and 4, respectively. The simplified model provides the intuition to understand the main results. The extended model is built to deliver a tractable Duffie and Kan (1996) affine term structure model capturing salient bond properties. Equilibrium bond yields are linear functions of macroeconomic factors, with factor loadings depending on the policy regime and preference and production parameters. Upward sloping yield curves and time-varying bond risk premiums are obtained by incorporating external habit formation in preferences, similar to the specifications in Abel (1990), Campbell and Cochrane (1999), or Wachter (2006).

A welfare-maximizing goal for monetary policy aims at the joint stabilization of output and inflation. Monetary policy influences real activity due to nominal rigidities in an environment of monopolistic competition in the production sector. These rigidities, in combination with shocks to production markups, generate a tradeoff between output and inflation stabilization. As a result, markup shocks have effects on output and inflation, whose size depends on the credibility of the policy regime. Following Kydland and Prescott (1977), credibility is captured by allowing monetary policy to be conducted under discretion or commitment. Under discretion, the monetary authority takes private sector's expectations as given. Under commitment, the policy is perfectly credible and affects these expectations. Equilibrium differences across the two regimes capture the effects of policy credibility on economic conditions and bond yields.

The implications of optimal monetary policy for output, inflation and bond yields are analyzed in Section 5. Welfare maximization prescribes an optimal tradeoff between output and inflation stabilization. The inflation weight in the welfare function is the elasticity of substitution across goods (ESG) and determines the tradeoff: The monetary authority must react to a percentage point of inflation by reducing output (or output growth if the policy is under commitment) by a number of percentage points equal to the ESG. This tradeoff and the existence of markup shocks do not allow the perfect stabilization of inflation and output simultaneously. The marginal utility of consumption is then affected by markup shocks and investors require a compensation for holding assets with returns sensitive to these shocks, such as nominal bonds. The sign and size of the compensation for markup shocks are determined by the policy and its credibility.

The optimal nature of the policy determines the net effect of markup shocks on the marginal utility of consumption and, thus, the sign of the compensation for these shocks in financial assets. A positive markup shock reduces output and increases inflation. Lower output and higher inflation have opposite effects on the marginal utility of nominal consumption. The positive output effect outweighs the negative inflation effect if the inflation weight in the welfare function is high enough. Specifically, if the ESG is higher than the elasticity of intertemporal substitution of consumption (EIS), the increase in marginal utility from a reduced real consumption is not offset by the increase in nominal values from a higher inflation. In this case, asset payoffs positively correlated with markup shocks are high in periods of high marginal utility, providing a consumption hedge. These assets involve a negative risk premium for markup shocks. The effect is the opposite if the EIS is greater than the ESG.

Policy credibility determines the size of the compensation for markup shocks. The compensation is larger under discretion than under commitment. Under commitment, anchoring private sector's expectations works as an additional mechanism to stabilize output and inflation. Then, the impact of markup shocks on economic performance declines and the compensation for this risk decreases.

Bond returns are affected by economic conditions and are sensitive to markup shocks. It follows that bond premiums for these shocks depend on the optimal policy and its credibility. The effects of credibility on bond risk premiums are analyzed based on the model calibration and the policy experiment in Section 6. The model under discretion is calibrated to match some macroeconomic and bond yield properties of the U.S. economy for the period 1971–2007. The experiment consists in a regime switch from discretion to commitment keeping unchanged the initial calibrated parameters. Lower average spreads between long- and short-term bonds are observed under commitment, reflecting reduced bond risk premiums. Investors demand lower compensations for holding long-term bonds under commitment since bond returns are less sensitive to markup shocks. In addition, bond yields and risk premiums are less volatile under commitment, implying reduced deviations from the expectations hypothesis. It is explained by the different response of inflation to markup shocks under commitment.

The discussion in Section 7 is intended to provide a credibility-based explanation for changes in bond yield dynamics across different monetary policy regimes in the United States. High policy credibility may explain the low volatile yields and low bond spreads during the Bretton Woods agreement. On the other hand, the increased bond risk premiums observed during the Greenspan era sheds some doubts about an improved policy commitment during this period. However, an explanation based on policy credibility may be given to the Greenspan Conundrum, since higher commitment in monetary policy reduces the response of long-term rates to economic shocks.

#### *Related literature*

This paper joins a growing body of work that relates the term structure of interest rates to monetary policy. Diebold et al. (2005) summarize recent attempts in empirical and theoretical grounds to understand the joint dynamics of the term structure of interest rates, macroeconomic variables, and monetary policy. For instance, Ang and Piazzesi (2003) and Piazzesi (2005) show how economic information and monetary policy help us improve the empirical fitting of the yield curve relative

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