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Taylor rules, McCallum rules and the term structure of interest rates ☆

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Abstract

Recent empirical research shows that a reasonable characterization of federal-funds-rate targeting behavior is that the change in the target rate depends on the maturity structure of interest rates and exhibits little dependence on lagged target rates. See, for example, Cochrane and Piazzesi [2002. The Fed and interest rates—a high-frequency identification. American Economic Review 92, 90–95.]. The result echoes the policy rule used by McCallum [1994a. Monetary policy and the term structure of interest rates. NBER Working Paper No. 4938.] to rationalize the empirical failure of the 'expectations hypothesis' applied to the term structure of interest rates. That is, rather than forward rates acting as unbiased predictors of future short rates, the historical evidence suggests that the correlation between forward rates and future short rates is surprisingly low. McCallum showed that a desire by the monetary authority to adjust short rates in response to exogenous shocks to the term premiums imbedded in long rates (i.e. "yield-curve smoothing"), along with a desire for smoothing interest rates across time, can generate term structures that account for the puzzling regression results of Fama and Bliss [1987. The information in long-maturity forward rates. The American Economic Review 77, 680–392.]. McCallum also clearly pointed out that this reduced-form approach to the policy rule, although naturally forward looking, needed to be

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studied further in the context of other response functions such as the now standard Taylor [1993. Discretion versus policy rules in practice. Carnegie-Rochester Conference Series on Public Policy 39, 195–214.] Rule. We explore both the robustness of McCallum's result to endogenous models of the term premium and also its connections to the Taylor Rule. We model the term premium endogenously using two different models in the class of affine term-structure models studied in Duffie and Kan [1996. A yield-factor model of interest rates. Mathematical Finance 57, 405–443.]: a stochastic volatility model and a stochastic price-of-risk model. We then solve for equilibrium term structures in environments in which interest rate targeting follows a rule such as the one suggested by McCallum (i.e., the "McCallum Rule"). We demonstrate that McCallum's original result generalizes in a natural way to this broader class of models. To understand the connection to the Taylor Rule, we then consider two structural macroeconomic models which have reduced forms that correspond to the two affine models and provide a macroeconomic interpretation of abstract state variables (as in Ang and Piazzessi [2003. A no-arbitrage vector autoregression of term structure dynamics with macroeconomic and latent variables. Journal of Monetary Economics 50, 745–787.]). Moreover, such structural models allow us to interpret the parameters of the term-structure model in terms of the parameters governing preferences, technologies, and policy rules. We show how a monetary policy rule will manifest itself in the equilibrium asset-pricing kernel and, hence, the equilibrium term structure. We then show how this policy can be implemented with an interest-rate targeting rule. This provides us with a set of restrictions under which the Taylor and McCallum Rules are equivalent in the sense if implementing the same monetary policy. We conclude with some numerical examples that explore the quantitative link between these two models of monetary policy.

JEL classification: G0; G1; E4

Keywords: Term structure; Monetary policy; Taylor Rule

1. Introduction

Understanding a monetary authority's policy rule is a central question of monetary economics, while understanding the determinants of the term structure of interest rates is a central question of financial economics. Combining the two creates an important link across these two related areas of economics and has been the focus of a growing body of theoretical and empirical research. Since work by Mankiw and Miron (1986) established a clear change in the dynamic behavior of the term structure after the founding of the Federal Reserve, researchers have been working to uncover precisely the relationship between the objectives of the monetary authority and how it feeds back through aggregate economic activity and the objectives of bond market participants, to determine an equilibrium yield curve that embodies monetary policy considerations.

Of particular interest in this area is the work by McCallum (1994a). McCallum showed that by augmenting the expectations-hypothesis model of the term structure with a monetary policy rule that uses an interest rate instrument and that is sensitive to the slope of the yield curve, i.e., the risk premium on long-term bonds, the