Evolving Participatory Learning Fuzzy Modeling for Yield Curve Forecasting with Time-Varying Volatility

Leandro Maciel  Fernando Gomide
Department of Computer Engineering and Automation
School of Electrical and Computing Engineering
University of Campinas
Albert Einstein Ave. 400, 13083-852, Campinas, SP
E-mails: {maciel,gomide}@dca.fee.unicamp.br

Rosangela Ballini
Department of Economic Theory
Institute of Economics
University of Campinas
Pitágoras St. 353, 13083-857, Campinas, SP
E-mail: ballini@eco.unicamp.br

Abstract

This paper suggests a dynamic approach for the term structure of interest rates forecasting using evolving participatory learning fuzzy modeling (ePL). The model includes a time-varying volatility structure in order to predict the yield curve factors. Thus, this framework both comprises an adaptive framework for term structure parameters behavior and deal with the uncertainty related to these factors by describing its variability patterns. Results based on US Treasury market data indicate that the ePL model outperformed a common approach in the literature, based on autoregressive processes, for short- and long-term horizons considering the fitness accuracy.

Keywords: Fuzzy Systems, Adaptive Forecasting, Interest Rate, GARCH Models.

1 Introduction

The term structure of interest rates depicts the relationship between the nominal rates of default-free zero-coupon bonds and time to maturity. Its fitting and forecasting is an extremely useful tool for finance and macroeconomics. The yield curve may be employed for the pricing of bonds, interest rate derivatives, asset allocation, portfolio and risk management and corporate financial decisions. In macroeconomics, the interest rate gives relevant informations on the economic status and it is also used for the implementation and evaluation of the monetary policy.

The major models devoted for the yield curve modeling can be categorized into three main classes: no-arbitrage, equilibrium, and statistical models. No-arbitrage models are constructed by the imposition of consistency conditions between the interest rates of several maturities so as to prevent the systematic existence of arbitrage opportunities [12]. On the other hand, equilibrium models are characterized by the imposition of equilibrium conditions between the yields of several maturities for the interest rate. Using the structure of affine models, this class is obtained on the modeling of the instantaneous forward rate, in which the rates of other maturities can be derived by assuming that the risk premium is given by an affine function [5]. The third class of models, statistical models, is obtained as statistical