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Estimating Yield Curve The Svensson Extended Model Using L-BFGS-B Method Approach

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Abstract. Yield curve is curves that describe the magnitude of the yield against maturity. To describe this curve, we use the Svensson model. One extension of this model is Rezende-Ferreira. Expansion undertaken by Rezende-Ferreira has weaknesses that there are several parameters have the same value. These values form Nelson-Siegel model. In this paper, we propose expansion of Svensson model. These models are non-linear model, so it is more difficult to estimate. To overcome this problem, we propose Nonlinear Least Square by L-BFGS-B method approach.

Keywords: Yield curve, Svensson extended, and L-BFGS-B.
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INTRODUCTION

Investing in bonds, we need information about the yield that would be obtained and the maturing of the bond. This component is the main component in bound investing. These two components is also foundation for researchers to describe the yield curve.

Yield curve can be described by various model, one of which is Nelson-Siegel class model. This model is experiencing rapid growth which is widely used by various states as reference in the view of the yield curve. The models included in Nelson-Siegel class model that is Nelson-Siegel (NS) model, Svensson (SV) model, Rezende-Ferreira (RF) model, and Svensson extended (SVE) model. SVE model is a model that extended of SV model by combining the first hump and hump two in one factor, so this model consists of flat, slope, hump combined, and the second hump.

The extension of this model is based on the RF by adding second slope into SV model resulting model will form NS model until the addition of the slope does not give accuracy from previous models (SV model). RF model is a model consisting of flat curve, first slope, second slope, first hump, and second hump (Rezende and Ferreira (23)). This model is extension of the SV model, SV model consist of flat curve, slope, first hump and second hump (Svensson (26)).

These models are based on earlier model which consists of flat, slope, and hump proposed by Nelson and Siegel of the University of Washington in 1987 (Nelson and Siegel (21)). In this paper, we just depictions of the yield curve and do not forecasting of yield curve. Papers that discuss the Nelson-Siegel class model, namely: Svensson (26); Boldier and Streliski (2); Mansi and Philips (20); Brousseau (3); Jankowitsch and Pictler (16); Diebold, et al (10); Diebold et al (6); Diebold, et al (8); Diebold, et al (9); Krippner (18); Ejsing, et al (12); Bauer (1); Christensen, et al (4); Christensen (5); Kripner (19); Ferst and Hayden (13); Gilli, et al (14); Rezende and Ferreira (23); and Rosadi (24).

Nelson-Siegel class model has linear and nonlinear parameters. In these conditions of these models has many local minima so that the estimate can't use the usual estimate. Previous studies have been widwly discussed estimation of the Nelson-Siegel class model, including: Boldier and Streliski (2) discusses this model in various maturity by estimate discuss the maximum likelihood estimation (MLE), Maria, et al (28) compared the Nelson-Siegel Model and Vasicek models, the estimate used is MLE. Gilli, et al (14) estimate the Svensson models with Least Square algorithm in two forms the optimization: first optimization of curvature has many local optima, second particular emphasis on a range of parameters, the conditions are bad models provide estimates of the parameters are not stable against the data. Rezende and Ferreira (23) compare the forecasting of the four development Nelson-Siegel model class, namely: NS, Bliss, SV and the five-factor model in improving the model of perfection, which is to use innovation to quantile Autoregression (QAR). Rosadi (24) doing SV model estimation by PQRT using a R computational.

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