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RECURSIVE PARAMETER IDENTIFICATION FOR INFINITE-DIMENSIONAL FACTOR MODEL BY USING PARTICLE FILTER -APPLICATION TO US-TREASURY BONDS-

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Abstract. *We consider the dynamics of forward rate process which is modeled by the parabolic type infinite-dimensional factor model. The parameters included in this parabolic model are estimated by using the yield curve as the observation data. In this paper, we propose the filtering and identification method for the parabolic type factor model by using the particle filter algorithm.*
Keywords: Parabolic type factor model, Yield curve data, Kalman filter, Parameter estimation, Particle filter

1. **Introduction.** The modeling of the term structure is one of the most challenging topics of financial research.

The most significant contribution to the infinite dimensional approach was made by Heath, Jarrow and Morton [1]. For infinite dimensional stochastic models, Goldstein [2] and Kennedy [3] introduced a new model of the term structure based on random fields. This setting has already been adopted by several authors [4,5]. The empirical analysis of treasury yields has also been studied by Duffee [6]. The term structure models are important to study commodity prices [7] and backwardation in option prices [8].

Recently, from empirical observations, Bouchaud et. al. and Cont [9] proposed term structure dynamics following a parabolic stochastic partial differential equation driven by a general Brownian motion process. According to the parabolic type modeling, parameter and stochastic volatility estimations and utility maximization problem are also studied in [10,17].

In this paper, we select the parabolic type stochastic partial differential equation with stochastic boundary inputs for the term structure dynamics. The stochastic boundary inputs are generated by the linear stochastic equations with mean-reverting property. Noting that the instantaneous forward process is unobservable, we need to construct an observation mechanism from market instruments. Choosing the yield curve data as the observation process, we set the finite dimensional discrete-time observation mechanism. For fixed parameters included in the parabolic systems, the optimal filter becomes the Kalman filter which can be computed exactly. However once we construct the augmented