Empirically Effective Pricing Model for US Government Bonds and Analysis on Term Structures of Implied Interest Rates in Financial Crisis

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Abstract

Using Kariya’s bond pricing (1993) model, whose empirical pricing capability for non-defaultable bonds has been shown for Japanese Government bonds (JGBs) in Kariya and Tsuda (1994) and Kariya, et.al (2012), this paper makes a comprehensive empirical analysis on US Government bond (USGB) prices for a period including the Financial Crisis in 2008 and makes some comparisons with the results of JGBs. The model is a cross-sectional model that simultaneously values individual fixed-coupon (non-defaultable) bonds of different coupon rates and maturities via a stochastic discount function approach. In this paper we first clarify the theoretical relation between our stochastic discount function approach and the spot rate or forward rate approach in mathematical finance. Then we make a comprehensive empirical study on its pricing capability for individual USGBs with different attributes and its capacity of describing the movements of term structures of interest rates that USGBs imply as yield curves. Based on various tests of validity in a GLS (Generalized Least Squares) framework we propose a specific formulation with a polynomial of order 6 for the mean discount function that depends on maturity and coupon as attributes and a specific covariance structure. It is shown that even in the middle of the Financial Crisis, the cross-sectional model we propose is shown to be very effective for simultaneously pricing all the existing USGBs and deriving and describing zero yields.

Key words and phrases: Cross-Sectional Bond Pricing Model, Term Structure of Interest Rates, Subprime Shock, Financial Crisis, Swap Rate, Japanese Government Bond, Generalized Least Squares, Forward Rate, Discount Function