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The U.S. Treasury yield curve: 1961 to the present ☆

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Abstract

The discount function, which determines the value of all future nominal payments, is the most basic building block of finance and is usually inferred from the Treasury yield curve. It is therefore surprising that researchers and practitioners do not have available to them a long history of high-frequency yield curve estimates. This paper fills that void by making public the Treasury yield curve estimates of the Federal Reserve Board at a daily frequency from 1961 to the present. We use a well-known and simple smoothing method that is shown to fit the data very well. The resulting estimates can be used to compute yields or forward rates for any horizon. We hope that the data, which are posted on the website http://www.federalreserve.gov/pubs/feds/2006 and which will be updated quarterly, will provide a benchmark yield curve that will be useful to applied economists.

JEL classification: G12; E43

Keywords: Yield curve; Treasury market; On the run premia; High-frequency data

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1. Introduction

Interest rates are one of the basic ingredients of applied work in macroeconomics and finance. Having a long time series of properly measured high-frequency yield curves will therefore facilitate research in these areas. Towards that end, this paper fits a yield curve to off-the-run Treasury notes and bonds at the daily frequency for the entire maturity range spanned by outstanding Treasury securities, from 1961 to 2006. The resulting yield curve can be expressed in terms of zero-coupon yields, par yields, instantaneous forward rates, or $n \times m$ forward rates (that is, the m-year rate beginning n years ahead) for any n and m.

Several authors have produced time series estimates of U.S. Treasury yield curves. Perhaps the most commonly used among these are the Fama–Bliss (1987) yields. Commonly available Fama–Bliss yields are month-end measures of yield curves going out to five years in maturity. The yield curve estimates that we present more information than the Fama–Bliss yields in three ways. First, we provide daily estimates, facilitating high-frequency studies. Second, we present estimates going out to the longest available maturity—for example, we provide more than 35 years of 10-year yields. Lastly, the estimates presented in this paper will be updated quarterly, keeping the data current.

Section 2 of the paper briefly reviews the fundamental concepts of the yield curve. Section 3 describes the specific methodology that we employ to estimate the yield curve, and Section 4 discusses our data and some of the details of the estimation. Section 5 shows the results of our estimation, including an assessment of the fit of the curve, and Section 6 demonstrates how the estimated yield curve can be used to calculate the yield on "synthetic" Treasury securities with any desired maturity date and coupon rate. As an application of this approach, we create a synthetic off-the-run Treasury security that exactly replicates the payments of the on-the-run 10-year Treasury note, allowing us accurately to measure the liquidity premium on that particular issue. Section 7 concludes. The data are posted as an appendix to the paper on the FEDS website.

2. Basic definitions

This section reviews the fundamental concepts of the yield curve, including the necessary "bond math" that will be used in the subsequent discussion.[1]

2.1. The discount function and zero-coupon yields

The starting point for pricing any fixed-income asset is the *discount function*, or the price of a zero-coupon bond. This represents the value today to an investor of a \$1 nominal payment n years hence. We denote this as $d_t(n)$. The continuously compounded yield on this zero-coupon bond can be written as

$$y_t(n) = -\ln(d_t(n))/n. \tag{1}$$

Although the continuously compounded basis may be the simplest way to express yields, a widely used convention is to instead express yields on a "coupon-equivalent" or

[1] The concepts and algebra presented here are a shortened version of the detailed exposition available in the working paper form of this paper, Gürkaynak et al. (2006).