CHEME 131 Module 3: Registered Interest and Principal of Securities (STRIPS) Bonds

Jeffrey D. Varner

Smith School of Chemical and Biomolecular Engineering
Cornell University, Ithaca NY 14853

Introduction

Registered Interest and Principal of Securities (STRIPS) bonds are a unique type of fixed-income investment instrument that provides investors with an alternative way to access the coupon payments of Treasury securities. STRIPS bonds are created by separating a Treasury securities coupon and principal components and trading them as individual zero-coupon securities. This process allows investors to purchase and trade the coupon or principal components separately, providing greater flexibility in managing their investment portfolios.

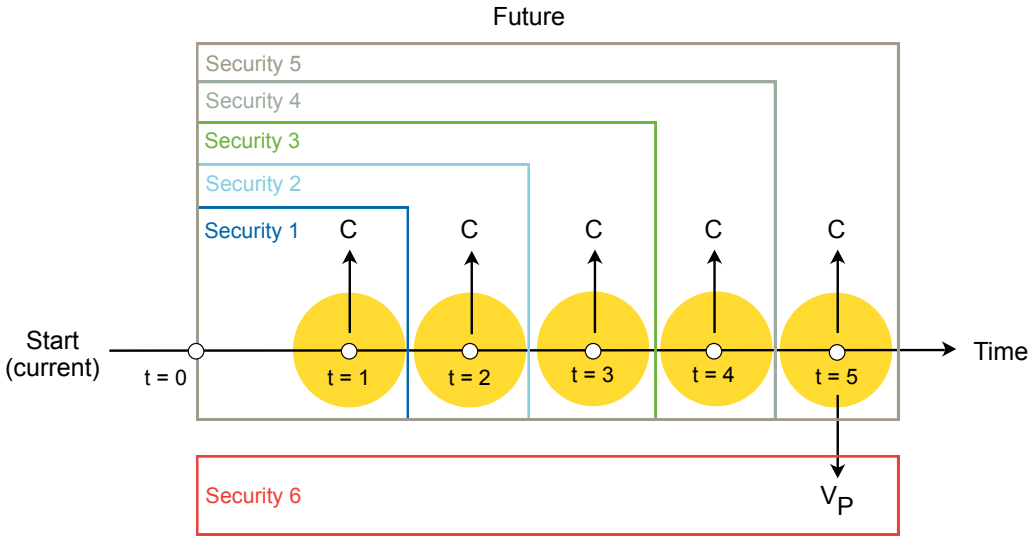

Fig. 1: Schematic of a Registered Interest and Principal of Securities (STRIPS) bond generated from a 5-year Treasury note. The coupon and principle payments from the coupon-based note are stripped fron the original instrument and sold as seperate marketable securities.

For example, a 5-year Treasury note with annual coupon payments of C USD and a face (par) value of V_P (USD) can be stripped into six separate zero-coupon securities, i.e., five zero-coupon bonds, each with face values of C and maturity of T= 1,2,3,4 and 5 years, and a six security with face (par) value of V_P USD with a duration of T = 5 years (Fig. 1). In the general case, a treasury note or bond with $N = \lambda T$ coupon payments, where T denotes the maturity in years, and λ represents the number of coupon payments per year, can be stripped into $N + 1$ separate zero-coupon securities. Beyond thier immediate value as investment tools, STRIPS are interesting as they provide look at the term structure of interest rates, i.e., the relationship between the remaining time-to-maturity of debt securities and the yield on those securities.

In this module, we'll explore the mathematics of STRIPS bonds, and how they can be used to understand the term structure of interest rates, i.e., how we can use STRIPS to compute the short-rates, and the yield curve.

Spot, Short and Forward Rates

A spot rate is the annual interest rate which is to be used for discounting the cash flows which occur at that date, i.e., now. Alternatively, the spot rate is the rate of return on a zero coupon bond that is purchased today and matures at some future date. Suppose a bond with a face value of V_P (future USD) and a maturity of T years is purchased today for V_B (USD). The spot rate, $\bar{r}$, is the interest rate that makes the future face value of the bond equal to the purchase price, i.e.,

$$V_B \cdot (1 + \bar{r})^T = V_P \tag{1}$$

Given the spot rate, we can compute the price of a bond with a face value of V_P (USD) and a maturity of T years or, alternatively, we can compute the spot rate $\bar{r}$ from the market price of a bond V_B:

$$\bar{r} = \left(\frac{V_P}{V_B}\right)^{\frac{1}{T}} - 1 \tag{2}$$

The spot rate $\bar{r}$ is constant for the entire life of the bond. However, we know that interest rates change in time, thus, we can take a more nuianced view of the spot rate as a function of time which we call the short rate.

The short rate is the interest rate that occurs between two consecutive time periods, i.e., the interest rate that occurs between time t and time $t + 1$. We denote the short rate between time period t and $t + 1$ as $r_{t+1,t}$. The short rate is a random variable. which flucates in time. We've seen the short rate before in another guise, i.e., in the multiperiod discrete discountr factor, $D_{t,0}$, which is the discount factor between time $t = 0$ and $t = t$. Of course, the short rates are related to the spot rate, $\bar{r}$, by the following relationship:

$$\prod_{j=0}^{t-1} (1 + r_{j+1,j}) = (1 + \bar{r})^t \tag{3}$$

Summary

Fill me in.