1 Introduction

1.1 Overview

In the lab, you will use Bloomberg to explore the topics of bond total return, vari-
ous measure of bond return, and the leading factors of return change. Total return
includes not only capital gains, i.e. the profits from bond price change, but interests
earned, and the reinvestment return gained from interests.

The Financial Times’s article “Rivals jostle for bond king’s crown” will help you
get a better understanding of this topic. Carefully read the article, and try to answer
the question: what is this article about? What finance principles and theorems are
underlying in the issues the article is introducing?

This lab guide is setting to explore:

- Review bond yield
- The relationship between total return and yield
- Other measures of bond return
- Sensitivity of total return to yield change

1.2 Assignment details

As you work through these sections, be sure to prepare a detailed logbook for your-
self to contain all the steps and results. Your logbook should be in a spiral bound or
similar notebook, used only for purposes of our Labs. You will turn in your logbook after each Lab, and it will be returned to you after each Lab is graded.

You should make and save screenshots of some of the important Bloomberg screens you construct. (In the lab guide, there are tips for you to save the most important screens and you are expected save the minimum set of screenshots.) In your logbook, record the date/time and description (with the Bloomberg Mnemonic where feasible) of all Bloomberg screens used to obtain the specific numbers you rely on for each question below. This allows for your data to be checked later for the professor’s auditing purposes and your review purposes.

When you are finished, use your logbook and the understanding you have developed to prepare a 6-8 page Lab Report for turn-in. Your lab report should carefully and professionally explain what you have done, what you have found, and what your work teaches you about finance. Your Lab Report should be numbered and keyed to the sections and specific items in this Lab Guide.

Your report should contain some Bloomberg graphics to help illustrate your points and show your completion of the lab items. These should be carefully labelled as numbered exhibits and should be placed in an Appendix at the end of your written report. Every Exhibit should be specifically discussed in the text of your report! Do not attach extra pages and pictures that you do not refer to in the body of your report, by specific exhibit number.

You may work through the lab with a partner, and you may turn in a single report for your partner team. Your Lab Report must be typed and carefully edited, and it should conform to professional standards for a business report.

A final note, about this Lab Guide. The Guide gives specific instructions on how to do the experiment, which have been tested on a Bloomberg terminal. Sometimes Bloomberg changes functionality, and the defaults and settings on your account may vary from the account used for testing. Thus, some flexibility and small adjustments on your part may be needed as you work through the Lab Guide.

2 Yield of 10-year and 30-year US Treasury bond

1. In this section, you will draw the graph of the yield of 10-year US Treasury bond in Bloomberg and observe the changes in yield of the Treasury bond dur-
ing three specific periods. You have learned how to draw the yield graph of securities in Bloomberg function GY; enter GT10 <Govt> GY in command line and Bloomberg will show you the yield graph of 10-year US Treasury bond.

In this lab, you should focus on the yields of bonds in June 2013, June 2014 and the current month. The default setting in GY may not show you a time window that covers the three periods. So you may need to click on Daily tab at the top of the screen and choose an appropriate time window. The lab guide is written in December 2014, so the time window is 2Y (stands for 2-year) and Daily.

If you see Yld Wst or some words other than Bid YTM on the second-to-the-top row of yellow boxes, then use the pull-down to choose Bid Yield to Maturity. And continue to use Bid Yield to Maturity for other GY graphs you make later in this lab.

- What is the trend of the yield during the years?
- What is 10-year US Treasury bond’s yield in June 2013, June 2014 and now?
- What could be the underlying factors that cause the yield to change during the years? You can refer to the Financial Times article “Rivals jostle for bond king’s crown”, which is mentioned at the beginning of the lab guide to explore and inspire your thinkings; you can also click on the News button at the middle top of the chart to look up market events and information that could help.

2. In this section, you will compare the yield of 10-year US Treasury bond with yield of 30-year US Treasury bond. Click on Security/Study top at the right-hand side of the screen. Click on Add Security tab at the top of pop-up column, and Enter GT30 <Govt> (which stands for 30-year US Treasury bond) in the added yellow box. Then Bloomberg will display the yield of 30-year US Treasury bond; choose Bid Yield to Maturity as the Fields of Study in the box below. Click Security/Study again to make the chart big.

- What is the trend of the yield during the years? What is 30-year US Treasury bond’s yield in June 2013, June 2014 and now?
• Based on your observations in the previous items, how do the yields of 10-year and 30-year US Treasury bonds co-move with each other (i.e. when yield of 10-year US Treasury bond was increasing, was the yield of 30-year US Treasury bond increasing too? When 10-year US Treasury moved down did 30-year US Treasury moved down as well?)

3 Total return of 10-year US Treasury bond

1. According to the Bloomberg definition of Total Return,

$$\text{Net Future Value} = \text{NPV at Settlement} \times (1 + Y/(100 \times F))^T$$

where,

$$\text{Net Future Value} = \text{Principal at horizon date} + \text{Accrued Interest at horizon date} + \text{Coupon Payments} + \text{Reinvestment Income}$$

$$Y = \text{Total Return}$$

$$F = \text{Total Return Frequency, at which the total return compounds}$$

$$T = \text{the time from settlement to horizon in compounding periods}$$

Yield is defined as the rate of return paid if the security is held to its workout date, assuming that all expected payments are made and the security is paid in current price.

Type GT10 <Govt> FIHZ and <Go> in the command line to enter Bloomberg’s Fixed Income Horizon Analysis function. FIHZ allows you to value the expected total return (Total Return), holding period return (HPR) and money market return (MMKT) of a selected bond over a specific time horizon, based on expectations of yields and reinvestment rates. By using FIHZ you can compute the changes in the returns when yields shift in the investment horizon, and compare the sensitivities of different bonds.

*Left Top.* In Security frame window, you should enter GT10 <Govt> in the yellow box right below Security and chose B (stands for Buy) in the right-hand side yellow box. The Amt(M) should be 1,000. You can fill in other bonds in the second and third rows of the frame to form a portfolio. In this lab guide,
we only focus on one single bond each time.

Middle Top. In the Settlement frame window, Date stands for the settlement date, and in this lab we use today as the settlement date, which is also the default setting in Bloomberg. The Settlement date is not necessarily the same day as the issue date of the bond, so there is accrued interest when we buy the bond. Notice that the accrued interest is also a factor in the computation of total return.

Price stands for the current price value of the bond, and Yield is the current yield of the bond. In the right-hand side yellow box, W stands for Worst and M stands for Maturity. In this lab, you should always select Maturity.

Risk is the price value of a basic points change in yield for a 10,000 face amount. For instance, Risk is 8.86 for the 10-year US Treasury bond on December 8, 2014, which means that if we change the yield of a 10,000 face amount bond by 1 bp, the current price of the bond will change by 8.86. Think about the Risk and we will have a short discussion in class.

Right Top. At the right of the Settlement frame window is the Horizon frame window. You should set up the horizon date as one year after the settlement date. For instance, if the settlement date is 12/09/14, the horizon date will be 12/09/15. The Price in the frame is the price value of the bond at the horizon date and the Yield stands for the yield at the horizon date. We also choose M as Maturity in the right-hand side yellow box.

Click on Settings at the right top corner. Set Total Return Frequency and Money Market Day Count as Conventional.

Middle. In the Return Analysis frame window, the Reinvestment Rate is the repo rate as the default. In this lab, we will not study on the impact of reinvestment return. You should set the rate as zero to exclude the contribution of reinvestment income from returns. At the right of the frame window is the B/E which stands for break-even yield. The break-even yield is the yield at the horizon date for which the returns become zero.
You can click on View Cashflows to have detailed information, such as: (1) the accrued interest at settlement date; (2) NPV at settlement date; (3) coupon payments in the investment horizon; (4) and reinvestment income in the investment horizon.

Below the View Cashflows tab shows the Total Return, HPR, MMKT and Net P&L of the investment before and after tax.

We have defined total return at the beginning of the section. HPR (Holding Period Return) is defined as follows in Bloomberg:

\[
\text{HPR} = \left( \frac{\text{Net Future Value} - \text{NPV at Settlement}}{\text{NPV at Settlement}} \right) \times 100
\]

Net P&L is calculated as Net Future Value minus NPV at Settlement, where

Net Future Value is the sum of Principal, Accrued Interest, Coupon Payments and Reinvestment Income. Principal is the price of the bond at horizon date multiplied by the amount of the bond; Accrued Interest is the unpaid interests at horizon date since last coupon payments; Coupon Payments is the total coupon from settlement date to horizon date; and Reinvestment Income is the reinvested return (at repo rate as default) of the cash flow amount obtained from the investment.

After Tax returns are the net of tax effect and lower than the Pre Tax returns. You can set up the tax rates to zero and observe the pure effect of price change on the returns. Notice that in this lab, we only focus on Pre Tax returns.

To understand the returns, here is a calculation example. For instance, if NPV at Settlement is 1,000,000, Principal at horizon date is 1,000,100, Accrued Interest at horizon date is 1,000, Coupon Payments is 22,000, Reinvestment Income is 10, Total Return Frequency is semi-annual, and holding period is one year, then

\[
\text{Net Future Value} = \text{Principal at horizon date} + \text{Accrued Interest at horizon date} + \text{Coupon Payments} + \text{Reinvestment Income} = 1,000,100 + 1,000 + \]
22,000 + 10 = 1,023,110

HPR = Net Future Value / NPV at Settlement -1 = 1,023,110 / 1,000,000 -1 = 2.311%

Net P&L = Net Future Value - NPV at Settlement = 1,023,110 - 1,000,000 = 23,110.

We will discuss MMKT in later item.

*Bottom* The Historical Yield chart shows the historical yield of the bond in the past three months. You can change the time window in the right-hand side yellow boxes.

- At the top of the screen in the Settlement frame window the Yield yellow box shows the current yield, what is the current yield of the bond?
- In the middle of the screen the Total Return yellow box indicates the current total return. What is the current total return of the 10-year US Treasury bond?
- Click on View Cashflows tab in the middle of the screen, and the pop-up window should show you the details of the investment including Principles, Accrued Interests, NPV at Settlement and Net Future Value. What are the numbers showed in the pop-up window? Try to compute the total return based on the numbers (review the calculation example).
- Increase the yield at the horizon date by 0.1. What is the current total return of the bond? How much has the total return changed?
- Click on View Cashflows tab in the middle of the screen. How does the numbers on the window change? Try to compute the changed total return based on the numbers.
- What factors lead to an increase in bond total return? What change in economy and what market news could cause the increase? Refer to your answer to “What could be the underlying factors that impact and cause the yield change during the years?”. How does the change in yield have an impact on bond price? And how does the bond price lead to total return change?
• In the Financial Times article *Rivals jostle for bond king’s crown*, the author suggested what factors that lead to “the change of bond king”? What happened at the time when the article was written, in June 2014?

• What is the HPR of the bond? Click on View Cashflow tab and try to compute the HPR by yourself.

• What is the MMKT?

2. In this item, we will discuss the transmissions among Total Return, HPR and MMKT. As we have introduced at the beginning of the section,

\[
\text{Net Future Value} = \text{NPV at Settlement} \times (1 + \frac{Y}{(100 \times F)})^T, \quad \text{where} \quad \frac{\text{Net Future Value}}{\text{NPV at Settlement}} = 1 + \text{HPR}. \quad \text{So if restructure the equation we will have}
\]

\[
\text{Total Return} = ((\text{HPR} + 1)^{\frac{1}{T}} - 1) \times 100 \times F
\]

In the previous example, Total Return Frequency is semi-annual so to convert annualized return to semi-annual return we need to divide annualized total return by 2, i.e. \( F=2 \). Investment horizon is one year, so Total Return compounds two times from settlement to horizon date, i.e. \( T=2 \):

\[
\text{Total Return} = ((\text{HPR} + 1)^{\frac{1}{2}} - 1) \times 100 \times 2 = 2.298\%
\]

*Extra Credit.* Notice that Bloomberg calculation for the convention is far more complex; it takes into consideration coupon payment frequency, day count convention of the bond and foreign exchange rate effect. So the Total Return is not necessarily the same as the calculation result but they are very close. Extra credits are given for students who solve for the convention between Total Return and HPR. You can download Excel spreadsheets from the Help page where more details are included in Total Return calculation.

MMKT converts the HPR to the specified day count convention in Settings. For instance, if you set up the Money Market Day Count as ACT/360 in Settings, and HPR is 2.311%:
\[ \text{MMKT} = \text{HPR} \times \frac{360}{365} = 2.311\% \times \frac{360}{365} = 2.279\% \]

- Change the setting of Total Return Frequency to Semi-annual. Click on Update to close the pop-up window. What is the current Total Return? What is the HPR? Can you compute the Total Return from HPR? (Refer to the previous example in this item)
- Change the setting of Money Market Day Count to ACT/365. Hit Update and close the pop-up window. What is the MMKT? Is MMKT the same as HPR?
- Change the setting of Money Market Day Count to ACT/360. Hit Update to close the window. What is the MMKT? How do you compute MMKT from HPR?

4 Total return of 30-year US Treasury bond

1. Click on Settings and set Total Return Frequency and Money Market Day Count as Conventional. In this section, you will change the bond you study from the 10-year US Treasury bond to the 30-year US Treasury bond. 30-year US Treasury bond has a longer time of maturity and thus its features, for instance, sensitivity to yield change is different. Enter GT30 <Govt> in the Security yellow box at the top of the screen in place of GT10 <Govt>. Other settings should be the same as in the previous item and assure that you use a M for Maturity and zero as Reinvestment Rate.

- What is the current total return of the 30-year US Treasury bond? What is the current yield of the bond?
- Increase the yield at horizon date by 0.1. What is the current total return? How much has the total return changed? This is meant to allow you to compare the sensitivity of the 10-year US Treasury bond and the 30-year US Treasury bond.
- Does the 30-year US Treasury bond have the same sensitivity as the 10-year US Treasury bond? If not, which one shows a larger sensitivity? What might lead to the difference in their sensitivity of total return to a change in yield?
5 Total return of 30-year US Treasury STRIP

1. In this section, you will explore a US zero-coupon STRIP from which investors only receive principal payment at maturity but no interest payment during holding periods. Enter SP <Govt> (stands for principal only STRIP that is the principal component of US Treasury bonds) in the yellow Security box. Bloomberg will show you multiple matches for SP <Govt> because SP <Govt> stands for zero-coupon STRIPS with different issue days and terms of maturity. You should select the STRIP with the same Issue Day and Maturity Day with your 30-year US Treasury bond.

Just for instance, in this lab, we use the 30-year US Treasury bond that was issued at 11/17/14 and that will mature at 11/15/44 because this lab was written in around Nov 2014 and Bloomberg will always have a preference for the latest issued bond. So we choose the STRIP that was issued at 11/17/14 and that will mature at 11/15/44. The 30-year US Treasury bond and zero-coupon principal-only STRIP both have the same Issue Day and Maturity Day. But notice that when you are working on the lab the latest might not be the one that issued at 11/17/14 and will mature at 11/15/44. You should select the STRIP that issued and will mature at around the same time as you previously used in your 30-year US Treasury bond.

- Load your selection of SP <Govt> in FIHZ and ensure that settings the same as in previous item. Click on Settings and set Total Return Frequency and Money Market Day Count as Conventional. Make sure to set Reinvestment Rate as zero and select M for Maturity. What is the current total return of 30-year US Treasury principal only STRIP? What is the current yield of the zero coupon bond?

- Click on View Cashflows. What is the difference between zero coupon cashflows and 30-year US Treasury bond cashflows? Can you compute the HPR, Total Return and MMKT by the numbers in the Cashflows window?

- Increase the yield at horizon date by 0.1. What is the current total return? How much has the total return changed?
• Click on View Cashflows. Can you compute the HPR, Total Return and MMKT by the numbers in the Cashflows window?

• Compare the sensitivities of total return changes to yield changes of zero coupon bond, 30-year bond and 10-year bond. Does the zero coupon bond have a larger or smaller sensitivity? What is the underlying factor affecting sensitivity?

6 Rivals jostle for bond king’s crown

1. Reread the article we discussed in the lab guide Rivals jostle for bond king’s crown. In class, we will have a detailed discussion about the article.

Focus on the table “10 biggest US bond funds” and the chart of “US government bonds”. The article was written on June 2014 when the 10-year Treasury yield decreased from 3.0 to about 2.6. You have explored the relationship between yield and price, and the consequence to total return of yield change in previous sections. In the same logic, the yield shift in June 2014 led to the change in the bond funds’ total return.

• What is the ranking of Mr Gross’s bond fund Pimco Total Return? According to the article, what has changed to the total return of the fund?

• How does Pimco Income managed by Mr Ivascyn perform? What is the fund’s ranking? According to the article, which class of assets does the bond fund manage? What are the characteristics of the assets? In which direction did the total return change as yield shift on June 2014? Specify the logic of the change in several short sentences.

• As yield decreased, some bond funds decreased their ranks. In your best guess, which characteristics should these bond funds have (low coupon bond or high coupon bond? long-term bond or short-term bond?).