

Instructions and Guide for Pricing and Valuation of Interest Rate Swap Lab

FINC413 Lab

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1 Introduction

1.1 Overview

In this lab, you will learn the basic idea of the meanings of interest rate swap, the swap pricing methods and the corresponding Bloomberg functions. The lab guide is about EUR and USD plain vanilla swaps and cross currency basis swap. You will learn in the lab guide:

- Single currency plain vanilla swap
- Cross currency basis swap
- Historical rates/spreads of the swaps
- The characteristics of interest rate swaps, such as the pay frequency and discount curve
- The calculation of swap coupon rates, spreads and market values

This lab only concerns the interest rate swaps, so we will leave credit default swaps, the credit derivative contract, which transfer the credit exposure from one party to another, and other types of swaps for future discussion.

In this lab guide, we primarily focus on two types of interest rate swaps:

- Single currency fixed-for-floating (plain vanilla) interest rate swaps, which exchange fixed-rate interest payments for floating-rate (usually LIBOR) interest payments between two counterparties on a specified notional amount and do

not exchange the notional amount (principle). For example, firms desire floating borrowing opportunity can borrow in a fixed rate bond and use a fixed-float swap to synthesize a floating rate borrowing.

- Cross currency interest rate swaps exchange the coupon payments of different currencies. The notional principle might or might not be exchanged between the two counterparties, and it depends on the type of the swap. By the use of cross currency swap, for instance, a US company can borrow EUR at the spot foreign exchange rate from the European bond market and pay EUR coupon payments, and at the maturity of the swap, the company payback the principle in USD.

In this lab, also, by following the instructions of Bloomberg functions, and answering the related questions, you will be able to obtain a basic knowledge about interest rate swaps, and to establish the three Takeaways: stylized facts of the financial world, skills to carry into your finance future and principles to guide your thinking about finance.

1.2 Assignment details

As you work through these sections, be sure to prepare a detailed logbook for yourself 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 Single currency interest rate swap

In this section you will primarily focus on single currency plain vanilla (fixed-for-floating) interest rate swap. You will graph swap rates in the 5-year timeframe to observe their trends, and get a rough idea about the probable factors that drive the trend. Your main goal is to interpret the swap rates and explore their meanings.

1. In this item, you will get a basic knowledge about swaps. Log in your Bloomberg account.

Command Line. Type WS (World Swap Matrix) <Go> in the command line.

Left. The default setting for the yellow box at the left top of the screen should be Regional, otherwise, you should select Regional in the drop-down list to have a regional view for swaps.

In this section, you will focus on a 5-year term of maturity, and you should select 5 Year at the left top yellow box. You should also use Bid in the Market

yellow box at the right top of the screen.

Have a look around the screen, save it and answer the questions.

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- Briefly describe the given information on the screen, i.e. what items are showed on the screen? For instance, the answer should be, current rate for each swap displayed on the screen is given.
 - What regional of swaps can you find on the screen? (For instance, Europe/Africa)
 - You can display the swaps by ticker or by name. (Hint: Select “Ticker” or “Name” at the left top of the table to make your adjustments.) What are tickers for the swaps of USD 5 Year S/A and EUR 5 Year?
2. On the screen, find the row for USD 5 Year S/A, which right below the Current Page tab.
- What information is given for the swap USD 5 Year S/A (for instance, you may write, Current Rate is given)?
 - What is the current rate for USD 5 Year S/A? What is the change on the day? Please also give the Update Time at the right of Change on Day.
 - What is the 12-month yield change? What is the 6-month yield change? You can select the terms for the yield changes displayed in the yellow drop-down lists at the top of the screen.
3. In this item, you will learn how to get the description, the basic information, about the swap. Click USD 5 Year S/A, the swap on the first row on the Current Page tab on the screen, and select DES: Description on the pop-up window. Bloomberg will open a new window for USD 5 Year S/A swap description.
- What is the definition of swap rate of a single currency plain vanilla interest rate swap? Is it same as the fixed rate the counterparty enter into the swap needs to pay? (Hint: You can Google “swap rate” and find some very useful information about it.) How is swap rate related to the floating rate?
 - What is swap spread, how is it calculated by government bond yield and swap rate? (Hint: Google “swap spread”)
 - What is denominated currency?

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- What does Day Count stand for? (Hint: try to find some definitions about “day count”, and one of the ways is to Google “swap day count”) What are the specific type of Day Counts for the swap? What do these specific Day Counts, such as 30/360 and ACT/360, for this swap stand for? (i.e. How many days are counted per month, and how many days are counted in a year?)
 - What does Pay Freq mean? What are the Pay Freqs for Fixed Leg and Float Leg, respectively, for the swap? What do they stand for?
4. In this item you will graph the historical swap rates of the single currency plain vanilla swap and observe their trends.

Close the child window. Click USD 5 Year S/A again and select GP: Price Graph on the pop-up window. Bloomberg will open another new window for the chart of USD 5 Year S/A swap.

The default data field should be Last Price, which stands for the price of last trade. If not, you could change the data field by selecting Last Price in the drop-down list at the top left of the chart.

Date range is displayed right bellows the data field yellow box. Here you should click 5Y to change to a Daily 5 Year time frame setting.

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- The swap name displayed on the left top of the window is USSWAP5 CMPN Curncy. Could you explain the meaning of USSWAP5 CMPN Curncy? (Hint: “CMPN” is the pricing source for the security selected) Can you have a guess for “USSWAP5”? What does “Curncy” mean? Recall what you have completed in the first section about Ticker.
- What is the current swap rate of USSWAP5 Curncy? Is it the same as what is displayed on the WS screen? What is the update time?
- What is the swap rate for the last trade day? What is the change since the last trade day? Is it the same as that on the WS screen?
- What is the periodicity for the graph? (Hint: recall what we have learned in the first lab guide) What trend does the graph show? When is it highest and when is it lowest? What are the corresponding swap rates?
- Click on the News button near the top center of the screen, and explore what would push the swap rates upwards and what would drive them

down. (Recall what you have learned in the previous lab guide) What general economic factors, in your opinion, might make turbulences in the swap market?

- This question may need a little research and exploration on your own. Can you speculate on future USD 5 Year S/A swap rate movement? What does your guess base on, i.e. explain how you make the guess (Hint: your reasoning can based on your expectations on the factors influence the swap rate, references can include economists' forecast report, finance news and market movement)?

5. Close the child window and go back to the WS screen.

Select Europe/Africa in the yellow the drop-down list at the top left to change region from America to Europe and Africa.

Click EUR 5 Year on the second row of the Swaps Table and select GP: Price Graph on the pop-up window. In the newly opened window will display the price graph of EUSA5 CMPN Curncy.

Setup your graph setting for data field and date range at the top of the chart: they should be Last Price and 5Y, respectively.

- The swap name now displayed on the left top of the window is EUSA5 CMPN Curncy. Could you explain what EUSA5 CMPN Curncy stands for?
- What is the current swap rate of EUSA5 Curncy? Is it higher or lower than the rate of USSWAP5 Curncy? What is the reason, in your best guess, for the spread?
- What trend does the graph show? Does it show the same trend as USSWAP5 Curncy? When is it highest and when is it lowest? What are the corresponding swap rates?
- What do you think might push up or drive down the European swap rates? (Hint: You might use News button near the top of the screen to try to find relevant info, search info on the Internet, such as academic articles and finance news, or refer to what you have learned in your previous classes.) We are seem to ask questions similar to what we asked before, but the answers are different.

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3 Cross currency basis swap

1. In this section, you will explore the historical swap spreads of cross currency basis (floating-for-floating) swap. Please pay attention to the differences between single currency swaps and cross currency swaps and keep the idea in your mind, which might help you answer the questions in later section. Change the swap studied from EUR 5 Year to EUR-USD XCCY Basis Swap 5Y by typing EUBS5 Curncy <Go> in the yellow box at the left top of the window. Set data field and date range as Last Price and 5Y, respectively.

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- What is the EUR-USD XCCY Basis Swap 5Y? What do “XCCY” and “Basis” stand for? What is the differences between the EUR-USD XCCY Basis Swap 5Y and the two previously studied swaps (USSWAP5 Curncy and EUSA5 Curncy)?
- What does the curve in the chart stand for? Is it the swap rate?
- What is the current swap spread? What is the definition of swap spread of cross currency basis swap? (Hint: Google “cross currency swap” to find clues on swap rate.)
- What trend does the graph show? When are the highest and when is the lowest? Click on the News button near the top center of the screen, and try to explore what would push the swap spreads upwards and what would drive them down. What general economic factors, in your opinion, might make turbulences in the swap market?

4 Single currency plain vanilla swap in SWPM

SWPM (Bloomberg Swap Manager) is a useful tool to calculate, for example, the fair value of swaps, the at-market spread between two swaps and premium. In this section, you will use SWPM to explore characteristics of single currency plain vanilla swaps and get an idea of the pricing of swaps.

1. In this item, you will set up the pricing features of USD 5 Year plain vanilla swap.

Command Line. Go back to the screen of WS by tying WS <Go> in the command line.

Right click USD 5 Year S/A on the first row of the left column and click Load USSWAP5 Curncy <Go> to load the swap.

Command Line. Enter SWPM by typing SWPM <GO> in the command line. On the screen will display the SWPM setting for the swap USD 5 Year S/A.

In this item, you should use a Fixed Float Swap, which is the blue word showed at the left top of the screen. On the left top of the screen is the fixed leg of the deal, Leg 1; and on the right top of the screen is the floating leg of the deal, Leg 2. You can configure your settings in Leg 1 and Leg 2. You can enter, for example, the notional, currency, effective date, maturity date and pay frequency for the deal.

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- What are the default settings for the swap in Leg 1 and Leg 2? What currency are the cash flows of the swap denominate? What is the term of maturity of the swap?
 - In the swap, does the counterparty receive fixed rate or makes fixed rate payments? How can you switch the payer and the receiver? (Hint: Which setting should you change to make the USD floating rate payment receiver in Leg 1 to pay the floating rate in the swap?)
2. In this item, you explore other important characteristics of swaps, such as notional amount and reset frequency.
- What is the Notional (notional amount) of the swap? What index is used in the floating leg? What is the amount of each floating rate interest payments for the swap, i.e. how is the payment calculated?
 - What is the Pay Freq (pay frequency) for the fixed leg and what are the Reset Freq (reset frequency) and Pay Freq for the floating leg? What do they stand for? (Hint: you can click Help at the right top of the screen, and open the Help Page for SWPM. Then you should click on Definitions on the last row of the left column to find some very useful information)
 - What other settings can you setup for Leg 1 and Leg2? What do they mean? (Hint: you can click Help at the right top of the screen, and open the Help Page for SWPM. Then you should click on Definitions on the last row of the left column to find some very useful information)

3. In the middle of the screen, the Curve Data panel allows you to choose the market curve used to discount cash flows and to project forward pricing. In this lab, we use 23- (USD Bloomberg Curve) for swaps.

- What is Dscnt Curve (discount curve)? What is Fwd Curve (forward curve)? (Hint: you can use Definitions on Help Page to find more information) How do they change the value of the swap?

4. In this section, you will learn about the EUR 5 Year plain vanilla swap. Pay attention to the differences between USD and EUR swaps. You will switch from USD fixed-for-floating swap to EUR fixed-for-floating swap. Go back to the WS screen and select Europe/Africa in the drop-down list at the left top of the screen. Then right click EUR 5 Year on the second row of the left first column and hit Load EUSA5 Curncy <Go>. Type SWPM <Go> in the command line at the top to enter the SWPM function for EUSA5 Curncy.

- In what currency is the swap denominated? What is the term of maturity of the swap?
- What are the pay frequencies and reset frequency of the swap? Are they same as those of USSWAP5 Curncy?
- What curves are used to discount the swap payments? What do they stand for? (Hint: refer to their names)

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5 Cross currency basis swap in SWPM

1. In this section, you will explore the cross currency basis swap in SWPM and you will get a fundamental knowledge about the characteristics in order to price cross currency basis swap. Notice that the currency is a very important factor in pricing the cross currency swaps and that is the key factor differentiates cross currency swaps from single currency swaps.

Top. You should click Product button on the top red tool bar, then select Cross Currency Swaps in the pull-down list and select Cross Currency Swap (Float-Float) in the pop-up list.

You should have USD and EUR as currencies in Leg 1 and Leg 2, respectively, and 5-year term of maturity for the swap.

- In which Leg does the counterparty receive USD float rate and in which Leg does the counterparty pay EUR float rate? What amount of interest payments is made during the term of the swap in each Leg? How can you switch the payer and the receiver of USD in SWPM? (Hint: Which setting should you change to make the USD floating rate payment receiver in Leg 1 to pay the floating rate in the swap?)
- What does “Float-Float” mean? What is the difference between a floating-for-floating swap and a fixed-for-floating swap?
- In what currency is denominated for each of the two legs? What is the term of maturity of the cross currency basis swap?
- What are Reset Freq and Pay Freq of the two legs? What indexes are used in the swap? What do they stand for?

6 Swap pricing: swap rate, spread and market value

1. In Bloomberg Definitions, Market Value is defined as “The sum of the present values of the leg cashflows”. You should Google “interest rate swap” to find the valuation and pricing of interest rate swap.

For fixed leg of swap, interest (coupon) payments are calculated as swap rate multiplied by notional amount (principle); these interest payments are discounted by the discount factor and by the day count convention factor to get the present values of the interest payments (recall the Day Count you have learnt in the previous section); then the present values of each payment are summed to get the value of the fixed leg.

For floating leg of swap, interest payments are calculated as forward rate multiplied by notional amount. Then interest payments are discounted by day count convention factor and discount factor to get the present values. The value of the floating leg is the sum of present values of interest payments.

The value of the swap is the net present value of the swap pay and receive legs.

2. In this item, you will price the coupon rate, spread and market value of USD plain vanilla swap, a single currency swap, by SWPM. Go back to WS and load USD 5 Year S/A in SWPM.

- What is the Coupon (coupon rate) of Leg 1?
- What is the Spread in Leg 2? What does the spread of the floating leg mean? (Hint: you should find the definition of Spread in SWPM) How is spread calculated? (Hint: How is it related to the floating rate paid in the swap and LIBOR?) What is the difference between coupon rate in Leg 1 and the spread in Leg 2?
- Is Leg 1 the equivalent bundle of cash flows to Leg 2? How do you know? Indicate the judgment basis. (Hint: find the MV in Leg 1 and Leg 2)
- What is the Market Value of the swap, as indicated at the bottom of the screen? Is it 0? Explain how you use the pricing formula you found?
- At the bottom of the SWPM screen, you can enter the variable you want to solve for in the yellow box and configure your setting for the premium in the Premium fill-in box. Set the yellow box on the right of Calculate as Premium, and press <Go>. What is the value in the gray box on the right of Premium? How is Premium calculated? (Hint: refer to Definitions in Help Page)
- What is the Par Cpn (par coupon), which is at the bottom of the screen, of the swap? What does Par Cpn stand for? (Hint: recall the Help Page for SWPM)
- How will the Market Value and Premium, both at the bottom of the screen, change, if you increase the Coupon in the Leg 1 by 0.1%? Can you explain the change direction by the pricing formula you have used?
- Reset the Coupon in the Leg 1 as the default value. How much is the coupon rate, if you select Leg1: Coupon in the pop-up list on the right of Calculate, which is at the bottom of the screen, and set Premium, on the last row of the screen, as 1.00000? How much is the Market Value, also on the last row? Can you explain the value change direction by the pricing formula?
- Reset the coupon rate as the value of the Par Cpn at the bottom of the screen. In what direction will the Spread in the Leg 2 change, if you select Leg2: Spread in the pop-up list on the right of Calculate, which is at the bottom of the screen, and set Premium, on the last row of the screen, as 1.00000? Can you explain?

3. In this item, you will price the coupon rate, spread and market value of cross currency basis swap by SWPM. You should pay special attention to the differences between single currency swaps and cross currency swaps in their pricing methods. You should click Product button on the top red tool bar, then select Cross Currency Swaps in the pull-down list and select Cross Currency Swap (Float-Float) in the pop-up list. You should have USD and EUR as currencies in Leg 1 and Leg 2, respectively, and 5-year term of maturity for the swap.

- What is the Index for Leg 1 and Leg 2, respectively? Which Index is used, respectively? (For instance, US0003M is used in Leg 1) What do they mean? (For instance, US0003M stands for 3 Month US Dollar LIBOR) (Hint: Google the name of the Index)
- What is the spread for Leg 1 and Leg 2, respectively? What do they mean? (For example, 0.00 bp means the counterparty pay/receive a floating rate equal to the LIBOR) Is the spread in Leg 2 the same as that in Leg 1? If not, what does the difference mean?
- What is the MV (market value) of Leg 1? What about the MV of Leg 2? Is the market value of Leg 2 as large as that of Leg 1 in magnitude? How do Notional and Index change the value of the legs? For instance, if you increase the index by a little bit, what will the value of the leg change? Will it increase? You might refer to the swap pricing formula you have used.
- What is the Market Value of the swap, at the bottom of the screen?
- How much is the Premium, on the right of Market Value? What does it mean, i.e., how does it calculated?
- How will the Market Value and Premium, both at the bottom of the screen, change, if you increase the Spread in the Leg 1 by 0.1bp? Can you explain the change direction by the pricing formula you have used?
- Reset the Spread in the Leg 1 as the default value. How much is the spread in Leg 1, if you select Leg1: Spread in the pop-up list on the right of Calculate, which is at the bottom of the screen, and set Premium, on the last row of the screen, as 1.00000? How much is the Market Value, also on the last row? Can you explain the value change direction by the pricing formula?
- Reset the Spread in Leg 1 as the default value. In what direction will the Spread in the Leg 2 change, if you select Leg2: Spread in the pop-up list

on the right of Calculate, which is at the bottom of the screen, and set Premium, on the last row of the screen, as 1.00000? Can you explain?