MMA 708 Analytical Finance

Create a model in Excel/VBA to value Floating Rate Notes (FRN), fixed coupon bonds and swaps.

20th December,2010

Members:

GBADAGO EVELYN DELA

BASHIRUDDIN NABUBIE IBRAHIM

ISAAC NSIAH YEBOAH

OSEI-FOSU AUGUSTINE

Lecturer: Jan R. M. Röman



Department of Mathematics and Physics

Mälardalen University, Vasteras, Sweden

**Abstract**

This report, we wrote about Create a model in Excel/VBA to value Floating Rate Notes (FRN), fixed coupon bonds and swaps. We spoke about the: Interbank Rate that the floating payments are based upon. These payments occur every three months, every six months or every year, i.e. with reset periods of 3, 6 or 12 month, A given spread upon the Inter Bank Rate (LIBOR, EUROBOR, STIBOR etc), that gives the cash flow amount, Maturity of the FRN. The Discount Margin, Day count convention and the days of the cash flows. MathType, Excel and VBA are the useful tool that did help us in giving better in-depth explanation and analysis of the work. We finally found out that Floating Rate Notes (FRN), fixed coupon bonds and swaps, in the first place is an interesting contract to enter and also very complex to deal with.

Table of content

Abstract………………………………………………………………….2

Table of content…………………………………………………………3

Introduction……………………………………………………………...4

Goal……………………………………………………………………...4

Definition of basic terminologies………………………………………..4

Floating Rate Notes (FRN)……………………………………………...6

Issuer…………………………………………………………………….6

Variation………………………………………………………………...6

Risk……………………………………………………………………...7

Trading…………………………………………………………………..7

Methodology…………………………………………………………….7

Swap……………………………………………………………………11

Types of swap………………………………………………………….11

Valuation of swap……………………………………………………...13

Using bond price………………………………………………….........13

Using arbitrage argument………………………………………………13

Conclusion……………………………………………………………..14

Reference………………………………………………………………14

1 Introduction

* 1. Goal

The goal of this report is to

* Create a model in Excel to value Floating Rate Notes (FRN), fixed coupon bonds and swaps
* Familiarizing ourselves with how to construct an optimizer
* Give explanation to terms like: Floating Rate Notes (FRN), fixed coupon bonds and swaps

2.1 Definition of basic terminologies

* Floating Rate Notes (FRN): Floating rate notes (FRNs) are bonds that have a variable coupon, equal to a money market reference rate, like SIBOR, plus a spread
* Bond: is a debt security, in which the authorized issuer owes the holders a debt and, depending on the terms of the bond, is obliged to pay interest
* Coupon: is the amount of interest paid per year expressed as a percentage of the face value of the bond. In a nut shell it is the interest rate that a bond issuer will pay to a bondholder
* Money market:is a component of the financial markets for assets involved in short-term borrowing and lending with original maturities of one year or shorter time frames
* Reference Rate: is a rate that determines pay-offs in a financial contract and that is outside the control of the parties to the contract. Euribor - Euro Interbank Offered Rate, KIBOR - Karachi Interbank Offered Rate, LIBOR - London Interbank Offered Rate, MIBOR - Mumbai Interbank Offered Rate SIBOR - Singapore Interbank Offered Rate, SIBOR- Stockholm Interbank Offered Rate, TIBOR - Tokyo Interbank Offered Rate, WIBOR - Warsaw Interbank Offered Rate, these are example of reference rate for short term interest rate.
* Swap: is a derivative in which counterparties exchange certain benefits of one party's financial instrument for those of the other party's financial instrument

2 Floating Rate Notes (FRN)

As we rightly defined it, in introductory chapter, Floating Rate Notes (FRN), are bonds that have a variable coupon, equal to a money market reference rate, like SIBOR, plus a spread. Floating-rate notes usually can be redeemed at face value on certain dates at the holder's option. Floating-rate notes pay short-term interest and generally sell in the secondary market at nearly par value. Floating-rate notes are indicated in bond transaction tables in newspapers by the symbol *t.* Also called, floater as well as variable rate note.

2.1 Issuer

The question of who has the right to issue floating rate note, In fact through our studies of floating rate note we couldn’t come out with the right people, but we were meant to believe that everybody is capable of issuing floating rate note in a said geographical location provided you have been confirmed by the laws of the said geographical location to do so. But we realized that mostly the right is giving to banks.

 2.2 Variation

Floating Rate Notes (FRN), has some variations of which some have special features such as maximum and minimum, they are called capped  and floored respectively, with both called collared  Another is perpetual  which is also called irredeemable or unrated .

2.3 Trading

Securities dealers make markets in FRNs. It traded over-the-counter. The biggest investors are banks. In the US unlike Europe FRNs are mostly held to maturity, so the markets aren't as liquid. In the wholesale markets, FRNs are typically quoted as a spread over the reference rate

2.4 Risk

FRN has a bond duration close to zero, and its price shows very low sensitivity to changes in market rates. When market rates rise, the expected coupons of the FRN increase in line with the increase in forward rates, which means its price remains constant. As FRNs are almost immune to interest rate risk, they are considered conservative investments for investors who believe market rates will increase.

2.5 Methodology

FRN Price/Yield calculations

Floating rate note are valued in exactly the same way as a standard fixed-coupon bond, ie discounting the future coupon payment from the FRN back to the settlement date, there are however at least two complications associated with applying the generic bond formula to an FRN, and both relate to the determination of the uncertain future coupon amounts:

* Unknown Coupon Periods: The main future of FRN is that the coupon rate for each coupon payment period is determined with reference to the value of an index at the beginning of each period. At any giving valuation date it is unknown that these rate will be, hence they required to be forecasted based on a specified set of assumptions.
* Choice of coupon payment Date: For vanilla fixed-coupon bonds, the market standard assumption is that each coupon period has an equal length, and this in part gives rise to a coupon amount that is also constant. The actual cash flows for are dependent on the length of the coupon period. This means that even if the coupon rate is constant, the coupon amount will differ across the life of the note. Calculation of price and yield of can therefore be based on different assumptions regarding coupon payment date.

To lay emphasis on the last point, note that in general the coupon amount for the coupon period of an FRN(per $1000 face value), assuming that the rate reset frequency and the payment frequency are the same, is computed as:



Where

coupon amount for the coupon period.

index level (as a percentage) as at the observation date for the  reset

quoted margin (as a percentage) relative to the index level

number of days in the period, based on the selected accrual method.

 number of days in year, based on the selected accrual method.

Quite clearly, the assumption regarding the treatment of coupon dates will potentially cause the calculated value of DIP to change across coupon periods. If the ‘actual’ number of payment date is used in the calculation, the resulting coupon periods length will differ and this will give rise to different coupon payments even if the reference rate is assumed to be the same for all reset dates.

The price/yield calculations of can be based upon three set of assumptions, which are

* Equal coupon rates and equal coupon periods
* Equal coupon rates and exact coupon periods
* Different coupon rates and exact coupon periods

In this our report we will write about different coupon rates and exact coupon periods.

Different Coupon Rates and Exact Coupon Periods

This valuation approach requires the availability of an appropriate curve from which from which forecasts for all future rate resets can be derived. These rates, or those derived from a separate curve, are also used as the ‘base’ rates for the discount factors used to compute the present value of each coupon payment.

The dirty price from FRN under this pricing approach can still be calculated using the pricing equations under the equal/exact assumption, but with some redefinitions for the coupon amount formulas. The equation is



If the rate reset frequency is the same as the payment frequency, than coupon amount are determined as





Where

the observed rate reset at the preceding rate reset date

the forecast rate reset for the rate reset date.

In case where the rate resets occur more frequently than the coupon payments, the coupon rate is computed as:



number of rate resets within the current payment period.

quoted margin that is applied to each rate reset

quoted margin that is applied to the compounded coupon rate



3 Swap

From the introductory chapter we know that swap is a derivative in which counterparties exchange certain benefits of one party's financial instrument for those of the other party's financial instrument. There are four types of swap which can also be diversify to six types, of they are:

* Interest rate swaps
* Currency swaps
* Commodity swaps
* Equity swap
* Credit default swaps
* Other variations

Interest rate swaps

The most common type of swap is a “plain Vanilla” interest rate swap. It is the exchange of a fixed rate loan to a floating rate loan. The life of the swap can range from 2 years to over 15 years. The reason for this exchange is to take benefit from comparative advantage.

Some companies may have comparative advantage in fixed rate markets while other companies have a comparative advantage in floating rate markets. When companies want to borrow they look for cheap borrowing i.e. from the market where they have comparative advantage. However this may lead to a company borrowing fixed when it wants floating or borrowing floating when it wants fixed. This is where a swap comes in. A swap has the effect of transforming a fixed rate loan into a floating rate loan or vice versa.

Currency swaps

A currency swap involves exchanging principal and fixed rate interest payments on a loan in one currency for principal and fixed rate interest payments on an equal loan in another currency. Just like interest rate swaps, the currency swaps also are motivated by comparative advantage.

Commodity swaps

A commodity swap is an agreement whereby a floating (or market or spot) price is exchanged for a fixed price over a specified period. The vast majority of commodity swaps involve crude oil.

Equity swap

An equity swap is a special type of total return swap, where the underlying asset is a stock, a basket of stocks, or a stock index. Compared to actually owning the stock, in this case you do not have to pay anything up front, but you do not have any voting or other rights that stock holders do have.

Credit default swaps

A credit default swap (CDS) is a swap contract in which the buyer of the CDS makes a series of payments to the seller and, in exchange, receives a payoff if a credit instrument - typically a bond or loan - goes into default (fails to pay). Less commonly, the credit event that triggers the payoff can be a company undergoing restructuring, bankruptcy or even just having its credit rating downgraded. CDS contracts have been compared with insurance, because the buyer pays a premium and, in return, receives a sum of money if one of the events specified in the contract occur. Unlike an actual insurance contract the buyer is allowed to profit from the contract and may also cover an asset to which the buyer has no direct exposure.

Other variations

* There are myriad different variations on the vanilla swap structure, which are limited only by the imagination of financial engineers and the desire of corporate treasurers and fund managers for exotic structures.

A total return swap is a swap in which party A pays the total return of an asset, and party B makes periodic interest payments. The total return is the capital gain or loss, plus any interest or dividend payments. Note that if the total return is negative, then party A receives this amount from party B. The parties have exposure to the return of the underlying stock or index, without having to hold the underlying assets. The profit or loss of party B is the same for him as actually owning the underlying asset.
* An option on a swap is called a swaption. These provide one party with the right but not the obligation at a future time to enter into a swap.
* A variance swap is an over-the-counter instrument that allows one to speculate on or hedge risks associated with the magnitude of movement, a CMS, is a swap that allows the purchaser to fix the duration of received

Valuation of swap

There two basic ways in which swap are valuated, they are

Using bond prices

Arbitrage arguments

In fact we will not dive in to the explanation of it because we will like to recommend to you to read about these two types from Wikipedia, which has a very simple and well understanding script on these.

4 Conclusion

Floating Rate Notes (FRN) and Swaps can be a very confusing topics at first, but this financial tools, if used properly, can provide many firms with a method of receiving a type of financing that would otherwise be unavailable. This introduction to the concept of plain vanilla Floating Rate Notes (FRN), swaps and currency swaps should be regarded as the groundwork needed for further studies. You now know the basics of this growing area and how Floating Rate Notes (FRN) and swaps are one available avenue that can give many firms the comparative advantages they are looking for.

Reference

R. Jan Röman, *Lecture note for analytical finance II,* 2010

John C. Hull, *Options, futures, and other derivatives,*6th ed., Pearson, New Jersey, 2008.

# Noel Amenc &Veronique Le Sourd, *About the Portfolio Theory and Performance Analysis,* Kindle Edition, Wiley, John & Sons Limited, May 21, 2010

Internet Link

http://help.derivativepricing.com/1701.htm

http://en.wikipedia.org/wiki/Floating\_rate\_note