Lecture 5: Introduction to Swaps

Tanweer Akram, PhD

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INTRODUCTION TO SWAPS

• Swaps are ubiquitous financial derivatives.
• Interest rate swaps and other swaps.
• Swaps exchange one type of cash flow for another.
• Most commons swaps are plain vanilla interest rate swaps.
• Typical example of a plain vanilla interest rate swaps: exchange floating cash flow based on LIBOR for a fixed rate cash flow.
• The payer of fixed rate believes that interest rate will rise.
• The receiver of fixed rate believes that interest rate will fall.
• A useful reference John HULL’s Options, Futures, and Other Derivatives. (Highly recommended).
BASIC PRINCIPLES OF PLAN VANILLA INTEREST RATE SWAP

1. Fixed interest rate paid semi-annually for the life of the swap. This fixed rate is known as the swap rate.
2. The floating interest rate is linked to the 3 month LIBOR rate. Each quarter the 3M LIBOR rate is noted. The floating rate is paid quarterly.
3. The present value of both legs of the swap are equal at inception.
4. Swaps are done with a dealer at a bank (or other financial institution) rather than at exchanges. Swaps are an Over the Counter (OTC) product.
5. Maturities of swaps vary.
BASIC SWAP DIAGRAM

Source: Jha (2011)
INTEREST RATE VIEW AND SWAPS

• View: Interest Rate will Rise (Going SHORT)
  • PAY Fixed
  • Receive Floating

• View: Interest Rate will Fall (Going LONG)
  • RECEIVE Fixed
  • Pay Floating
SWAPS

• Trading Swaps: the market’s expectation of average forward short rates against the investor’s expectation of where short-term rate will actually be.
• Interpretation: One leg is a bond with a fixed rate, another leg is a bond with a floating rate. Swaps transaction is the exchange of returns of the two legs.
• Another interpretation: Fixed rate bond financed with 3M LIBOR. The repo rate for the (hypothetical) bond is 3M LIBOR.
THE EVOLUTION OF U.S. SWAPS RATES

United States, Swap Rates, Macrobond, USD, Mid

Source: Macrobond
Interest rate swaps spreads

- 30 Yr Swap spread = 30 Yr US Swap Rate – 30 Yr US Treasury yield
- 10 Yr Swap spread = 10 Yr US Swap Rate – 10 Yr US Treasury yield
- 5 Yr Swap spread = 5 Yr US Swap Rate – 5 Yr US Treasury yield
- 2 Yr Swap spread = 2 Yr US Swap Rate – 2 Yr US Treasury yield
THE EVOLUTION U.S. SWAPS SPREADS

2Yr and 10Yr Swap Spreads

Source: Macrobond
THE PV OF THE FIXED RATE SIDE OF THE SWAP

- PV = \( \frac{c}{2} \left( \frac{1}{1 + \frac{r_1}{2}} \right) + \frac{c}{2} \left( \frac{1}{1 + \frac{r_2}{2}} \right)^2 + \frac{c}{2} \left( \frac{1}{1 + \frac{r_3}{2}} \right)^3 + \ldots + \frac{c}{2} \left( \frac{1}{1 + \frac{r_n}{2}} \right)^n + \frac{100}{1 + \frac{r_n}{2}} \)}
SOLVING FOR THE 1YR DISCOUNT RATE

• \((c/2)/(1+Zr_{6M}/2)+(100+c/2)/(1+ZR_{1Y}/2)^2 = 100\)
• Solve For \(ZR_{1Y}\)!
DURATION AND CONVEXITY

• The concepts of duration and convexity of swaps resemble that of a bond.
• $\Delta \text{ price} = \text{Duration} \times (\Delta \text{ yield})$
• Convexity correction = $\frac{1}{2} \times (\text{Convexity}) \times (\Delta \text{ yield})$
• $\Delta \text{ price} = \text{Duration} \times (\Delta \text{ yield}) + \frac{1}{2} \times (\text{Convexity}) \times (\Delta \text{ yield}) + \ldots$
USES OF SWAPS

- Manage interest rate risks
- Take advantage of pricing difference between floating rate and fixed rate instruments
- Debt swap by a corporation
- Asset swap of bonds
- Matched maturity swaps
DEBT SWAP BY A CORPORATION

Source: Jha (2011)
COUNTERPARTY RISKS

- Swaps are transacted against other firms
- Negotiated contracts
- ISDA (International Swaps Dealers Association) has templates
- Each party is exposed to risk that other party may default on cash payments
- Problems of contagion
- Move toward exchanges, would reduce counterparty risks, but standardized products may not be sufficiently differentiated.
OTHER TYPES OF SWAPS

- Overnight index swaps (OIS)
- Cross-currency swaps
- Fed funds basis swaps
- Three month/six month or one month/three month basis swaps
- Cross-currency basis swaps
- Constant maturity basis swaps
- SIFMA/LIBOR ratio swaps and SIFMA swaps
VARIOUS SWAPS

- Swaps are easy to modify
- Wide range of swaps to deal with various types of risk exposures
OVERNIGHT INDEXED SWAPS

- Floating leg tied to the overnight fed funds effective rate.
- The other leg is tied to a fixed rate.
FED FUNDS SWAP

Client A—receive fixed QIS

Fixed rate payment

Effective fed funds

Client B—receive floating fed funds

FIGURE 5.3 Fed Funds Swap

Source: Jha (2011)
CROSS-CURRENCY SWAPS

• Each side make payments of different currencies.
• Both sides can be fixed, floating or one of each with two legs denominated in two different currencies.
• Notional is exchanged at the start. The notional is exchanged back at the end of the contract.
CROSS-CURRENCY SWAP

Source: Jha (2011)
BASIS SWAPS

• When both sides of a swap are floating the swap is referred to as a basis swap.

• Some common basis swaps:
  • Fed funds basis swap
  • 3M/6M or 1M/3M basis swap
  • Cross-currency basis swap
  • Constant maturity basis swap
  • SIFMA/LIBOR ratio swaps and SIFMA swaps
LIBOR/FUNDS OIS SWAP

Source: Jha (2011)
SIFMA/LIBOR SWAP

FIGURE 5.6  SIFMA/LIBOR Swap Graphical Depiction

Client A—receive ratio

Fixed ratio × 3M LIBOR

SIFMA floating payment

Client B—receive SIFMA floating
CONVERTING A SIFMA/LIBOR SWAP TO A FIXED/FLOATING BMA SWAP

$100 million basis swap

Client A—receive percentage of 3M LIBOR

$100 million x Ratio LIBOR swap

Client A—pay fixed in plain LIBOR swap

Client B—receive SIFMA floating

Ratio x 3M LIBOR

SIFMA floating rate

LIBOR fixed x Ratio

3M LIBOR x Ratio

Client B—receive fixed in LIBOR swap

LIBOR fixed x Ratio

SIFMA floating rate

Client B—receive fixed in SIFMA swap

FIGURE 5.7 Converting a SIFMA/LIBOR Swap to a Fixed/Floating BMA Swap

Source: Jha (2011)
INFLATION SWAPS

- Swap counterpart to TIPS. Protection against inflation risk.
- Inflation protection without TIPS: contract between a dealer and an investor.
- Zero coupon swaps, but less liquid than plan vanilla swaps.
- Fixed leg assumes compounding the national at a certain interest rate, while floating rate tied to CPI (or some other inflation index).
- The investor receiving CPI and paying fixed views that inflation likely to rise, while the investor paying CPI and receiving fixed view inflation likely to decline.
- Unlike TIPS investors receiving CPI can have negative P/L. (No deflation protection).
EVOLUTION OF U.S. INFLATION SWAPS

USA Inflation Indexed Swap Rates

Source: Macrobond
SUMMARY OF LECTURE 5

Swaps
• Allow investors to exchange cash flows. Swaps enable investors to hedge or speculate based on views on interest rates or exchange rates.
• If the investor expects the interest rate will rise, he will pay fixed in swaps. If the investor expect that the interest will decline, he will receive fixed in swaps.

Plain Vanilla Swaps
• Take the side of a floating rate or fixed rates.

Various Types of Swaps
• Interest Rate Swaps, Basis swaps, Cross-currency swaps, swaps galore.