Chapter 18
SWAPS

A - Types and Valuation

• **Last Class – Several & Diverse Topics**

Country Risk (CR)

- It measures the risk of an asset/liability given by its location (country). Usually measure by a letter (A: very good, C: bad)
- Different methods to compute CR: Qualitative ("consensus") & Quantitative ("weighted average of factor scores")
- Incorporation of CR into a firm's valuation of a project/investment.
- Some country ("Political") Risk can be hedged by buying insurance.

Capital Structure & Cost of Capital (International Corporate Finance)

- We use the typical models (trade-off theory of capital structure) and formulas (WACC). We compute WACC:

$$k_c = \frac{D}{D+E} * k_d * (1-t) + \frac{E}{D+E} * k_e$$

- Issues with k_e, since we need a model for the expected return on equity, r_e, usually a factor model (CAPM or more realistic multi-factor models, like the **Fama-French** 3-factor model).

• **Last Class – Several & Diverse Topics**

Cost of Capital (Continuation)

◊ To keep things simple we use the CAPM (recall, in equilibrium $k_e = r_e$):

$$k_e = r_e = \text{E[r]} = r_f + \beta\ \text{E}[r_m - r_f]$$

r_f (= k_f): Risk-free rate (a government rate).

r_m (= k_m): Expected return on a (well-diversified) market portfolio.

β: Systematic Risk of the project/firm = Cov(r_e, r_m)/Var(r_m)

E[$r_m - r_f$]: Estimated risk premium (ERP).

◊ Domestic or World CAPM? It depends on type of firm/ownership (integrated/worldwide diversified: World; otherwise: Domestic).

◊ Many assumptions behind the computation of E[$r_{m,t}$]. We used a long-run historical average, $\bar{X}$ (sample mean). Even with a long history, it is computed with error.

◊ For emerging markets, with low quality data and short histories, it may be difficult to get a reliable estimate for the ERP. Several ad-hoc adjustments.

• **Last Class – Several & Diverse Topics**

International Bond Markets

◊ Eurobond + Foreign Bond Market = International Bond Market (30%)

◊ Eurobond: Same structure as a domestic bond, but *bearer* securities are OK and *mainly unregulated*

◊ Many Instruments in Eurobond Markets (most popular one: fixed bond)

◊ Pricing of a new bond –i.e., setting YTM. Key is finding the right benchmark.

◊ Different cases:

- Established company with borrowing history:

$$\mathbf{YTM}_{\textbf{new debt}} = \text{YTM}_{\text{oustanding}}$$

- Established company with no borrowing history:

$$\mathbf{YTM}_{\textbf{new debt}} = \text{YTM}_{\text{benchmark similar companies}}$$

- New company in new industry:

$$\mathbf{YTM}_{\textbf{new debt}} = \text{YTM}_{\text{book building/general benchmark}}$$

- **This Class**
- Swaps
  - Definition
  - Different Types: Interest Rate, Currency, Equity, Commodity & CDS.
  - Market Organization and Swap Dealers
  - Uses and Valuation
  - Combination of Swaps

Review - Case Study: Merotex

Pricing a New Straight Bond: Merotex

The Borrower

- Leading construction firm, based in Gorizia, Italy.
- Recently bought two U.S. construction companies.
- Financed by bank loans: USD 250 million

Borrowing requirements

- Amount: **USD 250 million**
- Currency of exposure: **USD**
- Maturity: *Medium-term* (**5 to 7 years, preferred 7 years**) USD debt.
- Preference: *Simple straight bond* with no early call options.

• **Information**

Market conditions:

- **Good** for a USD Eurobond issue.
- U.S. economic conditions are above expectations
- USD is currently very strong.
- **Recent successful placement** of 10-year Euro-USD issue by Fica, a competitor.

Merotex's Perception:

– Merotex has issued **GBP Eurobonds**: obtained *best terms*.

– Merotex has **no outstanding Euro-USD issues**.

• Perception of similar international borrowers ("Benchmarking")

(1) Comenti: **Italian construction company**

- Several Eurodollar issues.
- Last issue has 6 years of remaining life.
- Currently trading at **40 bps** over 6-yr U.S. Treasuries.
- Excellent reputation in Euromarkets

(2) Fix Constructions (FC): **major U.S. competitor** in Florida.

- Launched a 10-yr Eurodollar issue five years ago.
- It has a *call option* two years from now.
- Currently trading at a **65 bps** over 5-year U.S. Treasuries.
- Well-regarded but *performance* has been *just average*.

(3) **Other large Italian companies**:

- Many Euro-USD bonds with 5-year maturity
- Currently trading within a range of ***40-70 bps***.

Evaluation

• Merotex's track record is limited but **very good**.

– Merotex's GBP bonds have been **well received** in the market.

– Merotex plans to include one **UK** house in management group.

⇒ **Size:** sufficient to promote liquidity; but not so much as to make the placement process difficult. Proposed size: **USD 200 million**.

⇒ **Maturity:** Merotex is a first-timer on USD-Eurobond segment: For first timers shorter maturities are better: ***5 years***.

• Concern: The FC issue is trading at a **relative high spread**. But,

– Issue might suffer from poor design.

– Deterioration of FC's perception

– Call provision.

⇒ **Yield:** Lead manager suggests setting **spread** on the low-end of range ("aggressive spread"): ***40-70 bps***.

Proposed Issue

Amount:

– Proposed size: **USD 200 million**, with a possible increase.

Maturity:

– Shorter maturity than preferred: ***5 years***.

Yield spread:

– Aggressive spread = **40 bps** over 5-yr U.S. Treasuries.

– First-time issue: Add a small premium: ***Spread = 45 bps***.

The lead manager is able to formulate a pricing scheme:

U.S. Treasury: 6.915% s.a. (semiannual)

Merotex spread: **0.45% s.a.**

Merotex yield (**YTM**): **7.365% s.a.**, or **7.501% p.a.** (annual)

⇒ Terms for investors: a 5-year Eurobond at a price to yield **7.50% p.a**.

Fees

Selling concession: ¾%	(Sellers buys the issue at 99¼).
Underwriting allowance: ¾%	(Underwriters pays 98½)
Managing fee: ¼%	(Lead manager pays (98¼)
Total fees: **1¾% (= USD 3.5M)**	

Final terms:

Competitive bidding: Issuing house sells the issue at **99.24**

Coupon required to yield **7½%** is lower.

Assuming **YTM** = **7½**, T = 5, P = **99.24**, and FV = 100, solve for **C**

⇒ **C** = **7.3113%.**

Rounding up, the coupon rate is set at **7 (5/16)**.

Total coupon payment = (**7** + **5/16**) * **200 M** = **USD 14.625 M**

The issue is priced *at the selling concession.*

Expenses

1.- Paying Agency:	**100,000 bonds** in **USD 1,000 denominations**
	10,000 bonds in **USD 10,000 denominations.**
Total number of bonds:	**110,000**.
Coupon charge p.a.:	USD .07 per coupon payment (USD 7,700)
Redemption charge:	USD .70 **per bond** or USD 77,000
Authentication:	USD 4,000 on delivery of bonds.
Administration:	USD 2,000 (p.a.).
2.- Listing:	USD 20,000 payable in advance.
3.- Trustee:	USD 8,000 (p.a.) payable in advance.
4.- Other expenses:	USD 80,000.

Pro Forma of the Issue

Borrower:	Merotex C.A.
Guarantor:	None
Amount:	**USD 200 million**
Maturity:	**5 years**
Coupon:	**7 (5/16)** (= **7.3125%**)
Issue price:	100%
Amortization:	Bullet repayment on final maturity date
Issuer's call option:	None
Listing:	London
Denominations:	**USD 1,000** and **USD 10,000**
Form:	Bearer securities
.....	
Commissions:	**1¾% flat**
Yield:	**7.3125%** (at issue price), **7.5% p.a.** (at 99.24%)

Cash Flows of Merotex C.A. (in USD million):

Year	**0**	**1**	**2**	**3**	**4**	**5**
Principal	**200**	-	-	-	-	**-200**
Interest	-	**-14.625**	**-14.625**	**-14.625**	**-14.625**	**-14.625**
Commissions	**-3.500**	-	-	-	-	-
Paying Agency	-	-0.0077	-0.0077	-0.0077	-0.0077	-0.0847
Auth. & Adm.	-0.004	-0.002	-0.002	-0.002	-0.002	-0.002
Listing	-0.020	-	-	-	-	-
Trustee	-0.008	-0.008	-0.008	-0.008	-0.008	-0.008
Reimburs. exp.	-0.080	-	-	-	-	-
Cash Flow	**196.39**	**-14.6427**	**-14.6427**	**-14.6427**	**-14.6427**	**-214.7117**

⇒ Cost of funds (IRR) = 7.7778% p.a.

Note: Sometimes, IRR is calculated by *excluding* annual & minor expenses (listing, trustee, authentication, etc.). Under this method, IRR = 7.7580%.

Cost of Funds Exclusive Annual and Minor Expenses: Details

• This figure takes account:

- Coupon payments (**USD 14.625 M**)
- Commissions of **1¾%** flat on the issue amount (**USD 3.5 M**)
- Reimbursable managers' expenses (USD 80,000)

The issuer receives the net proceeds of:

USD 200,000,000 - USD 3,580,000 = **USD 196,420,000** (or 98.21%)

• All-in cost: IRR of a 5-year project:

- Positive cash flow of **USD 196.42 M** in year zero.
- Negative cash flows of **USD 14.625 M** every year.
- Negative cash flow of **USD 200 M** in year 5.

IRR = **7.7580%**. (Merotex obtains financing at a cost of 7.7580% p.a.)

⇒ Small difference between both IRRs.

Cost of Funds Inclusive Annual and Minor Expenses: Details

This figure takes account:

- Coupon payments
- Commissions of **1¾%** flat on the issue amount
- Reimbursable managers' expenses
- Commissions and Expenses

⇒ IRR = **7.7778% p.a.** (Merotex obtains financing at an annual cost of 7.7778%.)

SWAPS: Definition and Types

Definition

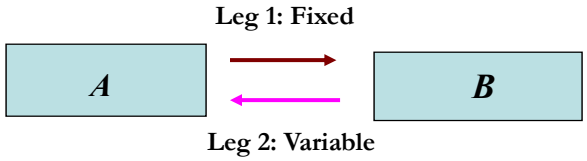
A *swap* is a contract between two parties to deliver one sum of money against another sum of money at periodic intervals.

• Obviously, the sums exchanged should be **different**:
  – Different **amounts** (say, one fixed & the other variable)
  – Different **currencies** (say, USD vs EUR)

• The two payments are the *legs* or sides of the swap.
  - Usually, one leg is *fixed* and one leg is *floating* (a market price).

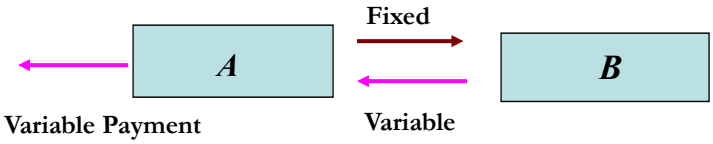
• The swap terms specify the duration and frequency of payments.

Example: Two parties (A & *B*) enter into a swap agreement. The agreement lasts for 3 years. The payments will be made semi-annually. Every six months, A and B will exchange payments.



• Swaps can be used to change the profile of a firm's cash flows.

If a swap is **combined** with an **underlying position**, one of the (or both) parties can change the profile of their cash flows (and risk exposure). For example, *A* can change its cash flows from variable to fixed.



• **Types**

Popular swaps:

- Interest Rate Swap (one leg floats with market **interest rates**)
- Currency Swap (one leg in one **currency**, other leg in another)
- Equity Swap (one leg floats with market **equity returns**)
- Commodity Swap (one leg floats with market **commodity prices**)
- CDS (one leg is paid if **credit event occurs**)

Most common swap: **fixed-for-floating** interest rate swap.

- Payments are based on hypothetical quantities called *notionals*.
- The fixed rate is called the *swap coupon*.
- Usually, only the *interest differential* needs to be exchanged.

• Usually, one of the parties is a **Swap Dealer**, also called *Swap Bank*.

Example: Interest Rate Swap (inception date: April)

Bank A (**fixed-rate payer**) *buys* an 8% swap

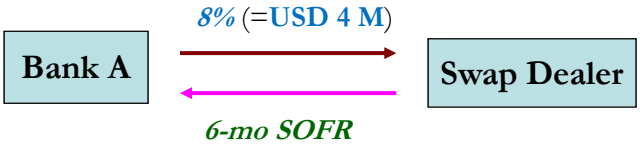
Notional: **USD 100 M**

Swap coupon (Fixed-rate): **8% (s.a.)**.

Floating-rate: **6-mo. SOFR** (= **Secured Overnight Financing Rate).**

Payment frequency: semiannual (April and October).

Maturity = Swap term or Swap tenor = 3 years.



Every six months Bank A (fixed-rate payer) pays:

USD 100 M * .08/2 = **USD 4 M**

Every six months Swap Dealer (floating-rate payer) pays:

USD 100 M * **6-mo SOFR**/2

Example: (continuation)

First payment exchange is in October. (The floating rate has already been fixed in April: **7.6%**.) Then, the Swap Dealer pays:

$\Rightarrow$ **USD 100 M** * **.076**/2 = **USD 3.8 M**

Bank A (fixed-rate payer) pays **USD 0.2 M** to the floating-rate payer.

Note: In October, the floating rate will be fixed for the second payment (in April of following year). ¶

Market Organization

- Most swaps are tailor-made contracts.
  - Swaps trade in an **OTC** type environment.
  - **Swap specialists** fill the role of broker and/or market maker.
  - Brokers/market makers are usually **large banks**.
  - Prices are quoted with respect to a standard, or generic, swap.

- *All-in-cost*: Price of the swap (quoted as the rate the fixed-rate side will pay to the floating-rate side)

- It is quoted on a **semiannual basis** (s.a.):
  - absolute level ("9% fixed against six-month *SOFR flat*")
  - bp spread over the U.S. Treasury yield curve ("the Treasury yield plus 57 bps against 6-mo SOFR flat").

"SOFR flat" = SOFR is quoted without a premium or discount.

• The fixed-rate payer is said to be "long" or to have "bought" the swap.

Example: Houseman Bank's *indicative swap pricing schedule.*

Maturity	HB Receives Fixed	HB Pays Fixed
1 year	1-yr TN sa + 44 bps	2-yr TN sa + 39 bps
2 years	2-yr TN sa + 50 bps	2-yr TN sa + 45 bps
3 years	**3-yr TN sa + 54 bps**	**3-yr TN sa + 48 bps**
4 years	4-yr TN sa + 55 bps	4-yr TN sa + 49 bps
5 years	5-yr TN sa + 60 bps	5-yr TN sa + 53 bps

• Consider the 3-year swap quote:

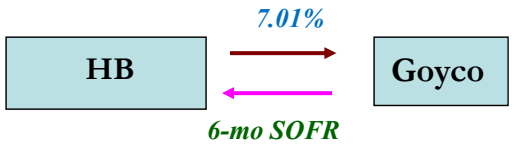
HB attempts to **sell** a 3- year swap to receive the offered spread of **54 bps** and **buy it back** to pay the bid spread of **48 bps**. HB's profit: **6 bps**.

Example: Goyco, a HB's client, wants to receive fixed-rate payments rather than pay fixed-rate for 3 years.

The current ("*on the run*") 3-yr Treasury Note rate is **6.53%**.

Goyco enters into a 3-yr swap.

Calculation of fixed rate: HB will pay ***7.01%*** (**6.53** + **.48**) s.a. ¶



Note: SOFR will be reset at (T-2) for the next 6-mo period.

• Q: Are swaps riskless?

A: No! Default risk is always present.

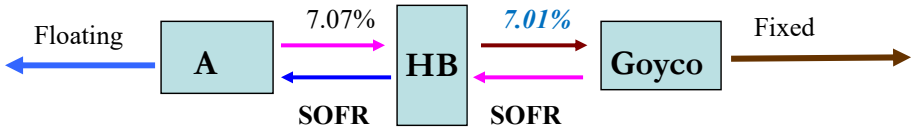
• The Dealer's Perspective

A swap dealer intermediating (making a market in) swaps makes a living out of the spread between the two sides of the swap.

Example: Houseman Bank entered into a 3-year swap with Goyco.

3-year quote: 3-yr TN sa + **48 bps** & 3-yr TN sa + **54 bps**

The *on the run* 3-yr Treasury Note rate is **6.53%**.



HB finds a counterparty A ⇒ HB gets rid of the swap exposure. ¶

Note: The difference between the rate paid by the fixed-rate payer over the rate of the *on the run* Treasuries with the same maturity as the swap is called the *swap spread*. In this example, the swap spread is **54 bps**.

Warehousing

When the SD matches the two sides (the buyer and the seller) of a swap is called **back-to-back transaction**, or "**matched book**" transaction.

In practice, a SD may not be able to find an immediate off-setting swap.

Most SD will **warehouse** the swap and **use interest rate derivatives** to hedge their risk exposure until they can find an off-setting swap.

In practice, it is **not always possible to find a second swap** with the same maturity and notional principal as the first swap, implying that the institution making a market in swaps has a residual exposure.

The relatively narrow bid/ask spread in the interest rate swap market implies that to make a profit, effective interest rate risk management is essential.

Dealer's Risk

- *Credit Risk*

  This is the major concern for a swap dealer: the risk that a counter party will default on its end of the swap.

- *Mismatch Risk*

  It is difficult to find a counterparty that wants to borrow the exact amount of money for the exact amount of time.

- *Sovereign Risk*

  The risk that a country will impose exchange rate restrictions that will interfere with performance on the swap.

• Market Size

Notional amount outstanding (Nov 2022):	**USD 463.0 trillion.**
- Interest rate swaps:	**USD 414.2 trillion**
- Currency swaps:	**USD 30.3 trillion** (≈ 7%)
- Equity-linked contracts (includes forwards):	**USD 6.9 trillion**
- Commodity contracts (includes forwards):	**USD 2.3 trillion**
- CDS market:	**USD 9.3 trillion** (≈ 2%)

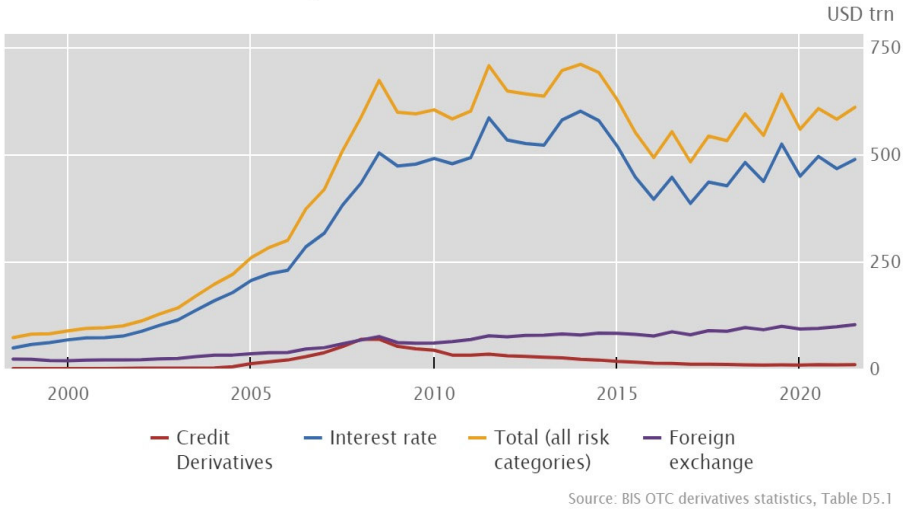
- Gross market value: **USD 16.35 trillion**

Interest rate swaps is a very popular derivative: It represents **60%** of the Global OTC Derivatives Market.

Interest rate swaps also shows big growth from early 1990s.

Growth of OTC Derivatives (Swap Market) - 1998-2021

Figure XIII.1 - Growth of Swap Market



Source: BIS (2021). ¶

Swaps: Why Use Them?

- **Using Swaps**
  - Manage risks (change profile of cash flows)
  - Arbitrage (take advantage of price differentials)
  - Enter new markets (firms can indirectly create new exposures)
  - Create new instruments (no forward contract exist, a swap completes the market)

(1) Change profile of cash flow

Goyco's underlying situation: Fixed payments to bondholders, but wants floating debt.

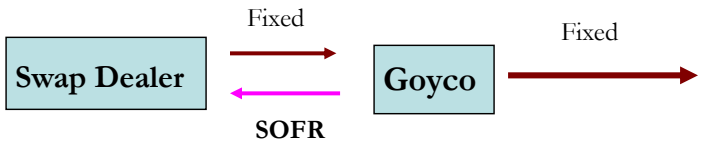
Solution: A fixed-for-floating debt solves Goyco's problem.

Example: Goyco enters into a swap agreement with a Swap Dealer.

Terms:

Duration: 3-years.

Goyco makes floating payments (indexed by SOFR) and receives fixed payments from the Swap Dealer.



Q: Why would Goyco enter into this swap?

A: To **change the profile** of its cash flow: From fixed to floating. ¶

• Swaps are derivative instruments (derived valued from value of legs!).

(2) Arbitrage: Comparative Advantage

A has a *comparative advantage* in borrowing in USD.

B has a *comparative advantage* in borrowing in GBP.

If they borrow according to their comparative advantage and then swap, there will be gains for both parties.

Example: Nakatomi, a Japanese company, wants USD debt.

There are at least two ways to get USD debt:

- Issue USD debt.
- Issue JPY debt and swap it for USD debt. ¶

Q: Why might a Japanese company take the second route?

A: It may be a cheaper way of getting USD debt -*comparative advantage*.

Note: From an economic point of view, there are two motives for entering into swaps:

- *Risk Sharing* (two firms share interest risk through a swap)
- *Comparative Advantage/Arbitrage*

Measuring comparative advantage

AAA companies routinely **have absolute advantage** in debt markets over all the other companies, due to their different credit-worthiness. A swap, however, takes advantage of **comparative** (or relative) **advantages**.

The *Quality Spread Differential* (**QSD**) measures comparative advantage

- **QSD** = Difference between the interest rates of debt obligations offered by two parties of different creditworthiness that engage in the swap.

- The **QSD** is the key to a swap. It is what can be shared between the parties.

Example: Comparative Advantage.

Nakatomi, a Japanese company, wants to finance a US project in USD.

HAL, a US company, wants to finance a Japanese project in JPY.

Both companies face the following borrowing terms.

	USD rate	JPY rate
HAL	**9%**	**4%**
Nakatomi	**8%**	**2%**

Nakatomi is the more credit-worthy: It has an **absolute advantage**.

- HAL pays 1% more to borrow in USD than Nakatomi.
- HAL pays 2% more to borrow in JPY than Nakatomi.

⇒ HAL has a **comparative advantage** in the USD rate market.
The **QSD** is 1% (different than zero!).

If they borrow according to their comparative advantage and then swap, there will be gains for both parties.

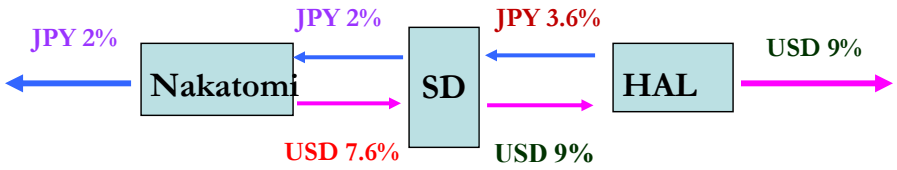
A Swap Dealer proposes the following swap:

- Nakatomi pays **7.6%** in USD and receives **2% in JPY**
- HAL pays **3.6%** in JPY and receives **9% in USD**

Swap + Domestic borrowing produces the following cost of borrowing:

Nakatomi: **2% in JPY** - **2% in JPY** + **7.6%** in USD = **7.6% in USD** < **8%**

HAL: **9% in USD** - **9% in USD** + **3.6%** in JPY = **3.6% in JPY** < **4%**



QSD is equally divided (**0.4%** savings each).

Note: The QSD is not usually divided equally. In general, the company with the worse credit gets the smaller share of the QSD to compensate the SD for a higher credit risk. ¶

Why the Growth of Swap Markets?

• Swap contracts have many **similarities with futures** contracts.

- Trade-off: Customization vs. liquidity.

Futures markets offer a high degree of **liquidity**, but contracts are more standardized.

Swaps offer additional flexibility since the they are **tailor-made**.

- **Settlement** is in **cash**.

There is no need to take physical delivery to participate in the market.

Interest Rate Swaps

• Most common swap: fixed-for-floating (*plain vanilla swap*)

- Used to **change profile of cash flows** (a firm can go from paying floating debt to paying fixed debt).
- Used to **lower debt costs**.

• Basis swap: floating-for-floating (*basis swaps*)

- Floating rates should be **different**, say 1-mo **SONIA** vs. 3-mo SONIA (Sterling Overnight Index Average) or USD T-bill vs **SOFR** (the alternative to USD LIBOR, Secured Overnight Financing Rate)
- Floating-for-floating currency swaps (also called *cross currency basis swaps*) are especial cases of interest rate basis swaps.

• Interest rates swaps have **very low** bid-ask spreads, lower than corporate bonds and, sometimes, government bonds.

Example: Plain Vanilla Swap

Underlying situation for Ardiles Co:

- **USD 70 M** floating debt at: **6-mo SOFR + 1%.**
- Ardiles Co. wants to change to fixed-rate USD debt.
- Currently, fixed-rate debt trades at **9.2%** (s.a.).

A Swap Dealer (Bertoni Bank) offers **8% (s.a)** against **6-mo SOFR**.

Terms:
- Notional amount: **USD 70 M**
- Frequency: semi-annual
- Swap term or tenor (Duration): 4-years
- Fixed Coupon: **8% (s.a)** $\Rightarrow$ **USD 70 M** * .08/2 = **USD 2.8M**

Ardiles Co. and SD only exchange the **net payment** (difference between the two legs of the swap: Ardiles pays SD if 6-mo SOFR < **8%**).

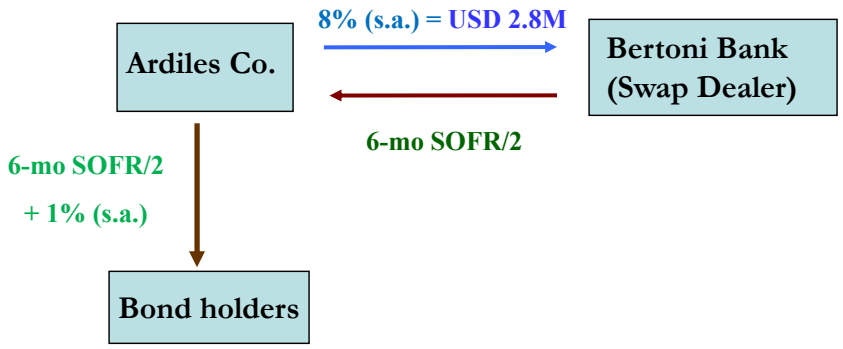
Notionals, obviously, will not be exchanged at maturity (year 4).

Example (continuation):

- Ardiles pays **8% (s.a.)** against **6-mo SOFR**.

Ardiles Co. reduces its cost of borrowing to:

(**6-mo SOFR + 1%**) + **8%** – **6-mo SOFR** = 9% (s.a.) (< **9.2%**)



Now, Ardiles has eliminated floating rate (**6-mo SOFR**) exposures. ¶

Day Count Convention

In the previous examples we have ignored the **day count conventions** on the short term rates.

For example, the floating payment refers to a **money market rate**, the 6-mo SOFR, which is quoted on an ***Actual/360 basis***. Suppose 6-mo SOFR was fixed at **8%,** the notional principal is USD 70M and assume there are **183 days** between payments.

Then, the actual payment should be

USD 70M * (**0.08**) * (**183**/360) = **USD 2.846667M**.

The fixed side must also be adjusted and as a result the **payments may not be equal** on each payment date.

Note: If the fixed rate is based on a different instrument, say a T-bond, then a different day count should be used for the fixed-rate side. In the **T-bond case**, it will be based on ***Actual/Actual***.

Swap Curve

Ardiles will observe the SD's indicative swap pricing schedule. The set of swap rates at different maturities is called the **swap curve**.

It is the equivalent of the **yield curve**.

• As we will see later, the swap curve will be **consistent** with the interest rate curve implied by the **Eurodollar futures contract**, which is used to hedge interest rate swaps that cannot be matched.

• It is easy to construct for **usual maturities** –i.e., **1-mo**, **3-mo**, **6-mo**, etc.– where there is **liquid Eurodollar futures** contracts and/or other similar market instruments (FRAs).

Interpolation techniques (linear, cubic spline, etc.) are used to complete the curve.

Swap Spreads

Swap spread: Interest rate paid by fixed-rate payer – Interest rate on the run treasury (with same maturity).

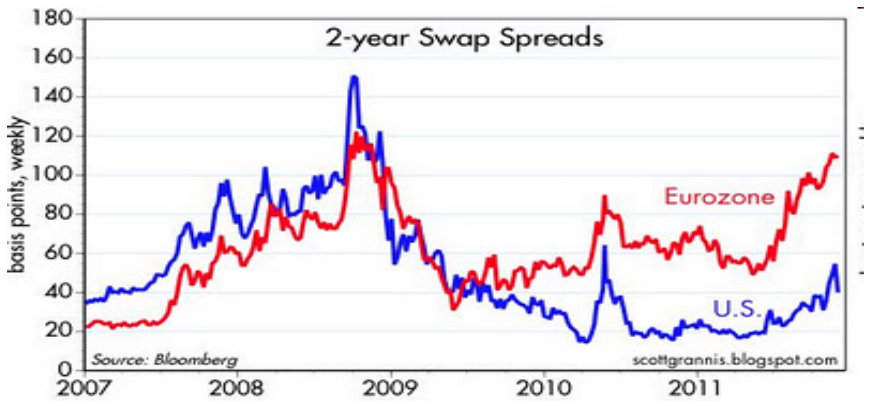
Example: In a 3-year swap, counterparty A pays the SD 7.07%, while the respective (3-year) on the run treasury rate is **6.53%**, then:

3-year swap spread = 7.07% - **6.53%** = **54 bps**. ¶

We expect to observe **positive swap spreads** since a negative spread, in theory, signals that banks or counterparties (say, counterparty A above) are viewed as safer than the government.

But, under unusual circumstances, for example, the 2008-2009 Financial Crisis, a **negative spread may occur**.

• Swap spreads are used as an indicator of a country's credit conditions.



Valuation of an Interest Rate Swap

Assume **no** possibility of **default**. (Credit risk zero!)

• An interest rate swap can be valued:

- As a **portfolio of bonds**: long position in one bond and a short position in another bond
- As a **portfolio of forward contracts**.

• We will value a swap as a **portfolio of bonds**. Define:

V: Value of swap

$\mathbf{B}_{\mathbf{Fixed}}$: NPV of fixed-rate bond underlying the swap

$\mathbf{B}_{\mathbf{Float}}$: NPV of floating-rate bond underlying the swap

$\Rightarrow$ Value to the fixed-rate payer (Ardiles Co.) = $\mathbf{V} = \mathbf{B}_{\mathbf{Float}} - \mathbf{B}_{\mathbf{Fixed}}$.

Note: At inception, $\mathbf{V \approx 0}$. The swap has to be *fair*. That is, the fixed coupon is set in a way that the NPV of both sides is approximately equal.

• The discount rates should reflect the level of risk of the cash flows:

An **appropriate discount rate** is given by the **floating-rate** underlying the swap agreement. In previous example, **6-mo. SOFR**.

• Since the discount rate is equal to the floating-rate payment, the value of the floating side payments (B_{Float}) is equal to par value.

$\Rightarrow$ **V** changes when B_{Fixed} changes -the NPV of fixed-rate payments.

• If coupon (fixed-rate) payment is higher than discount rate, then:

$B_{Fixed} > B_{Float} \Rightarrow$ fixed-rate payer has a **negative** swap valuation (**V**<0)

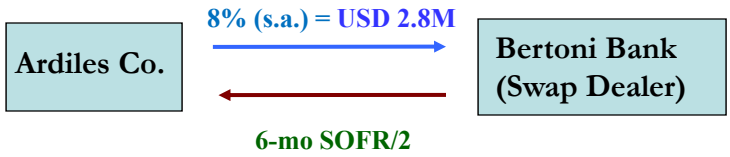
Technical Note: To use this approach to value a swap, we need to add an exchange of principals (in practice, it does not occur).

Example: Back to Ardiles' swap. Suppose the swap has **2 years left**.

Relevant SOFR rates: 6-mo: 6.00%; 12-mo: 6.25%; 18-mo: 6.25%; & 24-mo: 6.50%

Notional amount: **USD 70 M**

Ardiles pays **8%** (s.a.) fixed.



B_{Fixed} = 2.8M /[1 + .06 * (181/360)] + 2.8M /[1 + .0625 * (365/360)] +
+ 2.8M /[1 + .0625 * (546/360)] + 72.8M /[1 + .065 * (730/360)] =
= **USD 72,521,371.94**

B_{Float} = 2.1M/[1 + .06 * (181/360)] + 2.1875M/[1 + .0625 * (365/360)] +
+ 2.1875M/[1+.0625 * (546/360)] + 72.275M/[1+.065 * (730/360)] =
= **USD 69,951,000.36** ($B_{Float} \approx$ Q. Why?)

Example (continuation): We used an **Actual/360 day count**:

B_{Fixed} = **USD 72,521,371.94**

B_{Float} = **USD 69,951,000.36**

Value of the swap to Ardiles Co. (the fixed-rate payer):

V = **USD 69,951,000.36** - **USD 72,521,371.94** = **USD -2,570,368.38**

Interpretation:

- Ardiles can **pay USD 2,570,368.38** the SD **to close the swap**.
- Alternatively, SD can **sell** the swap –i.e., the CF– for **USD 2,570,368.38**.

Note: Today, a similar swap, with T = **2 years**, would have a fixed coupon = **6.26% (s.a.)**; with a s.a. payment of **USD 2.191M**. Check:

B_{Fixed} = 2.191M/[1 + .06*(181/360)] + 2.191M/[1 + .0625*(365/360)] +
+ 2.191M/[1 + .0625*(546/360)] + 72.191M/[1 + .065*(730/360)]
= **USD 69,972,490** ⇒ At inception, V ≈ 0! ¶

Euromarkets and interest rate swaps

Recall: **Knowledge of derivatives** is very important to select a lead manager of a Eurobond issue.

Arbitrage opportunities in Eurobond markets may exist: **Swaps** can be used to take advantage of them.

Case Study: Merotex (continuation)

Merotex issued 5-year **7(5/16)%** Eurobonds for **USD 200 M**.

Merotex's debt cost = **IRR** = **7.7479%** (p.a.)

But, Merotex wants USD floating rate debt.

Lead manager obtains a swap quotation from a swap dealer:

6-month SOFR v. U.S. Treasuries plus 77/**71** in 5 years.

⇒ Merotex gets U.S. Treasuries plus **71** & pays **6-mo SOFR**.

Case Study: Merotex (continuation)

Merotex receives U.S. Treasuries + **71** and pays 6-mo SOFR.

5-year U.S. Treasuries yield: **6.915% (s.a.)**

The fixed-rate coupon received by Merotex under the swap is:

6.915% (s.a.) + **.71% (s.a.)** = 7.625% (s.a.),

$\Rightarrow [(1+.07615/2)^2 - 1] * 100 =$ **7.7700 (p.a.)** annual.

The notional principal of the swap is **USD 200M** (same as in USD Eurobond issue).