Chapter 18
SWAPS

A - Types and Valuation

• **Last Class**

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:

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

- Established company with no borrowing history:

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

- New company in new industry:

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

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

SWAPS: Definition and Types

Definition

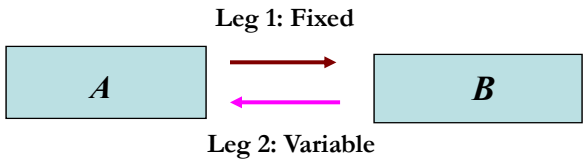
A *swap* is a contract between two parties to deliver one sum of money against another sum of money at periodic intervals.

- 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).

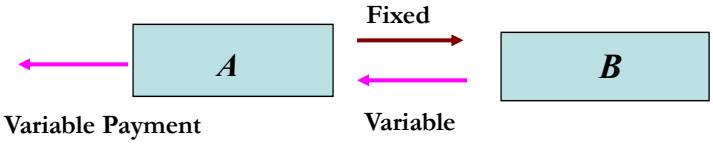
- The swap terms specify the duration and frequency of payments.

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

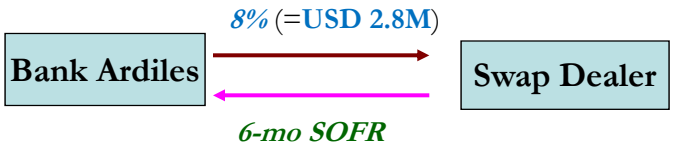
Notional: **USD 70M**

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 Ardiles (fixed-rate payer) pays:

USD 70M * **.08**/2 = **USD 2.8M**

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

USD 70M * **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:

⇒ **USD 70M** * **.076**/2 = **USD 2.66M**

Bank Ardiles (fixed-rate payer) pays **USD 0.14M** to the floating-rate payer:

USD 2.8M - **USD 2.66 M** = **USD 0.14M**

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 **54 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:

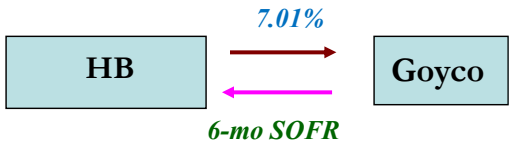
HB attempts to **sell** a 3- year swap to receive the offered spread of **54 bps** and **buy it back** to pay the bid spread of **48 bps**. HB's profit: **6 bps**.

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.

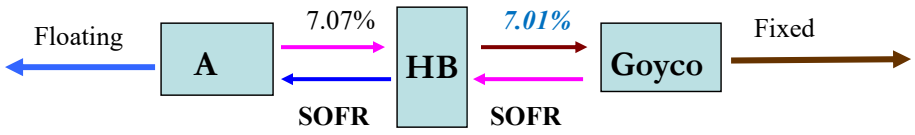
• The Dealer's Perspective

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:

⇒ Swap dealers usually have 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.

• 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 swap is a very popular derivative: It represents **60%** of the Global OTC Derivatives Market.

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

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.

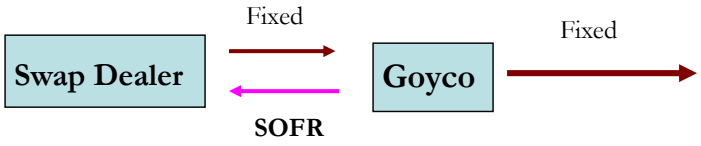
Solution: A fixed-for-floating debt solves Goyco's problem.

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!).

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**
- 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:
- **USD 70 M** floating debt at: **6-mo SOFR + 1%.**
- Ardiles 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)** ⇒ **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%**).

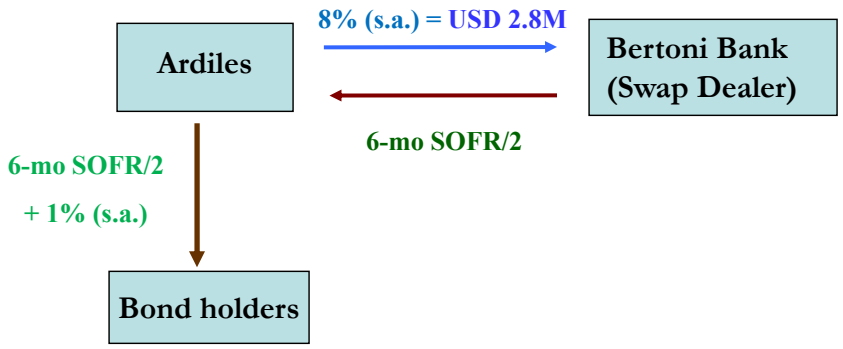
Notionals, obviously, will not be exchanged at maturity (year 4).

Example (continuation):

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

Ardiles 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. ¶

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

B_{Fixed}: NPV of fixed-rate bond underlying the swap

B_{Float}: NPV of floating-rate bond underlying the swap

⇒ Value to the fixed-rate payer (Ardiles Co.) = $V = B_{Float} - B_{Fixed}$.

Note: At inception, $V \approx 0$. 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)

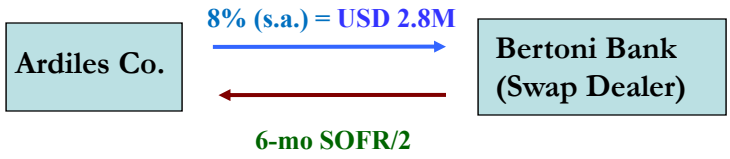
Technical Note: To use this approach to value a swap, we need to add an exchange of principals (in practice, it does not occur).

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**:

$\mathbf{B_{Fixed}}$ = **USD 72,521,371.94**

$\mathbf{B_{Float}}$ = **USD 69,951,000.36**

Value of the swap to Ardiles (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:

$\mathbf{B_{Fixed}}$ = 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** $\Rightarrow$ At inception, V ≈ 0! ¶

Currency Swaps

- Also called *Cross currency swaps* (XCCY).
- The legs of the swap are denominated in **different currencies**.
- Currency swaps change the **profile of cash flows**.
- Many possibilities for the CF exchanges: fixed-fixed, fixed-floating & floating-floating.
- Reference rates are **SOFR** & Ameribor (USD), **€STR** or Euro Short-Term Rate (EUR), **TONAR** (JPY), etc.

Example:

Situation: ExxonMobil has USD debt, but wants to increase EUR debt.

Solution: A swap.

ExxonMobil pays EUR. A Swap Dealer pays USD.

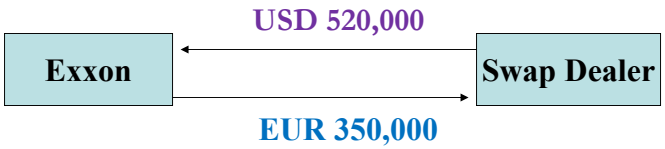
Example (continuation):

ExxonMobil pays EUR. A Swap Dealer pays USD.

• Swap Details:

- ExxonMobil pays **3.5%** in EUR, with a Notional principal: **EUR 20 M**
- Swap Dealer pays **4%** in USD, with a Notional principal **USD 26 M**
- Frequency of payments = 6-mo (**s.a.**)
- Duration = 4 years
- S_t = 1.30 USD/EUR.

Every six month, Exxon pays **EUR 350,000** & receives **USD 520,000**.



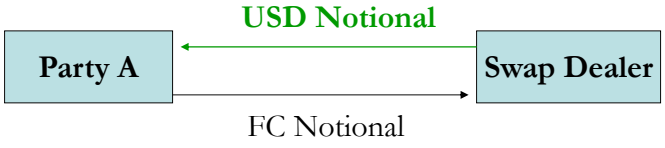
Note that Exxon and SD have implicitly fixed S_t for 4 years at:

S_{t+j}= **USD 520,000**/**EUR 350,000** = 1.485714 USD/EUR j=6,12,.,48. ¶

Usual CFs in a XCCY swap

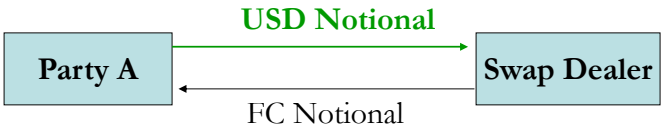
In currency swaps the notional principals are **usually exchanged**. There are three sets of cash flows:

• At inception



• Periodic interest payments

• At end of term



Note: Similar to an exchange of bonds. At inception, Party A receives USD "funding" and pays interest during the duration ("tenor") of swap.

Currency Swaps: Variations

Key: Both legs are different currencies. **Different Instruments**:

1. Fixed-Fixed

Example: Exxon-Mobile example.

2. Fixed-Floating (also called *Circus swap* = Combined Interest Rate & Currency Swap)

Example: IBM pays 3-mo Ameribor in USD and receives 5% in EUR. ¶

3. Floating-Floating (also called *cross currency basis swap,* if initial exchange of notionals occurs)

Example: IBM pays 3-mo Ameribor in USD and receives 3-mo ESTR – **30 bps**. This EUR/USD XCCY swap is quoted "**-30 bps.**"

Note: **-30 bps** is the *spread* in EUR. The *spread* could be zero (IRP holds), positive or negative. ¶

Valuation of Currency Swaps

A currency swap can be decomposed into a position in two bonds:

- A domestic bond (or foreign currency 1 bond)
- A foreign bond (or foreign currency 2 bond)

V = Value of Swap (to DC payer) = NPV of FC bond – NPV of DC bond

In previous example the swap value to ExxonMobil is:

$$\mathbf{V} = B_D - S_t B_F$$

B_F: Value of FC denominated bond underlying the swap.

B_D: Value of DC denominated bond underlying the swap.

S_t: Spot exchange rate.

Note: For the Swap Dealer, the swap value (in DC) is:

$$\mathbf{V} = S_t B_F - B_D$$

Example FI:

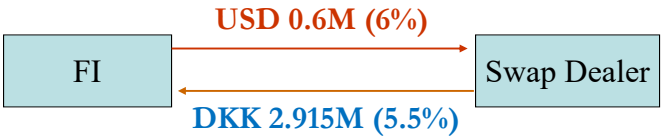
A U.S. financial institution (FI) is involved in a currency swap:

Terms:

- Frequency of payment: Annual.
- Notional principals: **DKK 53 million** & **USD 10 million**.
- FI get **5.5% p.a.** in DKK against **6% p.a.** in USD
- Payments: FI pays **USD 0.6M** & receives **DKK 2.915M**
- Swap will last for another three years (T = 3 years).

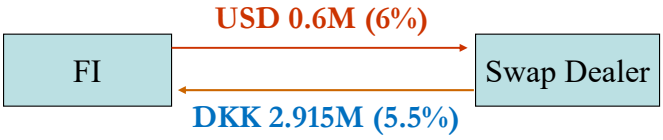
S_t = **0.18868 USD/DKK**.

Term structure in Denmark & U.S. is *flat,* with i_{DKK} = **5%** & i_{USA} = **6.5%**.



Note: At maturity, the principals will also be exchanged.

Example FI (continuation):



These periodic exchanges set an implicit forward contract (the swap forward rate), fixing S_t for each year at:

S_{t+j} = USD 0.6M / DKK 2.915M = **0.2058319 USD/DKK**, j =1, 2, 3.

There are 3 *long* forward contract for FI:
Maturity (T) = 1 year, 2 years, & 3 years.
Size: **DKK 2.915M**
Swap forward FX rate: **0.2058319 USD/DKK**

Note: Potentially, like in all long forward contracts, the FI profits if, at any T, the market forward rate, $\boldsymbol{F_{t,t_j}}$, is higher than **0.2058319 USD/DKK**.

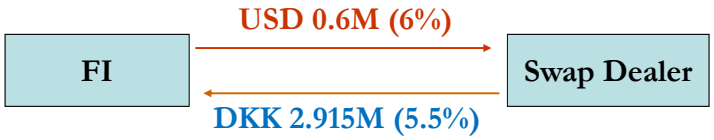
Example FI (continuation):

Discount rates: i_{DKK} = 5% & i_{USA} = 6.5%.

Coupons: DKK 2.915M & USD 0.6M

T = 3 years.

S_t = 0.18868 USD/DKK.



$$B_D = \frac{.6M}{(1+.065)} + \frac{.6M}{(1+.065)^2} + \frac{.6M}{(1+.065)^3} + \frac{10M}{(1+.065)^3} = \text{USD } 9{,}867{,}577$$

$$B_F = \frac{2.915M}{(1+.05)} + \frac{2.915M}{(1+.05)^2} + \frac{2.915M}{(1+.05)^3} + \frac{53M}{(1+.05)^3} = \text{DKK } 53{,}721{,}661$$

$V_{US\ FI}$ = (53,721,661) * (.18868) – 9,867,577 = USD 268,585.45.

V_{SD} (paying DKK and receiving USD) = USD -268,585.45. ¶

Decomposition into Forward Contracts

The CFs of currency swap can be **valued** as a **series of forward contracts**, which are set by the exchanges of interest payments & principals.

Recall the value of a long forward contract is the present value of the amount by which the forward price exceeds the delivery price.

Example FI (continuation):

Annual exchanges: DKK 2,915,000 = USD 600,000

At maturity, final exchange: DKK 53 M = USD 10 M

⇒ Each of these payments represents an implicit forward contract.

- Swap forward rate fixed by the annual exchanges of interest payments:
  USD 0.6M/ DKK 2,915,000 = 0.2058319 USD/DKK.

- Swap forward rate fixed by the last exchange of principals at T = 3 years:
  USD 10M/ DKK 53M = 0.1886792 USD/DKK. ¶

• We value the swap forward rate relative to the IRPT forward rate, $F_{t,T}$:

$$F_{t,T} = S_t * \frac{\left(1 + i_d * \frac{T}{360}\right)}{\left(1 + i_f * \frac{T}{360}\right)}$$

Suppose in the swap, we are long the FC (the FI is long DKK). Then, the PV, using i_d as the discount rate, of each annual payment j is:

$$(F_{t,t_j} - \text{Swap forward rate at time } t_j) * \frac{\text{Amount of FC}}{(1 + i_{d,j})^{t_j}}$$

Example FI (continuation):

FI's value of the exchange of principals at T = 3 years ($\text{Value}_{\text{FI,Principals}}$).

$F_{t,T=3-yr}$ = .18868 USD/DKK $* \frac{(1 + .065)^3}{(1 + .05)^3}$ = .19688 USD/DKK

Swap forward rate = USD 10M/DKK 53M = 0.1886792 USD/DKK.

$\text{Value}_{\text{FI,Principals}}$ = (.19688 – 0.1886792) $* \frac{53M}{(1 + .065)^3}$ = USD 0.35982M

Note: We can do the same for each exchange of CFs. ¶

• Alternatively, we can value the CFs in terms of forward DC.

Notation:

t_j: time of the jth settlement date

$i_{d,j}$: domestic interest rate applicable to time t_j

F_{t,t_j}: forward exchange rate applicable to time t_j, calculated by IRPT.

• PV to the FI of the swap forward contract set by the corresponding exchange of payments at time t_j:

$$(\text{DKK 2,915,000} * F_{t,t_j} - \text{USD 0.6M}) * \frac{1}{(1 + i_{d,j})^{t_j}}$$

• PV to the FI of the swap forward contract set by the exchange of principal payments at time T:

$$(\text{DKK 53M} * F_{t,T} - \text{USD 10M}) * \frac{1}{(1 + i_{d,T})^{T}}.$$

$\Rightarrow$ The value of a currency swap can be calculated from the term structure of forward rates and the term structure of $i_{d,j}$.

Example (continuation): Reconsider FI Example.

S_t = **.18868 USD/DKK.**

i_{DKK} = **5%**

i_{USA} = **6.5%**.

Using IRPT, the one-, two- and three-year forward exchange rates are:

$$\mathbf{F_{t,T=1\text{-}yr}} = \mathbf{.18868\ USD/DKK} * \frac{(1+.065)}{(1+.05)} = \mathbf{.19137\ USD/DKK}$$

$$\mathbf{F_{t,T=2\text{-}yr}} = \mathbf{.18868\ USD/DKK} * \frac{(1+.065)^2}{(1+.05)^2} = \mathbf{.19411\ USD/DKK}$$

$$\mathbf{F_{t,T=3\text{-}yr}} = \mathbf{.18868\ USD/DKK} * \frac{(1+.065)^3}{(1+.05)^3} = \mathbf{.19688\ USD/DKK}$$

Example (continuation): Reconsider FI Example.

• The value of the implicit swap forward contracts corresponding to the exchange of interest are therefore (in millions of USD):

$$(\mathbf{DKK\ 2.915} * \mathbf{.19137\ USD/DKK} - \mathbf{USD\ .6}) * \frac{1}{(1+.065)} = \text{USD } -.03957\text{M}$$

$$(\mathbf{DKK\ 2.915} * \mathbf{.19411\ USD/DKK} - \mathbf{USD\ .6}) * \frac{1}{(1+.065)^2} = \text{USD } -.03013\text{M}$$

$$(\mathbf{DKK\ 2.915} * \mathbf{.19688\ USD/DKK} - \mathbf{USD\ .6}) * \frac{1}{(1+.065)^3} = \text{USD } -.02160\text{M}$$

• The final exchange of principal involves receiving **DKK 53M** & paying **USD 10M**. The value of the forward contract is:

$$(\mathbf{DKK\ 53M} * \mathbf{.19688\ USD/DKK} - \mathbf{USD\ 10M}) * \frac{1}{(1+.065)^3} = \mathbf{USD\ 359{,}816}$$

• Then, the total value of the swap is (in USD):

359,816 – 39,570 – 30,130 – 21,600 = **USD 268,516**.

$\Rightarrow$ FI would be willing to sell this swap for **USD 268,516**. ¶

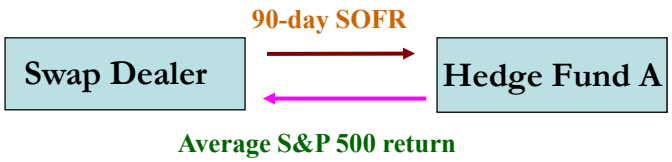
Equity Swaps

Equity swaps have two legs: One of the legs is pegged to the return of a stock or market index. Usually, the other is pegged to a floating rate (SOFR or ESTR **plus or minus a spread**).

Terms include notional principal, duration and frequency of payments.

Example: Stock returns against a floating rate.

On April 1, Hedge Fund A enters into a 3-year equity swap. Every quarter, Hedge Fund A pays the average S&P 500 return in exchange of 90-day SOFR (count 30/360) .



Example: (continuation)

Notional principal = **USD 40 million**.

Data at inception (April 1):

S&P500 index = 4100

90-day SOFR = **3%**.

On July 1, Hedge Fund A will pay (or receive if sum is negative):

USD 40 M * [**S&P 500 return (04/01 to 07/01)** – **0.03** * 90/360].

If on July 1, S&P 500 = 4153 ⇒ **Return** = 4153/4100 – 1 = **.0130**.

Then the payment will be:

USD 40M * [**.0130** – **0.03** * 90/360] = **USD 0.22M**.

On July 1, SOFR is set for the next 90-day period (07/01 to 10/01). ¶

• **Variations**

- Equity return against a **fixed rate** (S&P500 against 2%)
- Equity return against **another equity return** (S&P500 against NASDAQ)
- Equity return against a **foreign equity return** (S&P500 against FTSE)
- Equity swaps **with changing notional** ("reinvested") principals

• **Q: Why equity swaps?**

(1) Avoid **transaction costs** and **taxes**.
(2) Avoid **legal limits** (margins, capital controls) and **institutional rules**.
(3) Keep equity positions (and voting shares) **without equity risk**.

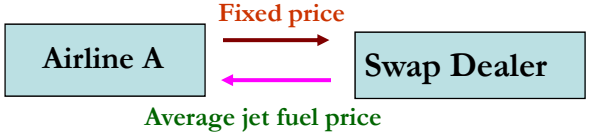
Commodity Swaps

Commodity swaps work like any other swap: one legs involves a fixed commodity price and the other leg a (variable) commodity market price.

Unlike futures commodity contracts, *cash settlement* is the norm.

Example: Jet fuel oil swap.

Airline A enters into a 2-year jet-fuel oil swap. Every quarter, Airline A receives the average market price –based on a known price quote- & pays a fixed price.



Example: (continuation)

Cash settlement: If the average jet-fuel price paid is above (below) the fixed price, the SD will repay (receive from) the airline the difference in what it paid versus the fixed price. ¶

Note: There is no futures contract for jet fuel oil. A swap **completes** the **market**.

You can consider the 2-year swap as a **collection** of 8 **forward contracts**.

• Q: Why commodity swaps?

(1) *A commodity swap eliminates basis risk*

Southwest Airlines has used NYMEX crude oil and heating oil futures contracts to hedge jet fuel price risk. But, this introduces basis risk.

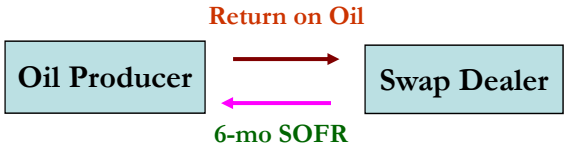
(2) *Expanded market*

Since there is cash settlement, market participants do not need to have the infrastructure to take delivery.

• Commodity for interest swap

They work like an equity swap: One leg pays a return on a commodity, the other leg pays an interest rate (say, SOFR plus or minus a spread).

Example: An oil producer enters into a 2-year swap. Every six month, the oil producer pays the return on oil –based on NYMEX Light Crude Oil– and receives 6-mo SOFR.



• Valuation of Commodity Swaps

Commodity swaps are valued as a series of **commodity forwards**, each priced at inception with zero value.

The fixed coupon payment is a weighted average of commodity forward prices.

Combination of Swaps

• Recall that swaps change the profile of cash flows.
• Swaps solve problems: *Financial Engineering*.

Example: A Brazilian oil producer is exposed to two forms of **price risk**:
- P_{oil} (priced in USD/barrel of oil) ⇒ **Commodity price risk**.
- S_t (BRL/USD) ⇒ **FX risk**.

Situation: Since expenses are in BRL, the Brazilian oil producer wants to **fix P_{oil} in BRL/barrel of oil**.

Solution: *Financial Engineering*, a combination of swaps can do it!

Note: This is a typical problem for commodity producers and buyers from non-USD zones: Commodities are priced in USD.

Diagram: Structured Solution for Brazilian Oil Producer