

FRM Part 1

Book 3 - Financial Markets and Products

SWAPS

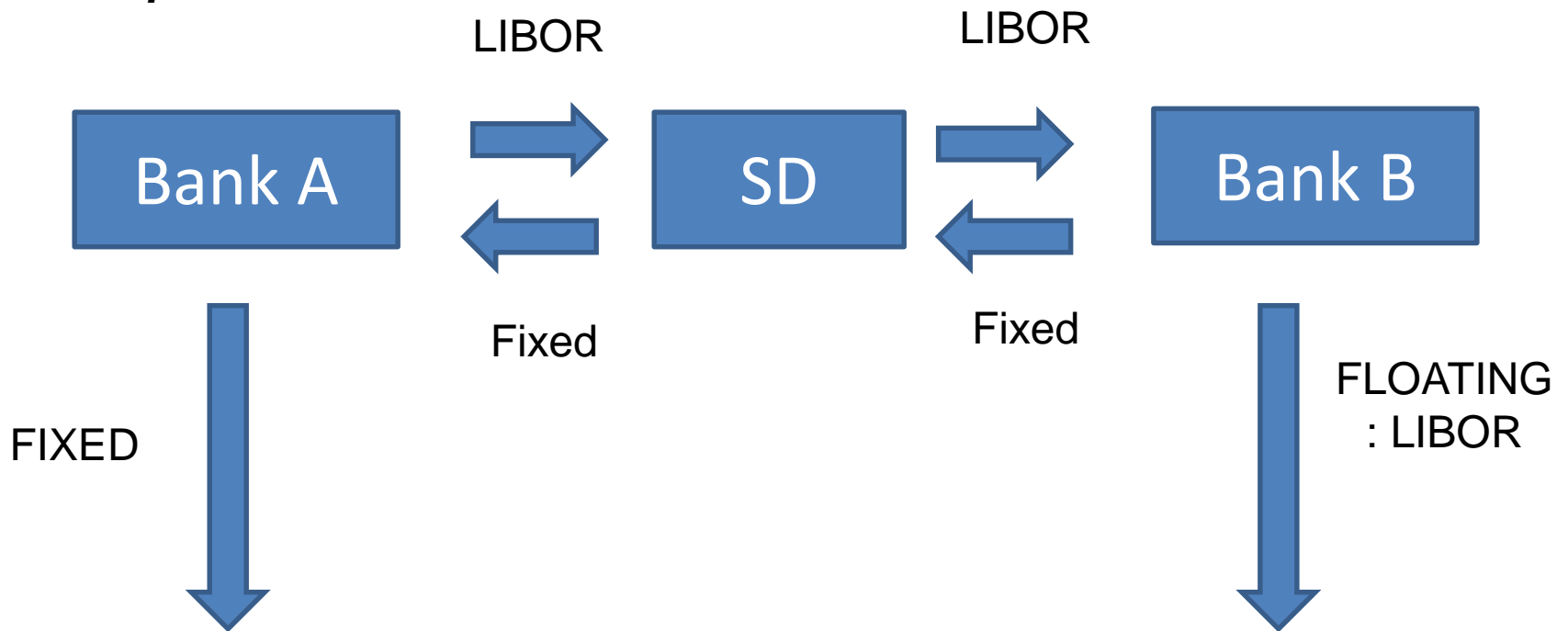
Learning Objectives

After completing this reading you should be able to:

- ✓ Explain the mechanics of a **plain vanilla interest rate swap** and compute its cash flows.
- ✓ Explain how a plain vanilla interest rate swap **can be used to transform an asset or a liability** and calculate the resulting cash flows.
- ✓ Explain the role of **financial intermediaries in the swaps market**.
- ✓ Describe the role of the **confirmation in a swap transaction**.
- ✓ Describe the **comparative advantage argument** for the existence of interest rate swaps and evaluate some of the **criticisms of this argument**.
- ✓ Explain how the **discount rates** in a plain vanilla interest rate swap are computed.
- ✓ Calculate the value of a plain vanilla interest rate swap **based on two simultaneous bond positions**.
- ✓ Calculate the value of a plain vanilla interest rate swap from a **sequence of forward rate agreements (FRAs)**.
- ✓ Explain the mechanics of a **currency swap** and compute its cash flows.
- ✓ Explain how a currency swap can be used to transform an asset or liability and calculate the resulting cash flows.
- ✓ Calculate the value of a currency swap based on two simultaneous bond positions.
- ✓ Calculate the value of a currency swap based on a sequence of FRAs.
- ✓ Describe the **credit risk exposure in a swap position**.
- ✓ Identify and describe **other types of swaps**, including commodity, volatility, and exotic swaps.

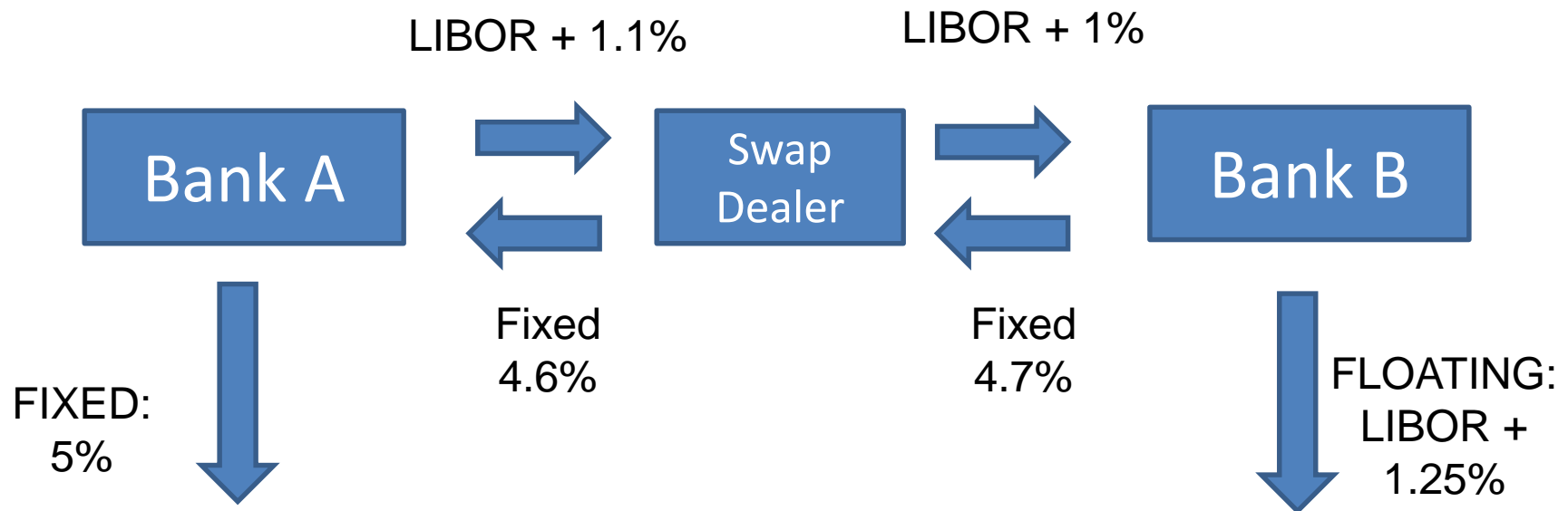
What's an Interest Rate Swap?

- An interest rate swap is an agreement to exchange **one stream of interest payments for another**, based on a **specified principal amount**, over a **specified period of time**.
- *Example*



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- First net payment for A: $5\% - (\text{LIBOR} + 1\%) = 4\% - \text{LIBOR}$
- First net payment for B: $(\text{LIBOR} + 1\%) - 5\% = \text{LIBOR} - 4\%$
- *"One man's gain is another man's loss"*
 - *[Loser/winner depends on how LIBOR moves]*

Cash Flows of a Plain Vanilla Interest Rate Swap

- In a **plain vanilla interest rate swap**, company A agrees to pay Company B a periodic **fixed rate** on a notional principal over the term of the swap.
- In return, Company B agrees to pay Company A a **periodic floating rate** on the same notional principal.
 - Both payments are in the same currency, and **only the net payment is exchanged**.
- The floating leg of the swap uses LIBOR as the reference rate. For example, the rate could be set at the three-month LIBOR + 1%.

Example

- Let's assume companies A and B have just entered into a **two-year plain vanilla IRS** with **semiannual payments** and the **6-month LIBOR** as the reference.
- We assume further that the **fixed leg is pegged at 2.75%**, and the **notional principal is \$10 million**.

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Cash Flows of a Plain Vanilla Interest Rate Swap

- The **fixed leg** is pegged at **2.75%**, and the **notional principal** is **\$10 million**.

Beginning of the period	LIBOR
1	2.0%
2	2.5%
3	3.0%
4	3.5%

End of period	LIBOR at beginning of period	Fixed cash flow	Floating cash flow	Net cash flow	Paid by
1	2.0%	137,500	100,000	37,500	A
2	2.5%	137,500	125,000	12,500	A
3	3.0%	137,500	150,000	12,500	B
4	3.5%	137,500	175,000	37,500	B

The Role of Financial Intermediaries and Confirmation In a Swap Transaction

- Just like in other OTC instruments, parties to a swap **do not interact one on one**.
 - A financial intermediary **intertwines themselves** between the parties such that all transactions occur through them.
 - In most cases, therefore, a swap party stays **unaware of the identity** of the party in the **offsetting position**.
- The details of each swap agreement are contained in a document called the **confirmation**.
 - Such documents are drafted by the International Swaps and Derivatives Association (ISDA).

The Comparative Advantage Argument

- Let's look at an example of two firms, A and B.
 - They could either borrow at the their **fixed or floating** borrowing rates, but A prefers floating and B prefers fixed.

Firm	Fixed borrowing	Floating borrowing
A	6%	LIBOR + 100bp
B	8%	LIBOR + 250bp

- Firm A has an **absolute advantage in both markets** but a **comparative advantage in the fixed market**.
- B has a **comparative advantage in the floating market**.
- When a comparative advantage exists, the implication is that the parties involved can **reduce their borrowing costs** by entering into a swap agreement.
- A borrows at fixed 6% and B borrows at LIBOR + 2.5%; Enter swap
- B pays A 7.75%; A pays B (LIBOR + 2.5%)
- Net Payment for A: $+7.75\% - \{\text{LIBOR} + 2.5\%\} - 6\% = \text{LIBOR} + 0.75\%$
- Net Payment for B: $-\{\text{LIBOR} + 2.5\%\} - 7.75\% + \{\text{LIBOR} + 2.5\%\} = 7.75\%$

The Comparative Advantage Argument

- If we assume that the net borrowing savings are split evenly between the parties, we will divide the total borrowing savings by 2, i.e.

$$\text{Borrowing saving} = \frac{\Delta \text{ fixed} - \Delta \text{ floating}}{2} = \frac{200\text{bps} - 150\text{bps}}{2} = 25\text{bps}$$

- A problem with the comparative advantage argument is that it **assumes the floating rates will remain in force in the long-term**.
 - In practice, the floating rate is **reviewed at 6-month intervals** and may increase or decrease to reflect the **credit risk of the borrower**.
 - It also **assumes zero transaction costs** even when an intermediary is involved in the swap.

Computing The Discount Rate In A Plain Vanilla Interest Rate Swap

- In essence, a swap is a **series of cash flows**, and therefore its value is determined by **discounting all those cash flows to the present** (valuation date).
 - The cash flows are discounted **using spot rates** developed using the swap curve.
- The curve makes use of the following relationship between forward rates and spot rates, assuming continuous compounding:

$$R_{forward} = R_2 + (R_2 - R_1) \frac{T_1}{T_2 - T_1}$$

- Where:
 - R_i = spot rate corresponding with T_i years
 - $R_{forward}$ = forward rate between T_1 and T_2

Value of a Plain Vanilla Interest Rate Swap Using the Bond Methodology

- In essence, the **pay fixed** party has a **long position in a floating rate** (since it's an inflow) and a **short position in the fixed rate** (since it's an outflow).
- The **pay floating party** has a **short position in the floating rate** (since it's an outflow) and a **long position in the fixed rate** (since it's an inflow).
- If we denote the value of the swap as V_{swap} , the present value of fixed-leg payments as P_{fix} , and the present value of floating-leg payments as P_{float} , then:
 - To the pay fixed, receive floating,

$$V_{\text{swap}} = P_{\text{float}} - P_{\text{fix}}$$


- To the pay floating, receive fixed,

The important thing to note here is that the two positions are **mirror images of each other**.

Currency Swap

- A currency swap works much like an interest rate swap, but there are **several key differences**:

A currency swap involves the exchange of **both principal and interest rate payments**, in different currencies.



Currency swaps use the **spot exchange rate**.



Because the principals in a currency swap are in different currencies, they are **exchanged at the inception of the swap**.

This ensures the principals have equal value using the spot exchange rate.



In a currency swap, there's **no netting of payments**, again because the payments are not in the same currency.

Currency Swap

- Currency swaps can be used to:
 - Transform a **liability** in one currency into a **liability** in a different currency.
 - Transform an **investment** in one currency into an **asset** in another currency.
- Two companies can also get into a currency swap to **exploit their comparative advantages** regarding borrowing in different currencies.
- **Example**
 - Firm X can borrow in \$ at 6%, or in £ at 4%
 - Firm Y can borrow in \$ at 4.5%, or in £ at 3.2%
- If Firm X wants to borrow £, and Firm Y wants to borrow \$, the two may be able to able to **save on their borrowing costs**.
- That could happen if each **borrow**s in the market in which they have a **comparative advantage**, and then **swapping** into their **preferred currencies** for their liabilities.

Other Types of Swaps

Equity swap

- One of the parties commits themselves to make payments **reflecting the return on a stock, portfolio, or stock index**.
- In turn, the counterparty commits themselves to make payments based on either a **floating rate** or a **fixed rate**.

Swaption

- A swaption gives the holder the **right to enter into an interest rate swap**.
- It's **purchased for a premium** whose value is determined by the strike rate specified in the swaption.
- Swaptions can either be American or European.

Commodity swap

- A floating (or market or spot) price **based on an underlying commodity** is traded for a fixed price over a specified period.
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