TOPIC 4 - OVERVIEW

1. EXCHANGE-TRADED INTEREST-RATE DERIVATIVES

- Exchange-traded futures contracts offer **hedgers, speculators and arbitrageurs** a product with the following advantages:
  - Capital effectiveness
  - Cost effectiveness
  - Guaranteed settlement

1.1 Hong Kong Interbank Offered Rate Futures

- There are two types of Hong Kong Interbank Offered Rate (HIBOR) futures:
  - **Three-month HIBOR** futures contracts introduced in September 1997
  - **One-month HIBOR** futures contracts introduced in October 1998
- HIBOR futures contracts are **cash-settled**
- The are designed to enable management of interest-rate risk
- HIBOR is the rate on which all Hong Kong dollar-denominated instruments are traded between banks in Hong Kong

2. OVER-THE-COUNTER INTEREST RATE DERIVATIVES

- According to Bank of International Settlements, the outstanding notional amounts of **OTC interest-rate derivatives at the end of 2019 was USD449 trillion** – 90% were swaps and forward rate agreements (FRAs) and 10% were interest-rate options
- All OTC derivatives are **flexible products**, which are **traded in a decentralised marketplace**
- Development of the OTC-traded interest-rate derivatives market was facilitated by the establishment of the **International Swaps and Derivatives Association (ISDA)** and the introduction of the **ISDA master agreement**
- The 2008 global financial crisis exposed the downsides of **counterparty risk** in the OTC markets as trades were not guaranteed by any exchange

2.1 Forward Rate Agreements (FRAs)

- An FRA is an agreement between two parties that fixes an interest rate for a period occurring at some time in the future
- FRAs are covered in Topic 2, Section 2

2.2 Interest-Rate Swaps (IRSs)

- Transactions in which two parties agree to make periodic payments to one another computed on the basis of specific interest rates on a notional principal amount
- Usually, there are two legs or payments: a **payment based on a floating rate** of interest (LIBOR or HIBOR); and a **payment based on a fixed rate** of interest
- The swap market began in 1980 and is now the largest type of traded interest-rate derivative in the OTC market
- The **largest swap market is in US dollar**, followed by the Euro, Japanese Yen, and the British pound sterling. IRSs are traded in many countries
- Hong Kong is one of the most active markets in the Asia Pacific region
- In Hong Kong, certain types of IRS transactions are subject to **mandatory reporting to the Hong Kong Trade Repository**, operated by the Hong Kong Monetary Authority, and **mandatory clearing** at SFC designated central counterparties

2.2.1 Swap Spreads

- Defined as the **difference between the swap rate and the yield on government bonds** of the same maturity
- The swap spread is **a credit spread**, representing the risk premium between an IRS and risk-free government securities
- Many consider it the most important credit spread
- Swap spread is a good indicator of the credit condition and will increase substantially whenever credit crunches occur

2.2.2 Application of Interest-Rate Swaps

- **Using interest-rate swaps for hedging**: Banks can use IRSs to lock in a spread over the cost of funds by borrowing at a short-term interest rate (LIBOR/HIBOR) and paying a fixed rate in a long-term IRS
- **Using interest-rate swaps for trading**: If investors expect interest rates to rise, they can pay a fixed rate and receive a floating rate. If investors expect interest rates to fall, they can pay a floating rate and receive a fixed rate.

2.2.3 Interest-rate Swap Variations

- As well as plain vanilla IRSs, there are a number of variations which are regularly traded and attract significant liquidity

Basis Swaps

- Both parties make their periodic payments based on floating interest rates, known as floating/floating IRSs. The most common are structured to manage:
  - *Index Basis*: The first leg references LIBOR, the second another index
  - *Tenor Basis*: Two different benchmarks are exchanged, such as one-month vs six month

Compounding Swaps

- Interest earned can be compounded over more than one fixed period, determined by the counterparties

Overnight Index Swaps (OISs)

- The floating leg is referenced to an overnight rate index, typically determined by a central bank, rather than LIBOR/HIBOR
- OISs have grown in importance as a benchmark rate and are considered good indicators of sentiment for the interbank credit markets

Variable Notional Swaps

- Interest rate payments are based on a notional which is subject to a schedule which may periodically increase or reduce the notional over time
- For example, where the notional periodically reduces to align to a mortgage repayment schedule, the swap will be known as an "amortising swap"

Forward Starting Swaps

- A structure where the initial exchange of cashflows is delayed for a period of time determined by the counterparties – for example, a five-year swap starting in two years' time
- Can be achieved by trading two swaps

Stub Swaps

- Swaps with a total life that is not exactly aligned with the coupon periods of the rate which they reference
- For example, a 13-month swap referencing a three-month LIBOR would have four standard quarterly coupon periods and a one month "stub period", which could be at the beginning or end of the swap

2.3 Over-The-Counter Interest-Rate Options

2.3.1 Caps, Floors and Collars

- **Caps and floors** are options that can be bought to hedge against a rise or fall interest rates
- The **seller of a cap** agrees to compensate the buyer if interest rates rise above a specified strike rate. The buyer pays the seller a premium
- **Borrowers can hedge** the cost of borrowing by buying caps. If interest rates do not rise, beyond the strike rate, the seller is ahead by the premium
- The **seller of a floor** agrees to compensate the buyer if interest rates fall below a specified strike rate. The buyer pays the seller a premium
- **Lenders can hedge** the interest-rate received by buying floors. If interest rates do not fall, beyond the strike rate, the seller is ahead by the premium

- For both caps and floors, the agreement is for a specified period over a notional amount
- A **collar is a combination of a cap and a floor** – by combining the two, both upside and downside risks can be hedged
- If **both cap and floor were set at the same strike price**, the net effect would be the **same as entering into a swap**
- A **zero-cost collar** can be established by:
  - Selecting the appropriate floor (or cap)
  - Selecting the opposite cap (or floor) with a net present value which, when added to the premium of the floor (or cap), will result in a zero net premium
- The purchase of either a cap or a floor can be offset by the sale of a cap or a floor

Creating a Collar – Example

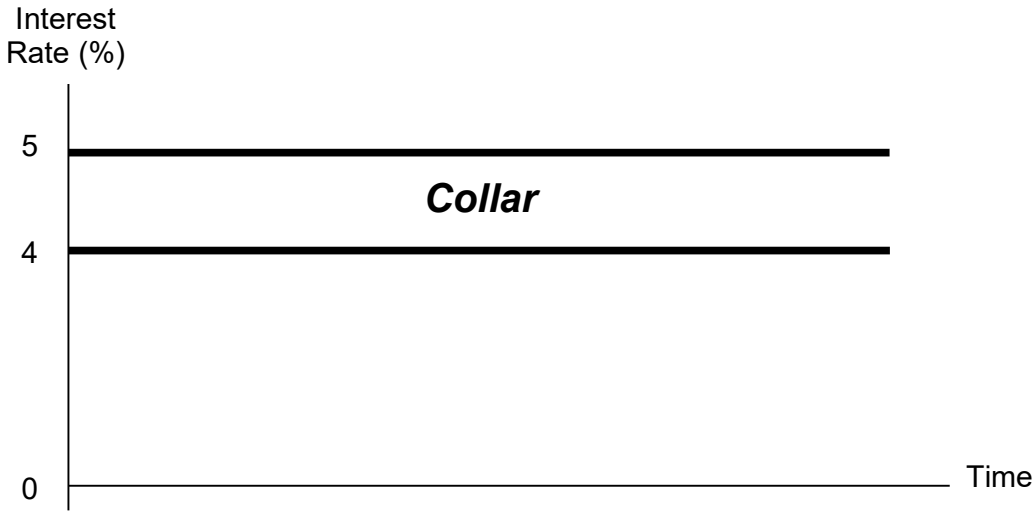
A bank with a HK$100 million floating rate borrowing and paying 5% interest has an annual interest-rate expense of HK$5m.

By purchasing a cap at 6%, for HK$1m, the bank has capped the maximum interest rate it will pay.

At the same time, the bank sells a floor at 4% and receives a premium of HK$1m, thereby offsetting the cost of the cap.

Should interest rates reach 4% or lower, the bank will need to pay the buyer of the floor. However, with interest rates at 4%, the bank's interest expense on its loan would fall to HK$4m, a reduction of HK$1m.

Creating a Collar



2.3.2 Swaptions

- A swaption is the option to enter into a swap
- **Two types of swaptions**: calls and puts
- A **receiver swaption**, like a call option on a swap, gives the buyer the right, but not the obligation, to receive a fixed rate
- A **payer swaption**, like a put option on a swap, gives the buyer the right, but not the obligation, to pay a fixed rate
- There are several types of expiry for swaptions, including American, European and Bermudan (the last is not described)

2.3.3 Bond Options

- Bond options include calls and puts on quantities of individual bonds or shorter-dated securities, or baskets of longer-dated securities
- Buyers and sellers of bond options must specify the types of bond and when they will be delivered

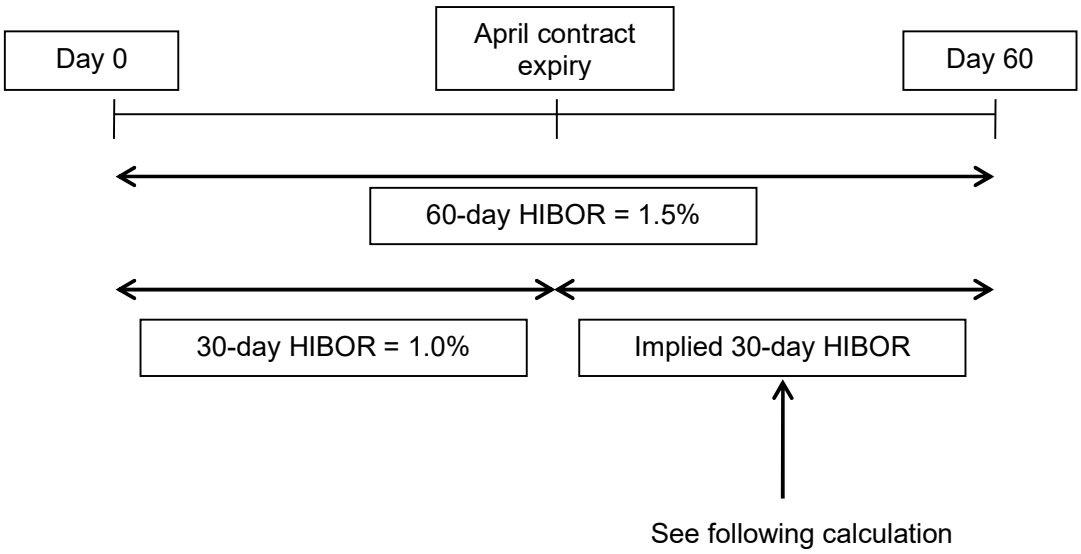
3. PRICING INTEREST RATE DERIVATIVES

3.1 Pricing HIBOR Futures Contract

- The theoretical price of a short-term interest-rate futures contract **assumes that no arbitrage opportunity exists** between the futures market and the underlying cash market
- The HIBOR futures contract locks in an interest rate for a future period

Example

Assume that there are 30 days before the expiry of the April 20x1 one-month HIBOR futures contract



Calculation of interest rate implied for April 20x1 one-month HIBOR futures contract

Deposit $100 for 30 days at 1%: $100 x (1 + (0.01 x 30/365)) = 100.0822

Deposit $100 for 60 days at 1.5%: $100 x (1 + (0.015 x 60/365)) = 100.2466

$100.0822 invested at r for 30 days produces $100.2466

=> (1 + r) = $100.2466/$100.0822

=> (1 + r) = 1.001643

r for 30 days = 0.001643 => r for 365 days = 0.001643 x 365/30 = 0.01999

Therefore, the implied 30-day HIBOR on the expiry of the April futures contract is 2% pa

- The market convention of quoting the futures price is to deduct the annual interest rate from 100
- So, the **theoretical futures price** of the April 20x1 one-month HIBOR futures contract is 100.00 – 2.00 = 98.00 – *must know for the exam*

3.2 Calculating the Contracted Value of HIBOR futures

- Contracted **value of a HIBOR futures contract** is:

  quoted price x (value of minimum fluctuation x 100)
- Value of minimum fluctuation = HK$125
- Contract sizes:
  - **HK$15m for one-month** HIBOR futures
  - **HK$5m for three-month** HIBOR futures

Example

What is the cash settlement value of a HIBOR futures contract trading at 98.00?

Solution

98.00 x (HK$125 x 100) = HK$1,225,000

4. HEDGING USING INTEREST RATE DERIVATIVES

- With debt securities, there is an **inverse relationship between yield and price**:
  - When price rises, yield falls
  - When price falls, yield rises
- Similarly, with interest-rate futures contracts, there is an **inverse relationship between the interest rate and the interest-rate futures contract price**
  - When interest rate rises, futures contract price falls
  - When interest rate falls, futures contract price rises
- When an investor **buys an interest-rate futures contract**, his bond portfolio's exposure to a change in interest rate increases
- Conversely, when an investor **sells an interest-rate futures contract**, her bond portfolio's exposure to a change in interest rate decreases
- Therefore, interest-rate futures contracts can be used to **change the duration** (bond price sensitivity to a change in interest rates) of a bond portfolio

4.1 Hedging Using HIBOR Futures

Hedging a Current Market Position

- **Details for this hedging example**:
  - In April 20X1, a fund manager holds a broad portfolio of short-dated discount securities (average 90 days)
  - The portfolio has a notional value of HK$800 million and an average investment yield of 3%
  - The fund manager fears a rise in interest rates over the next three months
- **Buy or sell futures?**
  - To profit from a rise in interest rates, the fund manager needs to **sell futures**. If interest rates rise, the price of futures will fall
- **Which contract to sell?**
  - Available contracts are: April, May, June and September
  - Given the fund manager's concerns over the next 3 months, the most appropriate contract is June, which is currently trading at 97.4
- **How many contracts?**
  - We need to divide the notional value of the portfolio by the notional value of the HIBOR futures contract
  - HK$800 million / HK$5 million = 160 contracts

- **Implementing the hedge**
  - Sell 160 June 20X1 three-month HIBOR futures @ 97.4

- **Closing the Hedge**
  - In late June 20X1, the interest rate has risen: average portfolio yield has risen to 3.2% and HIBOR futures are now trading at 96.7
  - The fund manager decides it is time to close the hedge and exit his futures position
  - To close the position, he will enter into a reversing trade which will involve buying 160 June 20X1 three-month HIBOR futures at 96.7

- **Loss in the physical market:**
  - The bond portfolio will have lost value. The amount of the loss will depend upon portfolio duration

- **Profit in the futures market:**
  - Difference in price: 97.4 – 96.7 = 0.7
  - Profit on each futures contract: 0.7 x HK$125 x 100 = HK$8,750
  - Overall profit: 160 contracts x HK$8,750 = HK$1,400,000

Physical Market	**Derivatives Market**
1. Fund holds an bond portfolio valued at HK$800 million	
	2. Sells 160 3-month HIBOR futures @ 97.4
3. Interest rates rise	4. 3-month HIBOR futures fall to 96.7
5. Value of bond portfolio falls	6. Buys back 160 3-month HIBOR futures for @ 96.7
7. Loss in physical market offset by profit made on derivatives trade of HK$1,400,000	

Hedging a Future Market Position

- **Details for this hedging example**:
  - In April 20X1, a corporate treasurer expects to have surplus funds of HK$800 million in three months' time. The funds will be used for a project in another three months' time
  - Accordingly, the treasurer wants to invest in a short-term instrument to enhance return, but is expecting the short-term interest rate to fall in the near future
  - The treasurer wants to lock in the interest rate that will be earned

- **Buy or sell futures?**
  - To profit from a fall in interest rates, the treasurer needs to **buy futures**. If interest rates fall, the price of futures will rise

- **Which contract to buy?**
  - Available contracts are: April, May, June and September
  - Given that the funds will only be available in 3 months' time, the most appropriate contract is June, which is currently trading at 96.8

- **How many contracts?**
  - We need to divide the value of the surplus funds to be received by the notional value of the HIBOR futures contract
  - HK$800 million / HK$5 million = 160 contracts

- **Implementing the hedge**
  - Buy 160 June 20X1 three-month HIBOR futures @ 96.8

- **Closing the Hedge**
  - In late June 20X1, the interest rate has fallen and HIBOR futures are now trading at 97.2
  - The treasurer decides it is time to close the hedge and exit his futures position
  - To close the position, he will enter into a reversing trade which will involve selling 160 June 20X1 three-month HIBOR futures at 97.2

- **Profit in the futures market:**
  - Difference in price: 97.2 – 96.8 = 0.4
  - Profit on each futures contract: 0.4 x HK$125 x 100 = HK$5,000
  - Overall profit: 160 contracts x HK$5,000 = HK$800,000

Physical Market	**Derivatives Market**
	1. Buys 160 3-month HIBOR futures @ 96.8
2. Interest rates fall	3. 3-month HIBOR futures rise to 97.2
4. Return on surplus fund investment will be lower due to fall in interest rates	5. Sells 160 3-month HIBOR futures for @ 97.2
	6. Profit on futures trade is HK$800,000

5. TRADING STRATEGIES FOR INTEREST RATE DERIVATIVES

5.1 Trading strategies Using HIBOR Futures

- **To speculate on interest rates rising:**
  - Sell HIBOR futures now at current HIBOR futures price
  - Buy back same number of futures contracts at HIBOR futures price when the reversing trade takes place
  - If interest rates have risen, a profit will be made; if interest rates have fallen, a loss will be made
  - The settlement value will be:
    change in futures price x HK$125 x 100 x number of contracts

- **To speculate on interest rates falling:**
  - Buy HIBOR futures now at current HIBOR futures price
  - Sell same number of futures contracts at HIBOR futures price when the reversing trade takes place
  - If interest rates have fallen, a profit will be made; if interest rates have risen, a loss will be made
  - The settlement value will be:
    change in futures price x HK$125 x 100 x number of contracts