2604697
Financial Markets, Institutions and Instruments

Topic 13: Money Market

MSF Program
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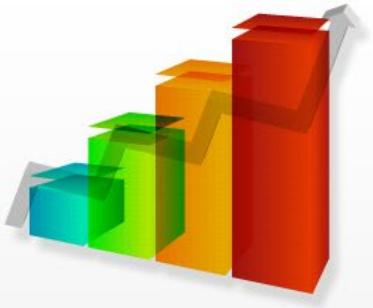

Overview

1. Money Markets

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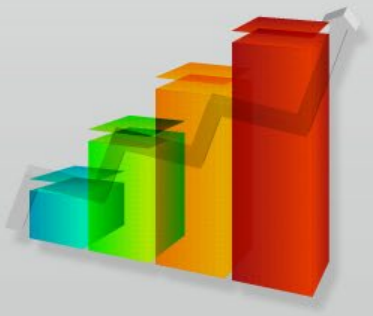


1.1 What is Money Market?

- **Money Market** (MM) is the market where short-term debt instruments are traded. It is used by market participants as a means for short-term borrowing and lending with maturities ranging from overnight to one year.
- MM also includes foreign exchange (FX) markets and Foreign currency and interest rate (FX-IR) derivatives markets.
- Instruments traded in MM are liquid and relatively safe, compared to those in capital markets. However, they offer relatively lower returns as well.
- MM is an OTC market consisting of informal networks of banks, brokers, dealers and financial institutions that are linked electronically.

1.1 What is Money Market?

- Apart from using MM to borrow and lend their own funds, commercial banks also participate in this market as dealers.
- Dealers are market makers who quote prices and stand ready to enter an MM transaction with other market participants.
- Dealers quote bid and ask interest rates simultaneously.
  - **Bid interest rate** is the rate that the quoting bank will pay for taking a deposit from another participant.
  - **Ask interest rate** is the rate that the quoting bank will charge for providing a loan to another participant.

1.1 What is Money Market?

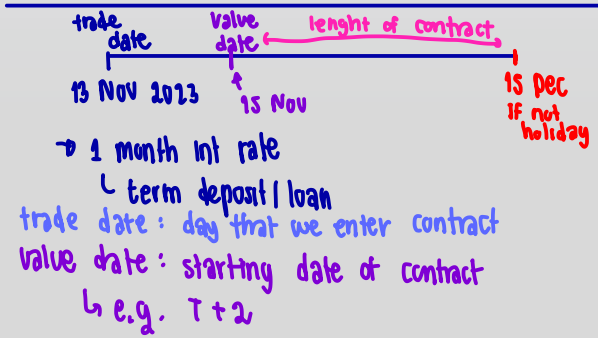
- Financial instruments traded in MM
  - Interest rate (IR) products
    - Interbank lending and borrowing
    - Repurchase agreements (Repos)
    - Short-term debt securities
    - IR Derivatives: FRA, IRS and CCS
  - Foreign exchange (FX) products
    - FX Spot
    - FX Derivatives: FX Forward, FX Swap and FX Options

1.2 Value Dates

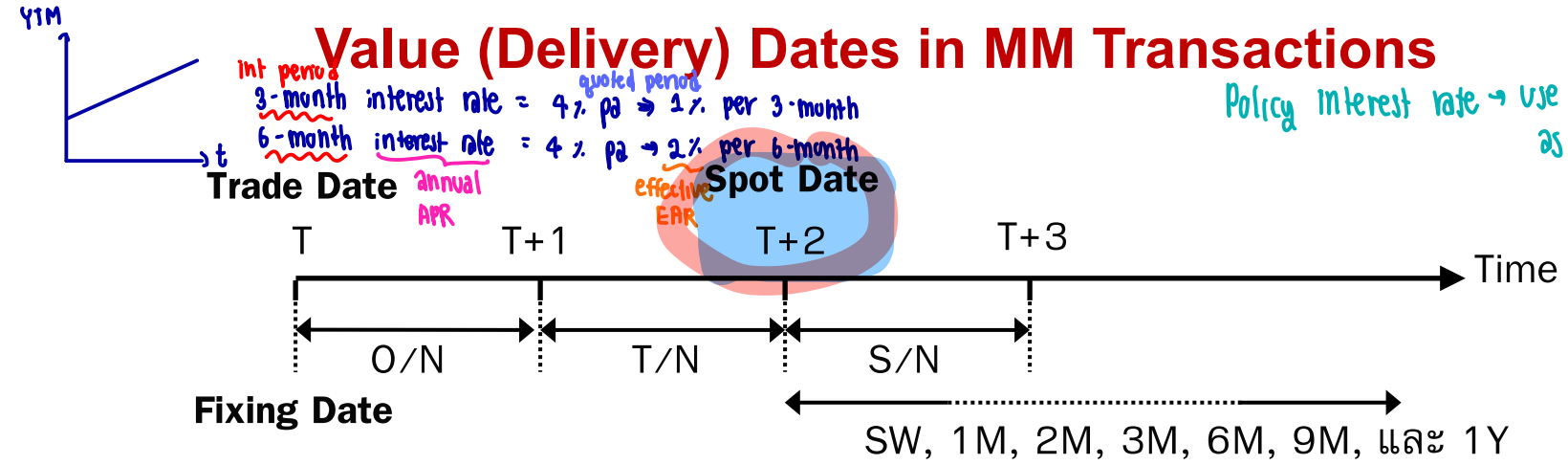
- Deal or Trade Date is the date that a transaction is agreed between the counterparties.
- Value or Settlement Date is the date that a transaction will be settled.
- A normal short-term lending/borrowing transaction that is agreed today is expected to start in 2 business days. This transaction is referred to as a spot transaction.
- A short-term lending/borrowing transaction involves 2 value dates. For example, one month deposit agreed today will start in 2 days' time (lenders give money) and mature a month after the spot date (borrowers repay the loan).

1.2 Value Dates

- Lending/borrowing transactions are quoted for certain regular tenors, for example, 1, 2, 3, 6 and 12 months.
  - On 19th April, the value dates for a 1-month deposit are 21st April and 21st May, regardless of any weekends or holidays between the two value dates.
  - If value dates fall on holidays, the actual value date will be moved (usually, forward).
- The following slide shows meanings of different tenors of MM transactions.



Value (Delivery) Dates in MM Transactions



Tenor		Description
O/N	Overnight	Loan agreement starting on trade date (T) and ending on day T+1
T/N	Tom/Next	Loan agreement starting 1 day after trade date (T+1) and ending on day T+1
S/N	Spot/Next	Loan agreement starting 2 day after trade date (T+2) and ending on day T+3
S/W	Spot–a–Week	Loan agreement starting 2 day after trade date (T+2) and ending 1 week later
1M	1 Month	Loan agreement starting 2 day after trade date (T+2) and ending 1 month later
6M	6 Month	Loan agreement starting 2 day after trade date (T+2) and ending 6 months later

1.3 Interest Calculation Methods

- As a general rule, interest (I) and total proceed at maturity (FV) can be calculated in the following manner:

$$I = PV \times r \times \frac{D}{B}$$

$$FV = PV + I = PV \times \left(1 + \left(r \times \frac{D}{B}\right)\right)$$

I = amount of interest

FV = total proceed at maturity (future value)

PV = capital or principal (present value)

r = interest rate in decimal point pa (i.e., 4% = 0.04)

D = number of days of the term of interest

B = day basis for calculation (number of days per year)

1.3 Interest Calculation Methods

- Day count convention determines how to count [1] number of days during the interest period, and [2] number of days in one full year.
- ACT/360 : Use actual number of days during the interest period and consider a full year is 360 days.
- ACT/365 : Use actual number of days during the interest period and consider a full year is 365 days.
- 30/360 : A full month during the interest period is considered 30 days and a full year is 360 days.
- Money market for THB uses ACT/365 convention, while for USD money market ACT/360 convention is employed.

1.3 Interest Calculation Methods

- EX: A bank quotes an interest rate of 5.0% pa for 1-year deposit from 1st Mar 2017 to 1st Mar 2018 of THB 10 mio. The interest calculation depends on day count convention used.
  - ACT/365: I = 10,000,000×0.05×(365/365) = ﬁ500,000.00
  - ACT/360 : I = 10,000,000×0.05×(365/360) = ﬁ506,944.44

1.3 Interest Calculation Methods

- The following formulas show how to convert interest from [1] ACT/365 to ACT/360 and [2] ACT/360 to ACT/365 conventions.

$$r_{ACT/360} = r_{ACT/365} \times \frac{360}{365} \qquad [1]$$

$$r_{ACT/365} = r_{ACT/360} \times \frac{365}{360} \qquad [2]$$

- EX: From the previous example
  - The ACT/360-equivalent of $r_{ACT,365}$ is 0.05×(360/365) = 0.0493 or 4.93% pa.
  - The ACT/365-equivalent of $_{rACT,360}$ is 0.05×(365/360) = 0.0507 or 5.07% pa.

Exercise

1. If a trader deposit THB 10 mio for 126 days at 4.50%, what is the total proceeds the trader will receive at maturity?
[Ans. THB 155,342.50]

2. If the interest rate on 182-day deposit is 3.25%. How much do you need to put on deposit now so that, after 182 days, it will grow to be THB 2,000,000.
[Ans. THB 1,968,105.90]

3. Mr. A borrows THB 10 mio for 213 days. At the end, he repays a total of THB 10,258,654. What is the interest rate on this borrowing?
[Ans. 4.43%]

Discount Rate vs. Yield

- Some MM instruments (such as T-bill and CP) pay only the face value (FV) with no interest payment at maturity. The current price (PV) of these instruments are quoted at discounts from their FV's.

$$\mathrm{PV} = \mathrm{FV} \times \left(1 - \left(\mathrm{d} \times \frac{\mathrm{D}}{\mathrm{B}}\right)\right)$$

Discount Rate vs. Yield

- EX: The 90-day Treasury bill is traded at 3.25% pa discount rate. The face value (FV) of the T-bill is THB 1 mio. What is the current price of the T-bill?
  - PV = 1,000,000×(1–(0.0325(90/365)) = 991,986.30
  - The interest is 1,000,000–991,986.30 = 8,013.70
  - The actual interest rate or yield = 8,013.70/991,986.30 = 0.0081 or 0.81% per 90 days
  - The yield or interest rate per year = 0.81%×(365/90) = 3.28% pa.

Discount Rate vs. Yield

- For investment with 2 cash flows, cash flow at the start (PV) and at maturity (FV), the simple annualized yield is

$$r = \left(\frac{FV}{PV} - 1\right) \times \frac{B}{D}$$

- This simple annualized yield is also known as Annual Percentage Rate (APR)
- Substitute PV = FV(1–d(D/B)) to the above equation, the formula becomes;

$$r = \left(\frac{FV}{PV} - 1\right) \times \frac{B}{D}$$

- EX: Apply the formula to the previous example.
  - r = 0.0325/(1–(0.0325×(90/365)) = 0.0328 or 3.28% pa.

Annualized Yield

- Simple annualized yield (APR) of an MM instrument is calculated as:

$$r = \left(\frac{FV}{PV} - 1\right) \times \frac{B}{D}$$

- However, APR does not consider compounding effect during the year.
- Effective annual yield or EAR can, then, be calculated as:

$$r_E = \left(1 + r \times \frac{D}{B}\right)^{\frac{B}{D}} - 1$$

Annualized Yield

- EX: Bank BBB borrows THB 1 mio for 73 days at 4.7% pa. At maturity, the bank borrows the whole amount again (principal and the interest) for another 124 days at 4.9% pa. What is the total proceeds to repay on day 197?
  [Ans: THB 1,026,203.05]

  What is simple interest over the combined period of 197 days?
  [Ans: APR = 4.85% pa., EAR = 4.91% pa.]

Interest Rate on Multiple Interest Payments

- For an investment or loan with fixed interest rate where interest is paid N times a year, the total proceed at the end of the year can be calculated as;

$$FV = PV \times \left(1 + \frac{r_N}{N}\right)^N$$

r_N = interest rate pa.

N = number of times the interest is paid per year (for example, N = 4 for quarterly interest payment and N = 12 for monthly interest payment)

Note: N = B/D

Interest Rate on Multiple Interest Payments

- To convert interest rate that pay interest N times p.a. (r_N) into an equivalent interest rate that pays M times p.a. (r_M), we simply try to solve for r_M of the following equation.

$$PV \times \left(1 + \frac{r_N}{N}\right)^N = PV \times \left(1 + \frac{r_M}{M}\right)^M$$

- The equivalent interest rate paying M times p.a. is;

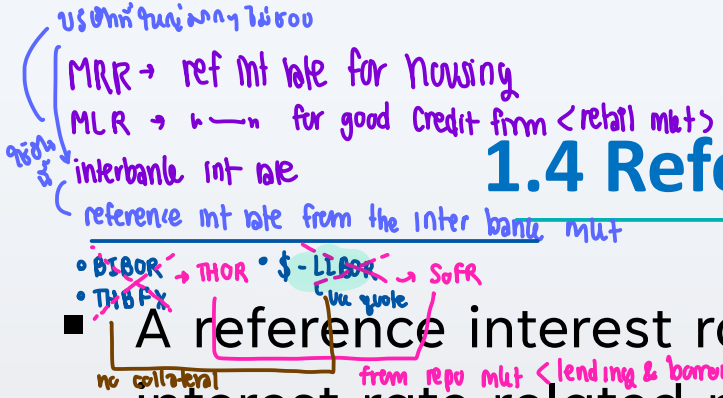
$$r_M = \left[\left(1 + \left(\frac{r_N}{N}\right)\right)^{\frac{N}{M}} - 1\right] \times M$$

Exercise

1. A dealer quotes a customer 7.35% to borrow for one year with interest paid monthly. The customer prefers to pay interest quarterly. What rate should the dealer quote instead? [Ans: 7.40% pa.]

2. A company borrows US dollars at 5.1% for 183 days and then at maturity refinances the principal and interest at 5.3% for a further 92 days. What is the simple cost of borrowing over the 9 months?. [ACT/360, Ans: 5.21% pa.]

3. You own THB T-Bill with face value THB 10 mio. The bill was issued at a discount rate of 4.50% on 15 March for 59 days, maturing on 13 May. It is now 19 April and you wish to sell the paper for value 19 April (24 days left until maturity). You are quoted 4.30/4.35% for the paper. How much money will you receive on the sale? What is the yield you received from this investment? [Ans: P_0 = 9,927,260.27; P_1 = 9,971,397.26; Profit 44,136.99 over 35 days; Yield = 4.64% pa.]



1.4 Reference Interest Rates

- A reference interest rate is the rate used as a benchmark in interest rate related products, such as a floating-rate loan, an interest rate derivative contract, etc.
- They are interest rates on term loans, ranging from one day (O/N) to one year, in the interbank market. The interest rates are usually derived through a survey.
- The most common reference rate for USD is $-LIBOR (London Interbank Offered Rate).
- For THB, the most common reference rates are THBFIX (Thai Baht Fixed) and BIBOR (Bangkok Interbank Offered Rate).
- In retail markets in Thailand, MLR (Minimum Lending Rate) is also used.

1.4 Reference Interest Rates

- Since 2008, the volume of unsecured interbank loans, upon which the LIBOR (and BIBOR) is based, has dropped significantly.
- 2013 LIBOR scandal has caused significant lost on the credibility of LIBOR figures.
- Since then, the world financial market has been in the transition process for new reference interbank interest rates that are liquid and less prone to manipulation.
- For USD, the new reference rate is obtained from one-day repo rates. It reflects risk-free interest rates on USD.
- While LIBOR is survey based, the new reference rates are transaction based.

1.4 Reference Interest Rates

- The next slide shows reference interest rates from various markets and currencies.
- Since the transition from LIBOR, the most common rate for USD is SOFR (Secured Overnight Financing Rate).
- In Thailand, we also have been abandoning BIBOR and move toward the use of THOR (Thai Overnight Repurchase Rate)

New Reference Interest Rates of Selected Currencies

	LIBOR	SOFR	SONIA	SARON	ESTR	TONA	THOR
	London Interbank Offer Rate	Secured Overnight Financing Rate	Sterling Overnight Index Average	Swiss Average Overnight Rate	Euro Short Term Rate	Tokyo Overnight Average Rate	Thai Overnight Repurchase Rate
Currency	5 major currencies	USD	GBP	CHF	EUR	JPY	THB
Types	Unsecured interbank rate	Secured treasury repo rate	Unsecured wholesale rate	Secured interbank repo rate	Unsecured wholesale rate	Uncollateralized overnight call rate	Secured treasury repo rate
Collection Method	Survey-based	Transaction-based					
Tenor	O/N, 1 week, 1/2/3/6/12 months	O/N (Historical average of 1, 3 and 6-month periods are also reported)					

The interest rate on a Eurodollar loan:

Term SOFR + Bank's Credit Spread + Customer's Lending Margin

BoT announces this every day

THOR Average (announced daily by BOT)

July 25, 2023

Tenor	Day Counts	THOR Average
1 Month	32 days	1.99381
3 Months	91 days	1.89715
6 Months	181 days	1.73838

Unit: % pa.

SOFR Average (announced daily by The Fed)

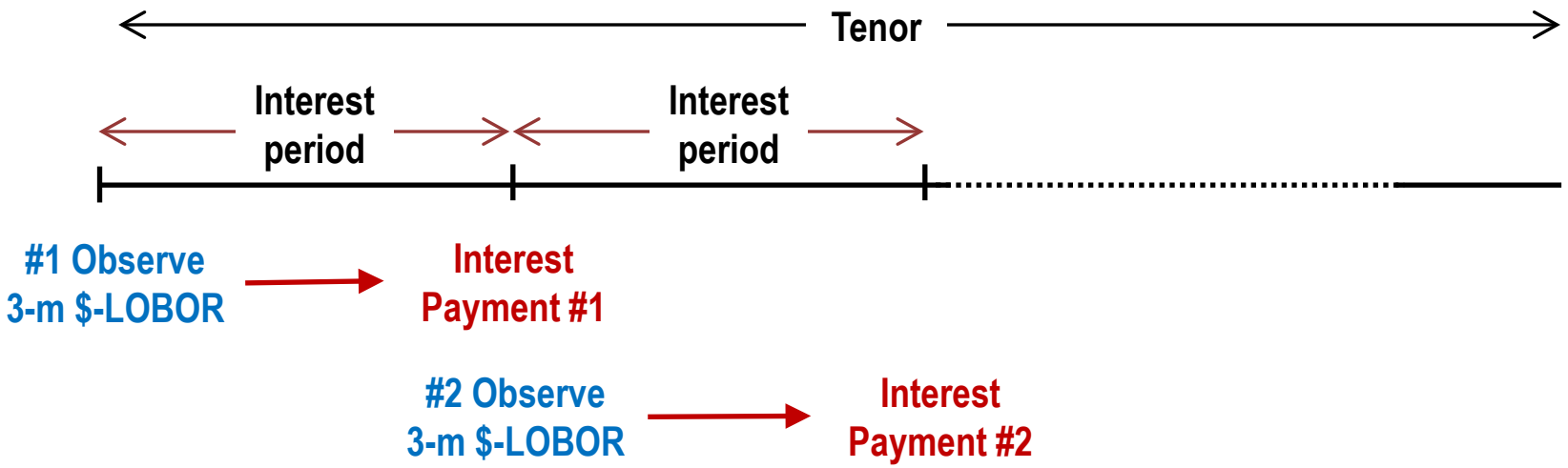
DATE	30-DAY AVERAGE (%)	90-DAY AVERAGE (%)	180-DAY AVERAGE (%)
07/24	5.06899	5.06295	4.88670
07/21	5.06901	5.05453	4.87391
07/20	5.06868	5.05159	4.86958
07/19	5.06868	5.04878	4.86531
07/18	5.06832	5.04585	4.86104
07/17	5.06794	5.04293	4.85672
07/14	5.06827	5.03451	4.84398
07/13	5.06794	5.03157	4.83965
07/12	5.06794	5.02876	4.83538
07/11	5.06760	5.02583	4.83105

Determining Setting and Settlement Times

Apart from determining the tenor and interest period, a floating rate loan agreement must specify when the interest rate is to be set and when the interest payment is to be settled.

For LIBOR related loans, the simple structure is to set the interest in advance (i.e., in advance structure) and settle the payment in arrears.

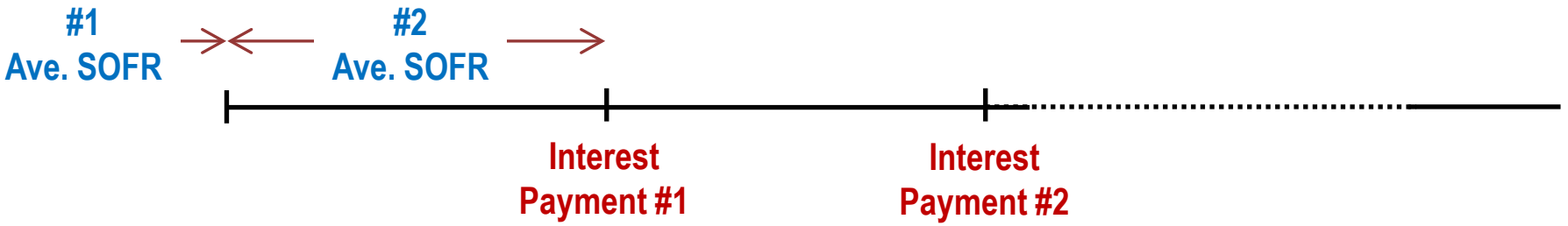
EX: A 2-year floating interest loan paying interest every 3 month at 3-month $-LIBOR. The loan has an in advance structure.



Determining Setting and Settlement Times

As SOFR is an overnight interest rate, when applying it to an interest period longer than 1 day, an average rate over the interest period will be used.

Case 1: The interest rate is set in advance (i.e., in advance structure) and settlement is in arrears.



Case 2: The interest rate is set in arrears (i.e., in arrears structure) and settlement is in arrears.