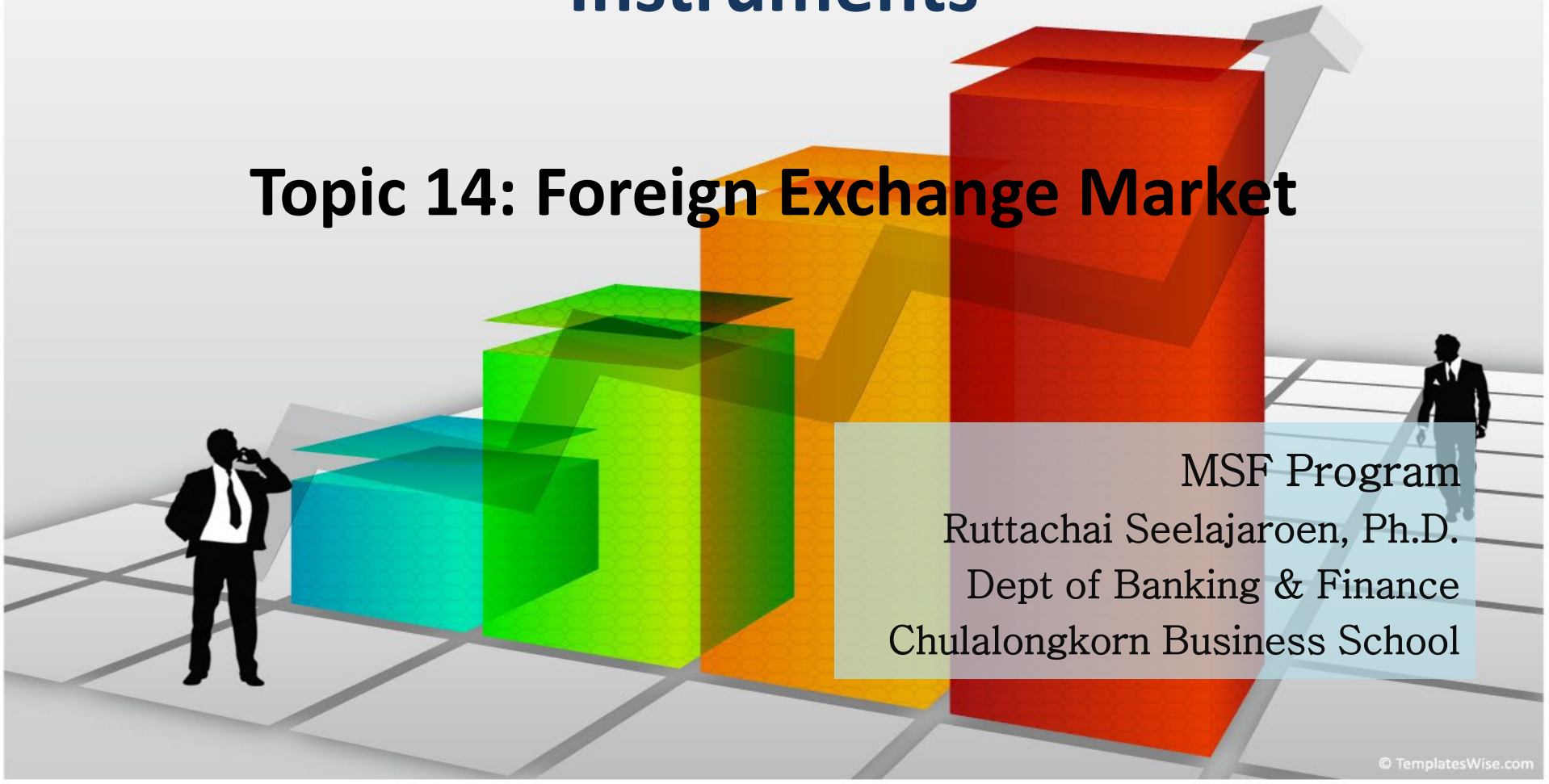
2604697
Financial Markets, Institutions and Instruments

Topic 14: Foreign Exchange Market



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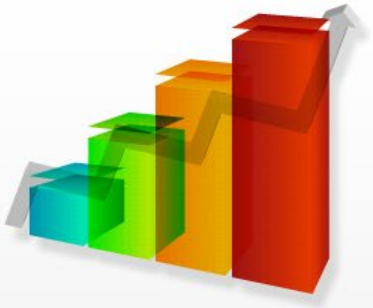


Overview

1. Foreign Exchange Market
2. FX Transactions

structure of mkt
how each transaction perform

1) FX spot
2) FX forward
3) FX swap ≠ interest rate swap
   ≠ currency swap (CCS)

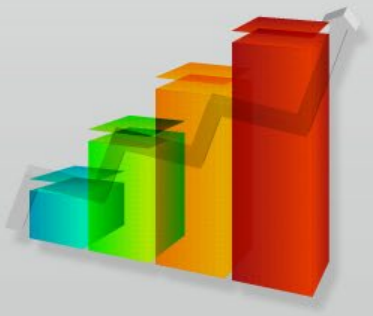
1. Foreign Exchange Market

1.1 Structure of the FX Market

1.2 Value Date

1.3 Types of Transactions

1.4 Market Statistics



*Importer, exporter, us ⇒ mkt user ← receive quotation

1.1 Structure of the FX Transactions

global

currency against currency

trade across mkt easily as long as fund can be transfered

- Foreign exchange (FX or Forex) market is the mechanism that allows money denominated in one currency to be bought/sold by/for money denominated in another currency.
- Foreign exchange dealers (normally commercial banks) are entities that make the market. That is, they stand ready to buy or sell foreign currencies with other market participants by quoting bid and ask exchange rates.

e.g. bank ⊢ stand ready to buy/sell currency

mkt maker → 賺 bid-ask spread

- It is an OTC market consisting of networks of FX dealers that facilitate currency exchange.
- The market is a two-tier markets consisting of the interbank and the retail markets.

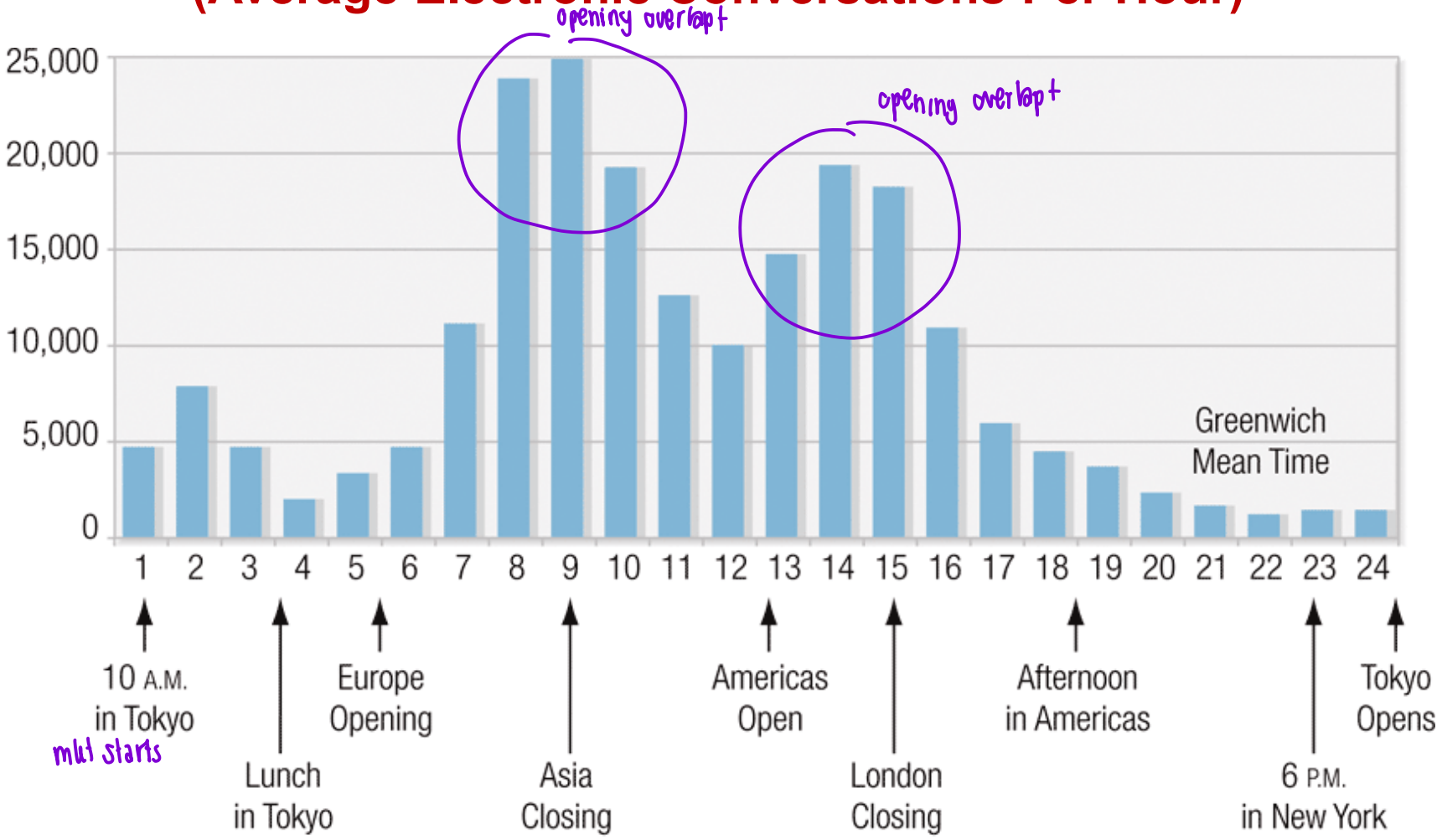
'bank & bank trade fc against each other

determine rate in retail mkt

open 24 hours in working day

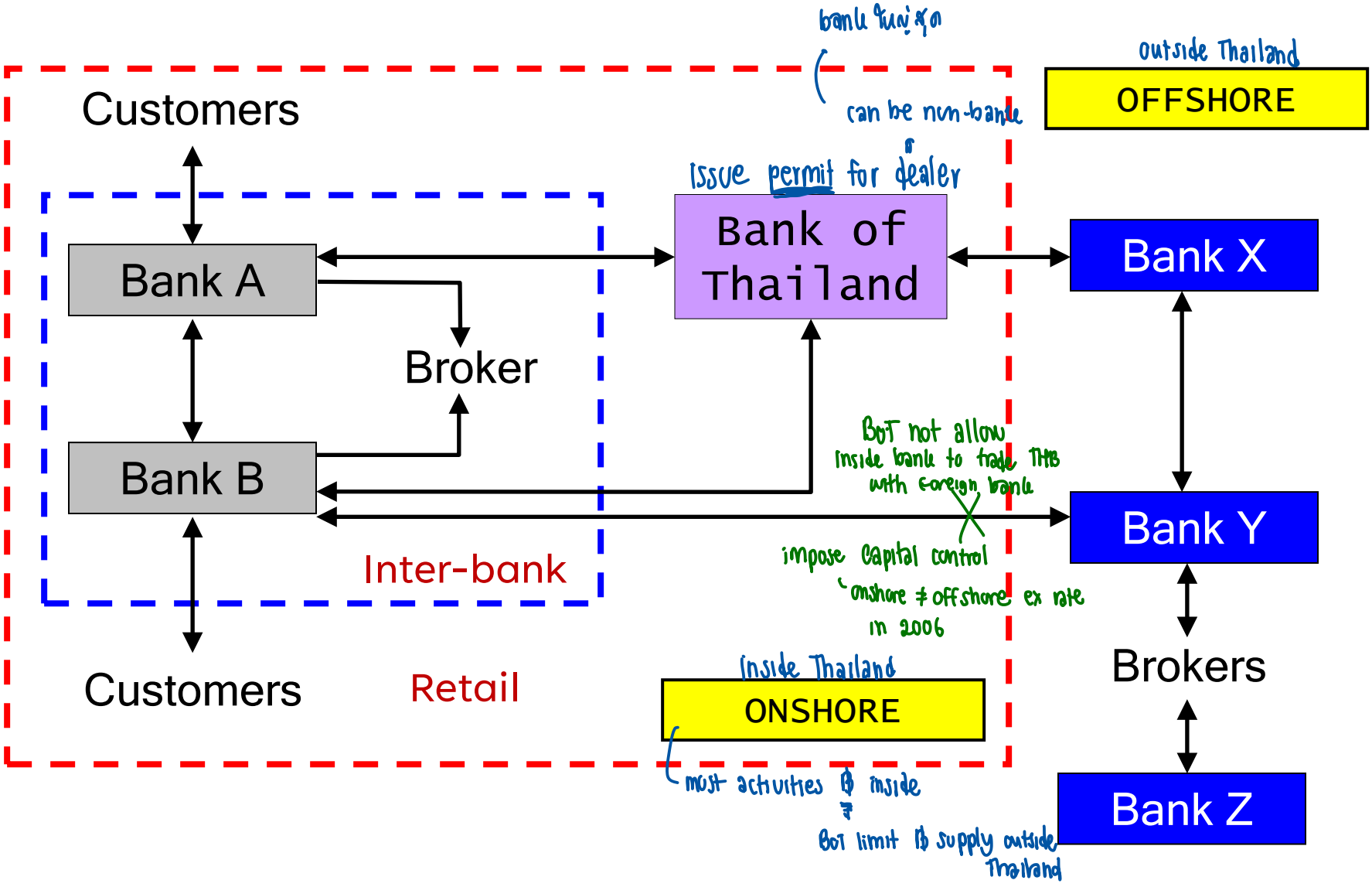
Dealers don't open position overnight
↓ square position

Foreign Exchange Market Activity (Average Electronic Conversations Per Hour)



Source: Federal Reserve Bank of New York, "The Foreign Exchange Market in the United States," 2001, http://www.ny.frb.org.

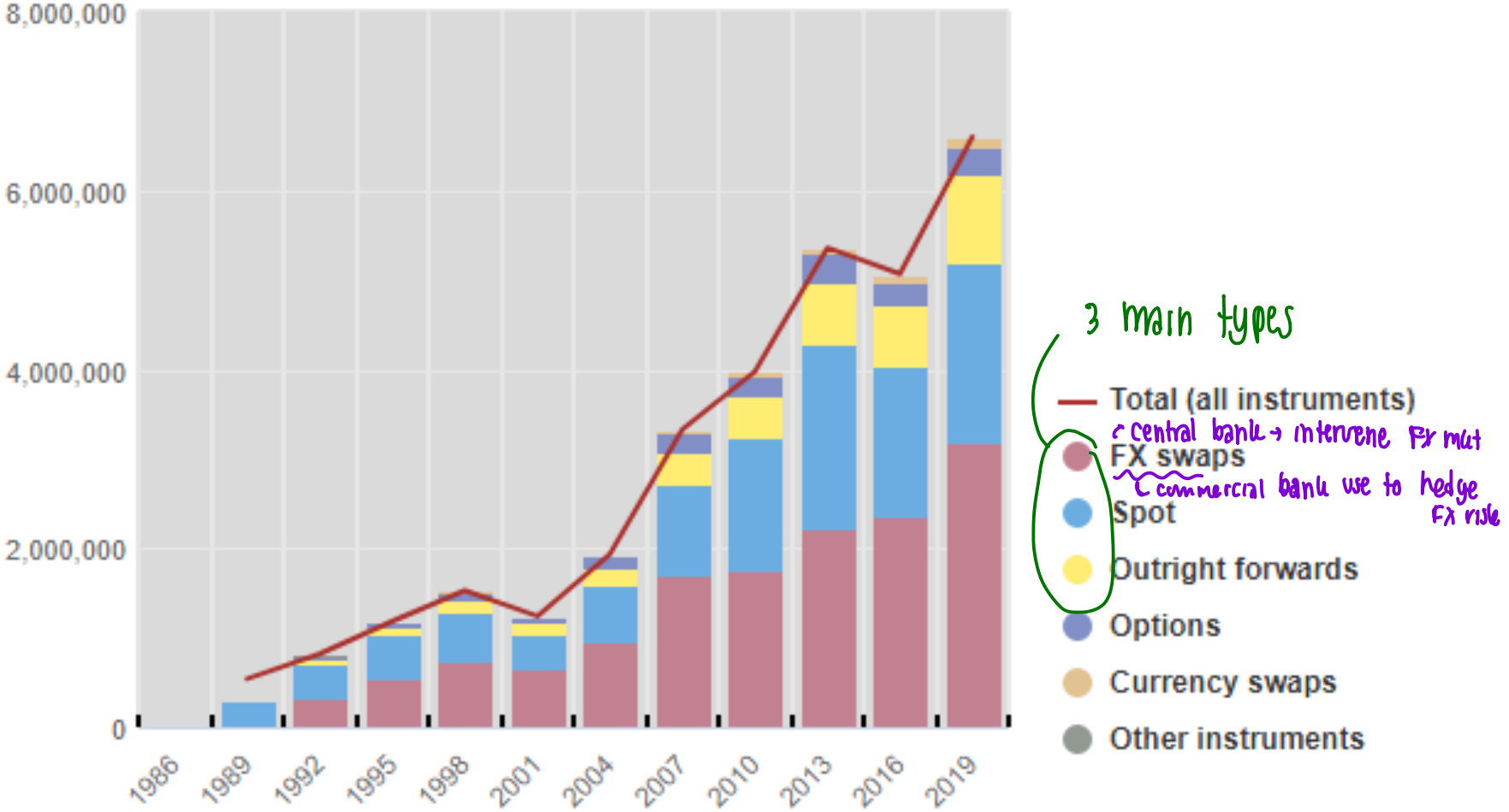
Thailand Foreign Exchange Market



1.1 Structure of the FX Transactions

- FX market is a truly international market, where traders can trade with other traders within and across countries.
- The interbank is the communication network among major banks who trade foreign currencies among each other.
- The interbank market makes up more than 90% of total trading volume in the FX market.

Global FX Turnover by Type of Instrument (daily averages, U$ mio)

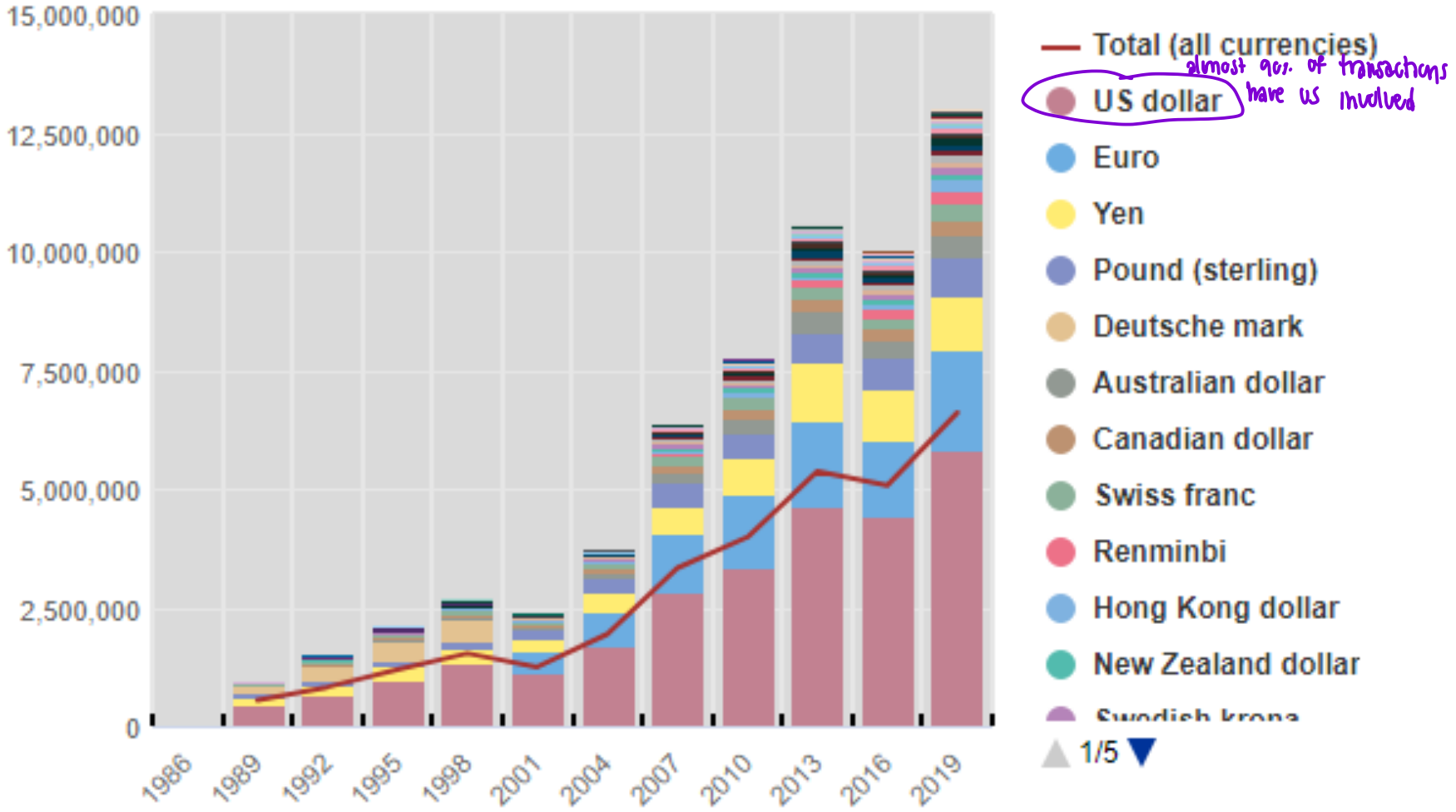


https://www.bis.org/statistics/rpfx19.htm

double count

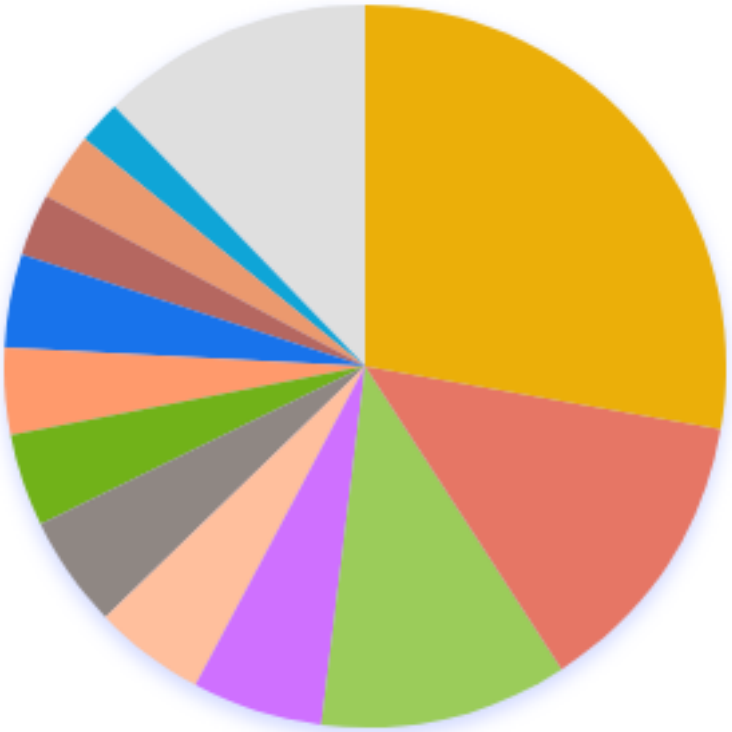
2 currencies at a time

Global FX Turnover by Currency (daily averages, U$ mio)



https://www.bis.org/statistics/rpfx19.htm

Global FX Turnover by Currency Pair, 2019



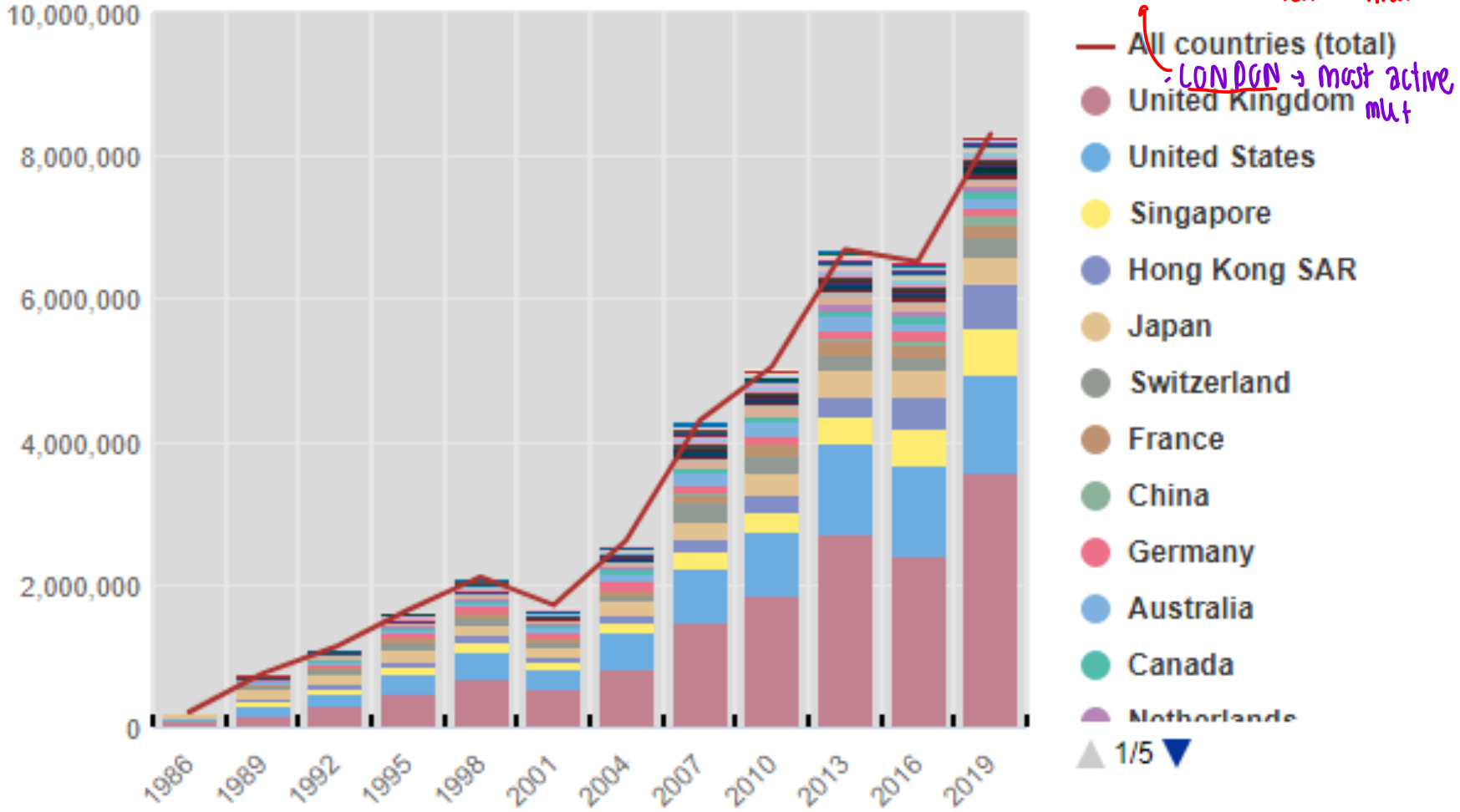
28% EUR/USD
13% USD/JPY
11% GBP/USD
6% AUD/USD
5% USD/CAD
5% USD/CHF
4% NZD/USD

always have USD

4% EUR/JPY
4% GBP/JPY
3% EUR/GBP
3% AUD/JPY
2% EUR/AUD
12% OTHER

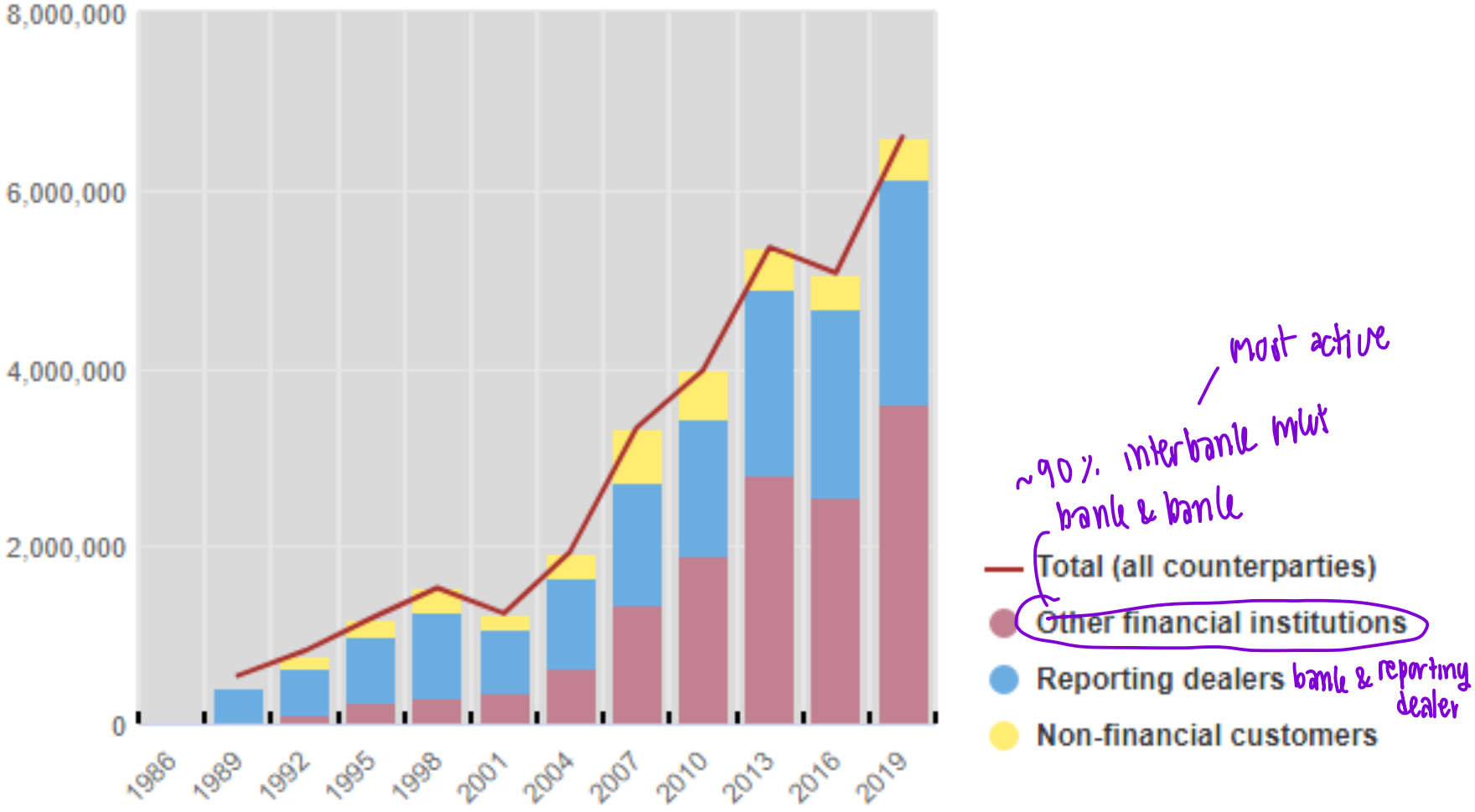
https://tradersunion.com/interesting-articles/best-forex-currency-pairs/

Global FX Turnover by Country (daily averages, U$ mio)



https://www.bis.org/statistics/rpfx19.htm

Global FX Turnover by Counterparty Sector (daily averages, U$ mio)



https://www.bis.org/statistics/rpfx19.htm

1.2 Types of FX Transaction

business use this

1. Spot Transactions

spot exchange rate

most participants use as reference exchange rate

- Currencies are traded for immediate delivery (the settlement occurs on the 2nd business day).

T+2

Obligation

obligation

- EX: On Mon, 12/Jun/04, Citibank sold $5 m. to Bangkok bank at the spot rate of B40/$.

spot exchange rate

  - No cash flows on the trade date Mon 12/Jun/04.
  - On Wed, 14/Jun/04, Citibank will deliver $5 m. to Bangkok bank's account and receive B200 m. from Bangkok bank

T+2 value date

pay

- Earlier deliveries (Today and Tomorrow) are available at slightly different rates.

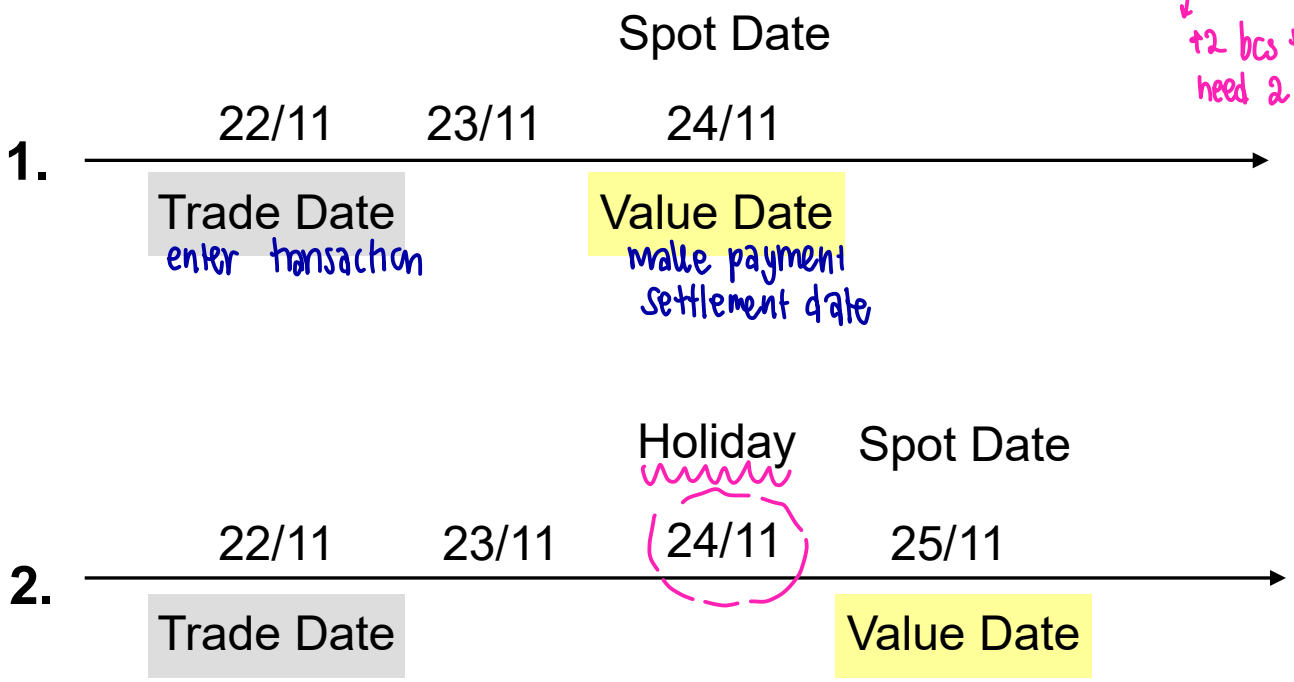
tourist use this

▷ Same-day delivery ; today exchange rate < Counter exchange rate >

▷ Tomorrow delivery : TOM

Delivery Date for Spot Transactions (T+2)

trade date
value date
+2 bcs there're 2 currencies need 2 days to settle



* The trade date is also called “deal date”.

* The value date is also called “settlement date”

1 day after spot date
1-day forward

1.2 Types of FX Transaction

Trade date : Mon 13 Nov → Wed 15 Nov Spot (T+1)

2. Forward Transactions

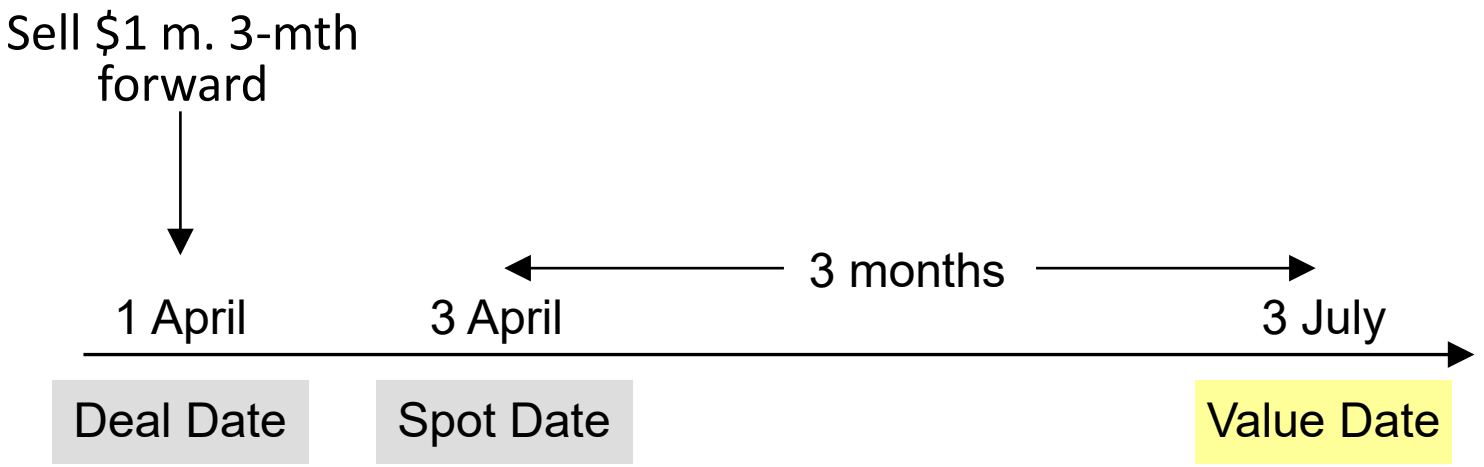
- Currencies are traded today (t_0) for delivery on a pre-specified future date (t_T), at an agreed upon amount of FC, delivery date and the forward exchange rate (F_0).

↑ spot date : 3 Apr ⇒ settle 3-month from spot date

- EX: On 1/Apl/04, ABC sell $5 m. 3-mth forward at the forward exchange rate (F0) of B38/$.

Transaction by ABC	Cash Flows	
	t_0 (3/4/04)	t_{3M} (3/7/04)
On 1/4/04, sell $5m. 3-month forward at F_0 = B38/$	–	+B190 m. –$5 m.

Delivery Date for Forward Transactions



The delivery date of a forward transaction is referenced with the spot date.

Spot
Forward

1.2 Types of FX Transaction

bundle two transactions into 1 contract
- settle contract 2 times
two legs transaction

3. Foreign Exchange Swap (FX Swap) Transactions

counterparty agree to buy | sell FC

- An FX swap transaction is the simultaneous purchase and sell (or sell and purchase) of a given amount of a foreign currency for two different value dates
- Both legs of the transaction are conducted with the same counterpart.
- Note that FX swap is different from currency swap. In FX swap, cash flows only occur at two different dates, one for each leg. There are no other cash flows during the life of the contract.

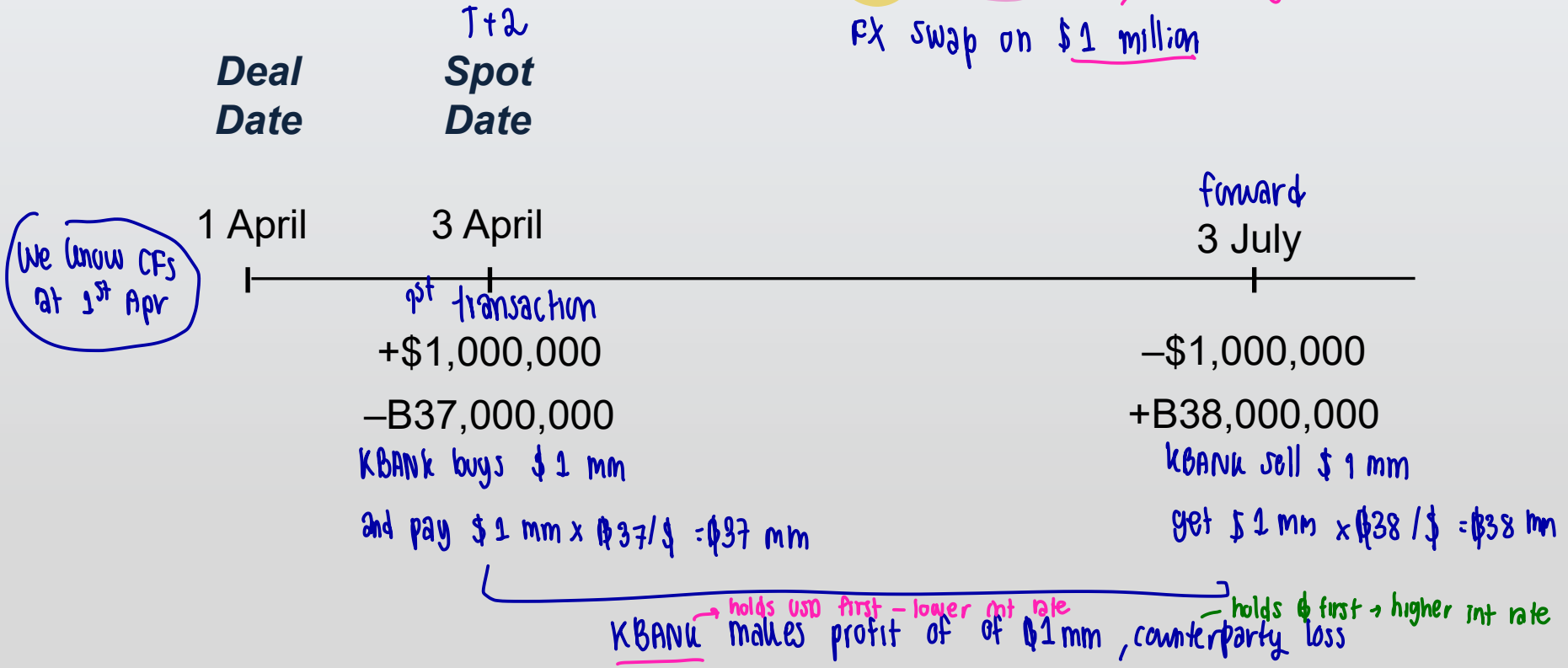
counterparty sell spot & buy forward

1.2 Types of FX Transaction

KBank buy spot & sell forward — first transaction — 2nd transaction

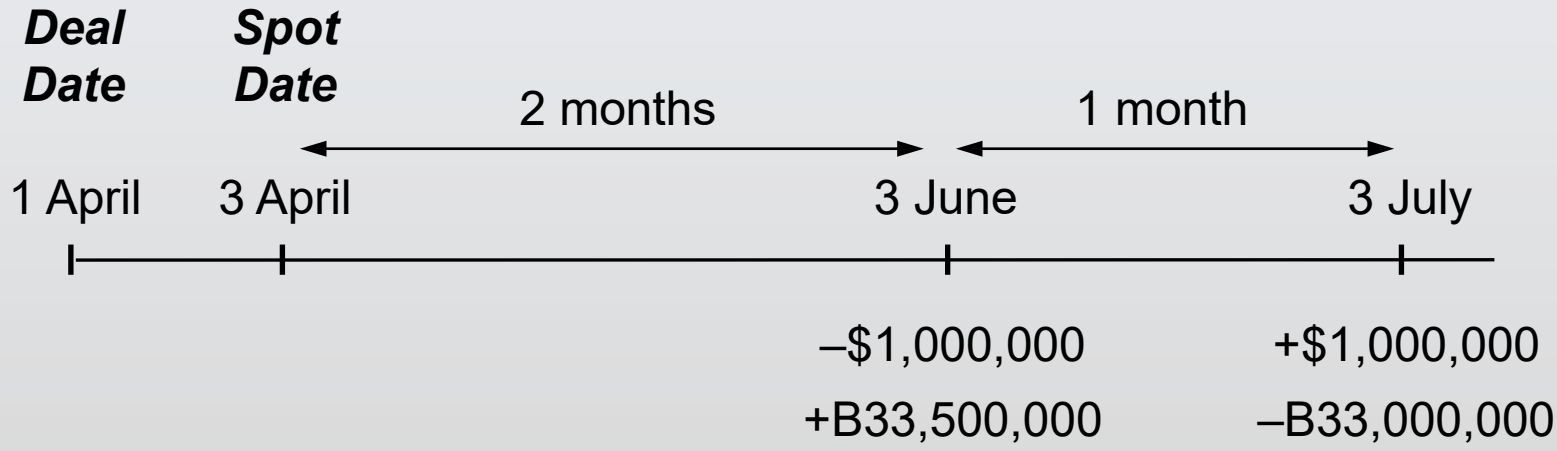
- EX: On 1/4/04, K-Bank enters a buy/sell Spot/3month FX swap on $1 m. The spot rate is B37/$ and 3-month forward rate is B38/$.

a 1st spot / 2nd 3 month FX swap on $1 million — underlying asset



1.2 Types of FX Transaction

- EX: On 1/4/04, a firm enters sell/buy 2mth/3mth FX swap on $1 m. The 2-mth forward rate is B33.50/$ and 3-mth forward rate is B33/$



USD/THB= (Interbank)
As of 22nd March 2013

	BID	ASK
Today	29.243	29.294
Tomorrow	29.200	29.300
Spot	**29.25**	**29.30**
1 Week	29.287	29.347
1 Month	29.287	29.347
2 Month	29.338	29.398
3 Month	29.368	29.428
6 Month	29.500	29.570
9 Month	29.600	29.680
1 Year	29.700	29.800
2 Year	30.550	30.700

forward exchange rate

USD/AEC= Spot Rate
As of 22nd March 2013

	BID	ASK
BND	1.248	1.2483
IDR	9740.00	9745.00
LAK	7809.00	7887.00
KHR	3982.00	3984.00
PHP	40.84	40.94
VND	20920.00	20960.00
THB	29.25	29.30
SGD	1.2482	1.2485
MYR	3.111	3.114
MMK	882.00	889.00

fixed based on $GD

almost exactly same

kyat

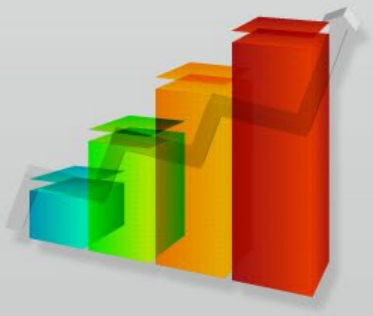
2. Market Conventions

2.1 Quotations

2.2 Bid-Ask Spread

2.3 Cross Exchange Rate

2.4 Triangular Arbitrage



commodity ← being price by quotation

฿ 34.65 / $

term, unit of account

2.1 Quotations

- An exchange rate is relative price between two currencies.
- One currency is used as a "commodity" or "base" currency, while the other is used as a "term" of "quote" currency.
- The commodity currency is the one being priced, while the term currency is the one used as the unit of account.
- If one US dollar is worth 34.65 Thai baht (i.e., B34.65/$), the exchange rate for the USD is conventionally written as;

what you want to buy/sell first

mention commodity first

not ratio, to just seperate

USD/THB=34.65 or **USD/THB: 34.65**

being price

Base Currency (BC)

unit of account

Term Currency (TC)

2.1 Quotations

- For Non-Bank Customers in a Domestic Market
  - Direct Quote: HC-price of one unit of FC
    - Direct quotation for USD in TH: B41.100/$
    - Direct quote for THB in MY: MYR0.13/B
  - Indirect Quote: FC-price of one unit of HC
    - Indirect quotation for USD in TH: $0.0243/B
    - Indirect quote for THB in AU: B25.02/A$
  - Banks in most countries use direct quotation for domestic transactions, exceptions for banks in Great Britain, Australia, New Zealand, Eurozone.

2.1 Quotations

- For Inter-Bank USD Trades
  - American Terms: USD-price of one unit of FC
    - The American terms for EUR: $1.2156/€
    - The American term for GBP: $1.2366/£
  - European Terms: FC-price of one of units USD
    - The European terms for EUR: €0.8227/$
    - The European term for THB: B34.18/$
  - Inter-bank trade involving USD are conventionally given in European terms except when trades involve the EUR, GBP, AUD and NZD American terms are used.

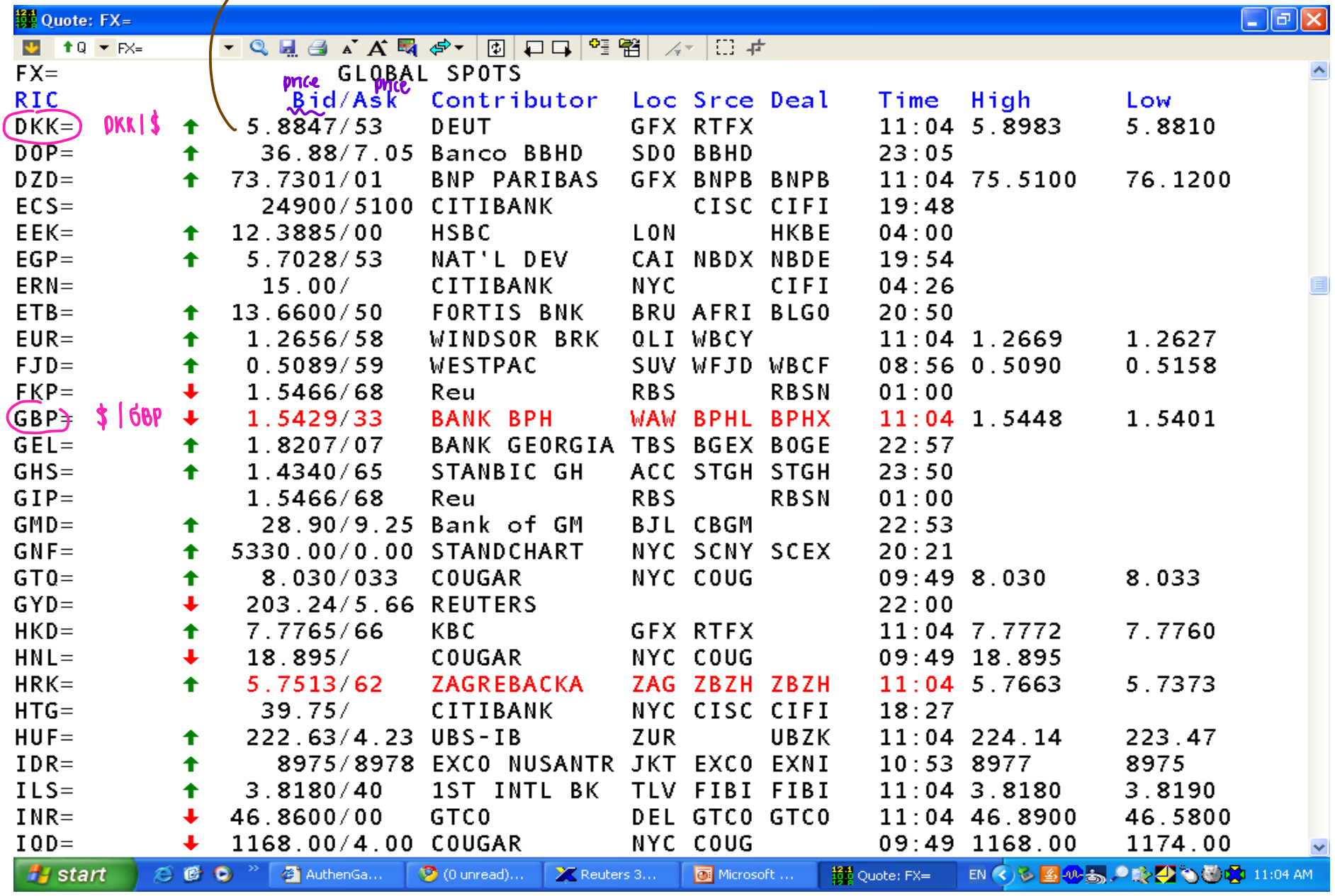
Exchange Rates

American term European term

Country	Symbol	US$ Equivalent	Currency per US$
Australia (Dollar)	AUD	.7687	1.3010
Denmark (Krone)	DKK	.1632	6.1270
Japan (Yen)	JPY	.009149	109.30
1-month Forward		.009174	109.00
3-months Forward		.009230	108.35
6-months forward		.009316	107.34
Malaysia (Ringgit)	MYR	.2632	3.8000
U.K. (Pound)	GBP	1.8277	.5472
Switzerland (Franc)	CHF	.7880	1.2691
Euro	EUR	1.2156	.8227

¥/$

Interbank Market Quotation



2.2 Bid-Ask Spread

- FX dealers quote an exchange rate they are willing to trade (buy and sell) in pairs of bid and ask prices.

  - Bid price is the price at which the quoting bank is willing to buy the foreign currency (or base currency).
  - Ask or Offer price is the price at which the quoting bank is willing to sell the foreign currency (or base currency).

* The party that quotes the price = Market maker
* The party that receives the price = Market user

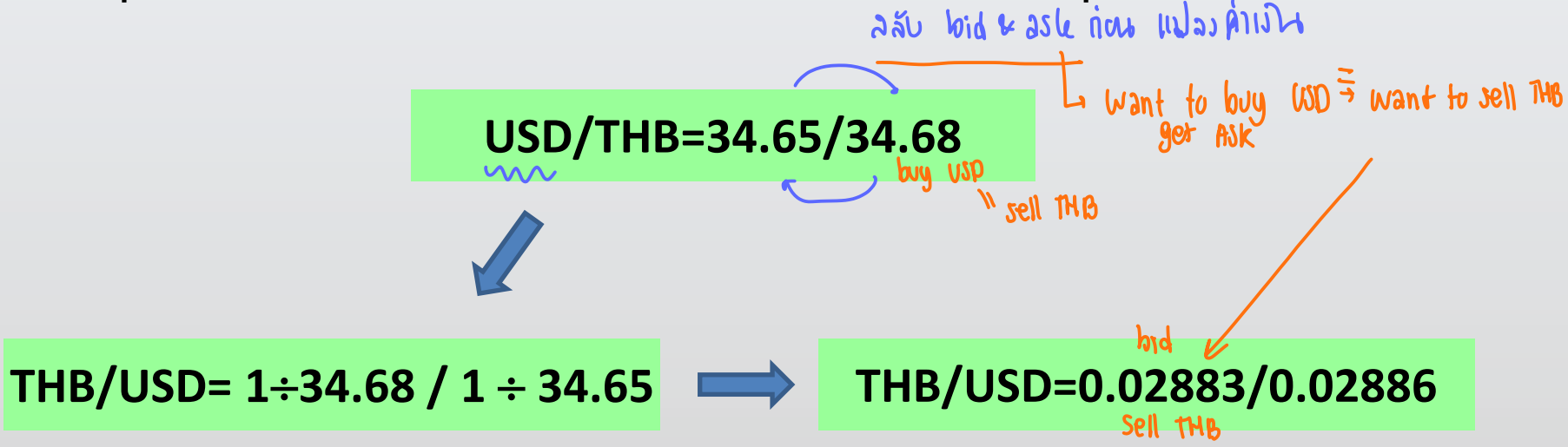
2.2 Bid-Ask Spread

- In FX quotation, bid price always comes before ask price.
- In the inter-bank market, dealers usually quote the last two digits for ask price.
  - EUR/USD = 1.1081–85
    - Bid price: $1.1081/€
    - Ask price: $1.1085/€
  - USD/THB = 41.14–19
    - Bid price: ฟ41.14/$
    - Ask price: ฟ41.19/$

https://capital.com/trade-forex

2.2 Bid-Ask Spread

- To convert between term and base currencies, we simply take the reciprocal of the exchange rate. However, the reciprocal of the ask become the new bid rate and reciprocal of the bid becomes the new ask price



2.2 Bid-Ask Spread

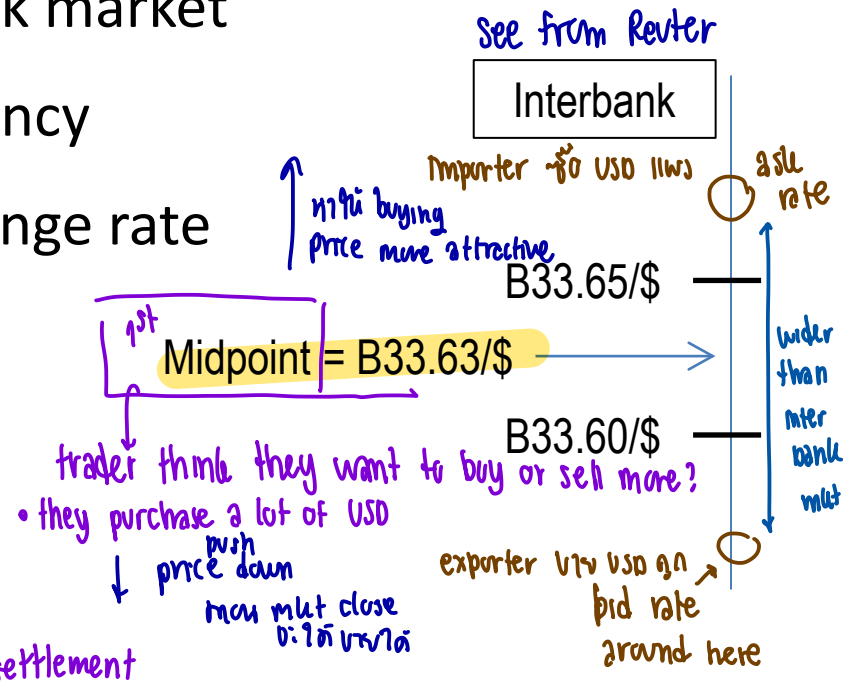
- A bank trader quotes the following exchange rate to his customer, USD/THB=33.46-55. → 33.46 - 33.55 ฿/$
  - If the customer wants to buy $1 m., how many THB will he pay? importer → ask
    $1 mm x ฿33.55/$ = ฿33.55 mm
  - If the customer wants to sell $0.75 m., how many THB will he receive? exporter → bid
    $0.75 m x ฿33.46/$
  - If the customer wants to sell ฿40 m., how many USD will he receive? need to divide = same as buy USD commodity

$$\frac{฿40\text{m}}{฿33.55/\$}$$

want to give less USD

How Do FX Dealers Obtain Quotations for Retail Customers?

1. Determine the midrate:
   - Current midrate in the inter-bank market
   - The bank's position on the currency
   - The bank's view on future exchange rate
2. Add bid-ask spread:
   - Bid-Ask Spread in the interbank
   - Liquidity risk
   - Exchange rate risk
   - Customer's spread (default risk)



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2.3 Cross Exchange Rate

- Cross exchange rates, or simply cross rates, are exchange rates between two non-USD currencies.
- EX: Suppose Pound Sterling, Yen and Baht are quoted at

  GBP/USD=1.2156

  USD/JPY=122.40

  USD/THB=41.45

  - What are the direct quotes for the Pound and Yen in TH?

$$\frac{฿}{¥} = \frac{฿}{\$} \Big/ \frac{¥}{\$}$$

$$\frac{฿}{£} = \frac{฿}{\$} \times \frac{\$}{£}$$

bank → keep stock of FC
& cannot afford to keep all currencies
↓
keep $
↳ use to buy other FC

e.g. ฿ —buy→ $ —buy→ MYR

Bank quote non-USD vs. THB
↓
cross exchange rate
go through exchange rate of
THB/USD & other FC/USD

2.3 Cross Exchange Rate

- EX: Suppose Pound Sterling, Yen and Baht are quoted at

  GBP/USD=1.2156-66

  USD/JPY=122.40-60

  USD/THB=41.45-55

  - What are the direct quotes for the Pound and Yen in TH?

Example: Cross Rate Calculation

A customer wants to sell JPY/THB or Bank buys JPY/THB (Bid rate)

A customer wants to buy JPY/THB or Bank sells JPY/THB (Ask rate)

2.3 Cross Exchange Rate

- Calculating JPY/THB= cross rate:
  - Bid rate for JPY/THB (dealer buys JPY against THB)
    - Sell JPY1 and buy USD at ¥112.50 receive $1/112.50
    - Sell USD and buy THB at B41.45 receive B41.45/112.50 = 0.3684
  - Ask rate for JPY/THB (dealer sells JPY against THB)
    - Buy JPY1 and sell USD at ¥112.40 cost $1/112.40
    - Buy USD and sell THB at B41.50 cost B41.50/112.40 = 0.3692

Shortcut

- To cross rate between THB and a currency with European terms: Divide bid with ask to get bid price for the cross rate, and vice versa.

  Spot: B41.45–41.55/$

  Spot: ¥112.40–112.60/$

  - B/¥ bid rate: 41.45×(1/112.60) = B0.3681/¥
  - B/¥ ask rate: 41.55×(1/112.40) = B0.3697/¥

  Spot: B0.3681–97/¥

Shortcut

- To cross rate between THB and a currency with American terms: Multiply bid with bid and ask with ask.

  Spot: B41.45–41.55/$

  Spot: $1.2156–1.2166/€

  - B/€ bid rate: 41.45×1.2156 = B50.3866/€
  - B/€ ask rate: 41.55×1.2166 = B50.5497/€

  Spot: B50.3866–5497/€.

Exercise: Cross Exchange Rates

- Given the following rates, what is the MYR/THB rate?

  USD/THB=35.024-044

  USD/MYR=4.4542-65

- Given the following rates, what is the AUD/THB rate?

  USD/THB=35.024-054

  AUD/USD=0.7596-04

- Given the following rates, what is the EUR/AUD rate?

  EUR/USD=0.9678-83

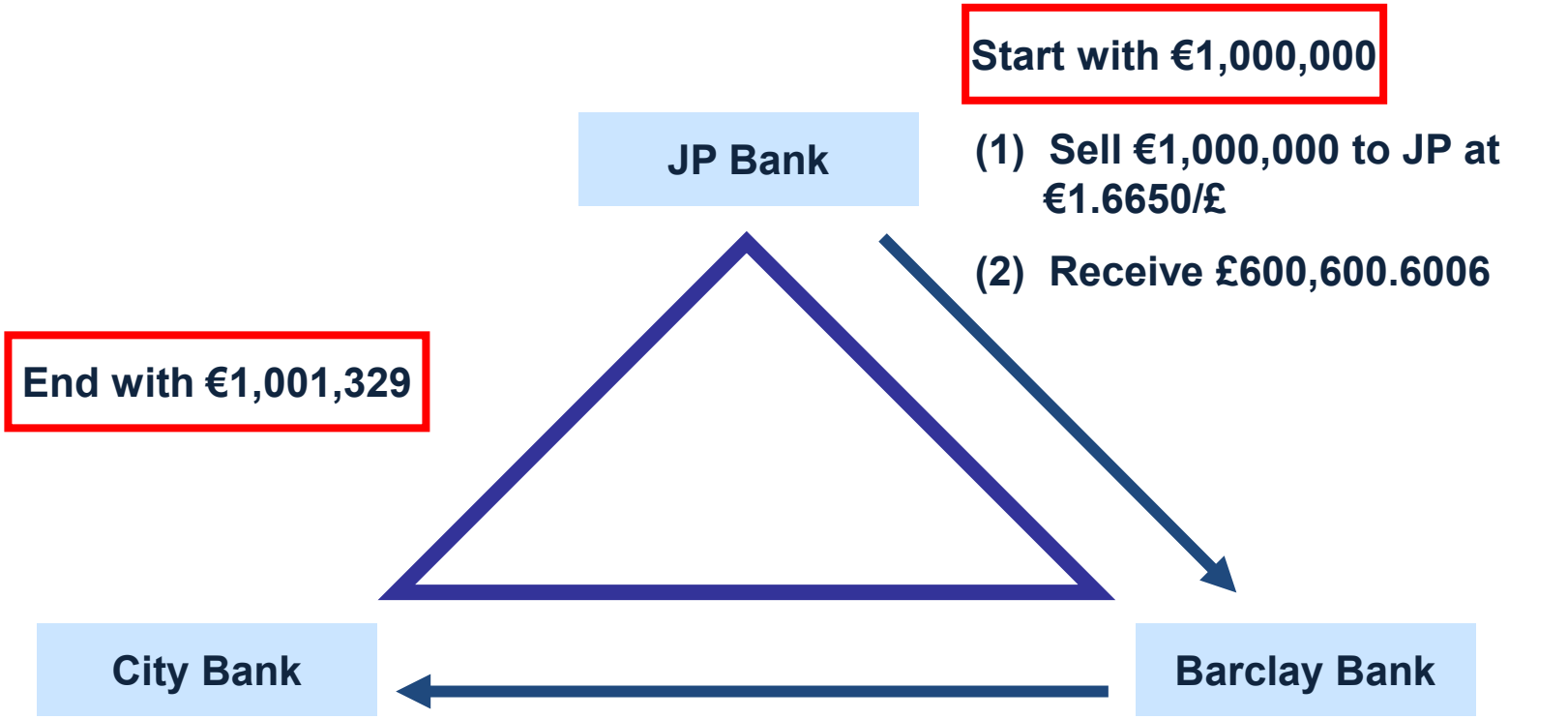
  AUD/USD=0.5438-43

2.3 Cross Exchange Rate

- When cross rates differ from one financial center to another, arbitrage profit opportunities exist.
- EX: (Triangular Arbitrage) Suppose the pound is bid at $1.5422 by Barclay and the euro is offered at $0.9251 by City Bank. At the same time the pound is offered at €1.6650 by JP. Is there an arbitrage opportunity?
- The cross rate between Barclay and City

$$\$1.5422/£ \div \$0.9251/€ = €1.6671/£$$

Triangular Arbitrage



2.3 Cross Exchange Rate

- EX: Suppose three banks quote the following spot rates.

  Barclay: GBP/USD= 1.2365/1.2375

  Citibank: EUR/USD= 1.0552/1.0563

  JP Bank: EUR/GBP= 0.8510/0.8518

  - Is there a triangular arbitrage opportunity? If yes, how to implement the arbitrage?
  - Cross GBP/USD and EUR/USD to get implied EUR/GBP
  - Bid EUR/GBP = 1.0552 ÷1.2375 = 0.8527
  - Ask EUR/GBP = 1.0563÷1.2365 = 0.8543

2.3 Cross Exchange Rate

- Hence, JP Bank quotes the selling price for EUR in terms of GBP relatively too cheap, while the rate across the other two banks are relatively too expensive.
- To arbitrage, “buy low and sell high” simultaneously.
- Assumed start with £1
  - Use £1 to buy EUR from JP Bank receive €1/0.8518
  - Sell EUR for USD with Citibank receive $1.0552×(1/0.8518)
  - Use USD to buy GBP with Barclay receive £1.0552×(1/0.8518)/1.2375 = £1.0008
- There is £800 arbitrage profit for each £1 mio.

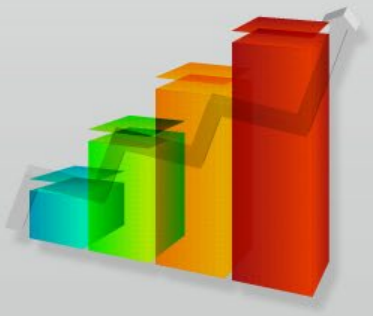
3. Foreign Exchange Transactions

3.1 FX Spot

3.2 FX Forward

3.3 FX Swap

3.6 Bank Risk



3.1 FX Spot

- FX Spot or spot transaction is the contract to trade a given amount of foreign currency for an immediate delivery (the settlement occurs on the 2nd business day).
- EX: On Monday, 12/Jun/04, Citibank sold $5 m. to Bangkok bank at the spot rate of B40/$.
  - On Wednesday, 14/Jun/04, Citibank will deliver $5 m. to Bangkok bank's account and in return the bank will receive B200 m. from Bangkok bank
- Earlier deliveries (Today and Tomorrow) are available at slightly different rates.

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Exercise: FX Spot

1. The SGD/NOK exchange rate is quoted as 2.9584. Does this exchange rate express the number of Norwegian kroner equal to 1 Singapore dollar, or the number of Singapore dollars equal to one Norwegian krone?
2. You wish to sell US dollars against sterling and are given the following quotes from two banks. At what price will you deal?

   First Bank: 1.4356/61
   Second Bank: 1.4358/63
3. If the spot AUD/USD exchange rate is quoted as 0.5413, what is the value of 1 'point' on a deal of 1 million of the base currency?
4. You are a dealer with a short position in US dollars against euros. A counterparty calls you for a price in EUR/USD. The market is currently 0.9503/08. Which of the following prices might you quote if you now wish to reduce the size of your position?
   - 0.9502/07 or 0.9503/08 or 0.9504/09

3.2 FX Forward

- FX Forward is the contract to trade a given amount of foreign currency at a pre-specified exchange rate at a specific time in the future, where all conditions of the trade are agreed today, including the forward exchange rate.
- Ex: On 3rd April, Krungsri quotes 3-mth forward rate: USD/THB=33.45-33.60. ABC Ltd. sells $4 mio value 3-months forward to the bank.

Transaction Date	Cash Flows to ABC	
	t_0 (5 April)	t_T (5 July)
3rd April, ABC sells $5m. 3-month forward at F_0 of USD/THB=33.45	–	+B133.80 mio –$4 mio

Forward Rate Quotation

- Forward rate quoted today may be higher, lower or equal to the current spot rate.
- FX forward rates are quoted either as
  - Outright forward quotation, or
  - Swap point quotation

$F_0 - S_0$ = "swap point" (diff btw int rate of two currencies)

- Swap point is the difference between forward and spot rate.

spot exchange rate + adjustment

$$F_0 = S_0 + \text{Swap Point}$$

- Note that if "swap point > 0 (< 0)", the forward rate is at premium (discount).

Exercise: Forward Rate Quotation

- **Ex:** The following table shows swap point quotation for USD/THB= exchange rate. forward premium

Tenor	USD/THB=
Spot	34.50-34.70
1 month	0.10/0.15
3 month	0.18/0.25
6 month	0.30/0.40

swap point

add first

USD/THB=
34.50-34.70
34.60-34.85
34.68-34.95
34.80-35.10

- **Ex:** The following table shows swap point quotation for USD/THB= exchange rate. forward discount

Tenor	USD/THB=
Spot	34.50-34.70
1 month	–0.10/–0.05
3 month	–0.20/–0.10
6 month	–0.35/–0.22

USD/THB=
34.50-34.70
34.40-34.65
34.30-34.60
34.15-34.48

Uses of FX Forward (Bank's Customers)

Risk is to buy $

- EX: On 1st Jan, XYZ Ltd. imports a truck from the US and must make the payment of $1 m. in 3 months' time. Krungsri bank currently quotes the following exchange rate:

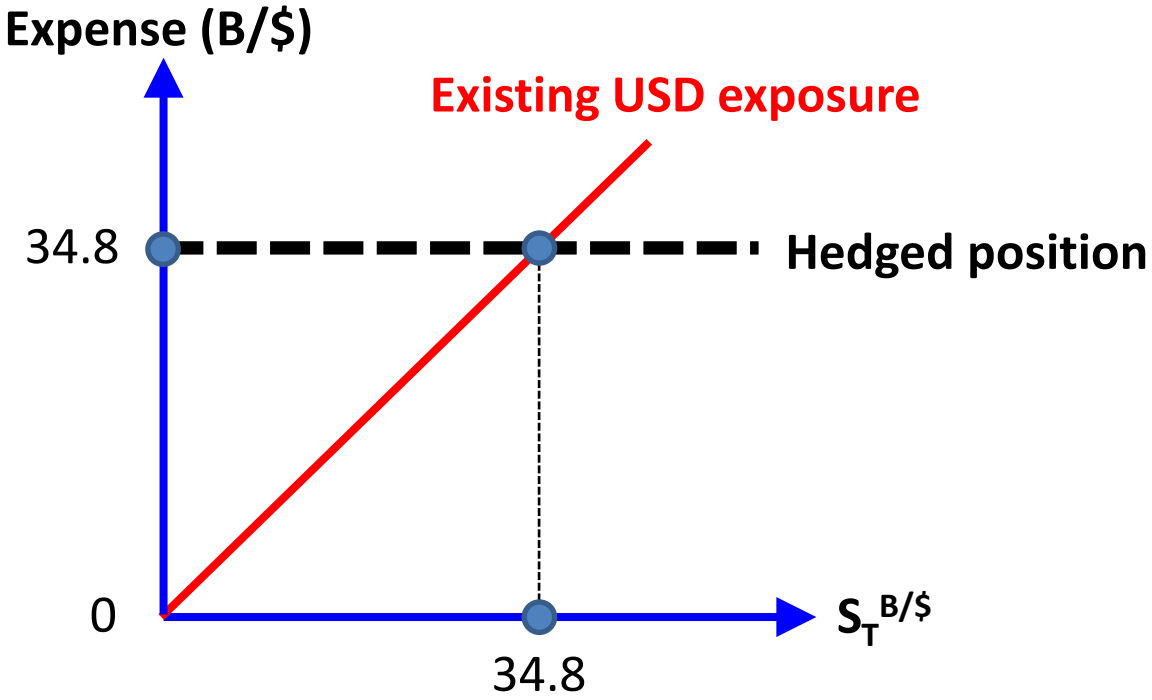
Spot rate: USD/THB:	34.00/34.25
3-month swap point:	0.50/0.55

  - What is XYZ exposure to FX risk?
  - How could XYZ use FX forward to hedge the risk and what could be the hedging outcome?
  - What is the opportunity cost of hedging with FX Forward?

FX Forward for Importers

Opportunity cost of hedging
↳ if USD depreciate → importer will not get benefit (option is better)

	Transaction	Cash Flows	
		3 Jan	3 April
1 Jan	Import a truck		–$1
1 Jan	Buy USD 3 month forward at B34.80/$		+$1 –B34.8
			–B34.8 million



Uses of FX Forward (Bank's Customers)

- EX: On 1st Jan, ABC Ltd. exports rice to the US and will receive $1 m. in 3 months' time. Krungsri bank currently quotes the following exchange rate:

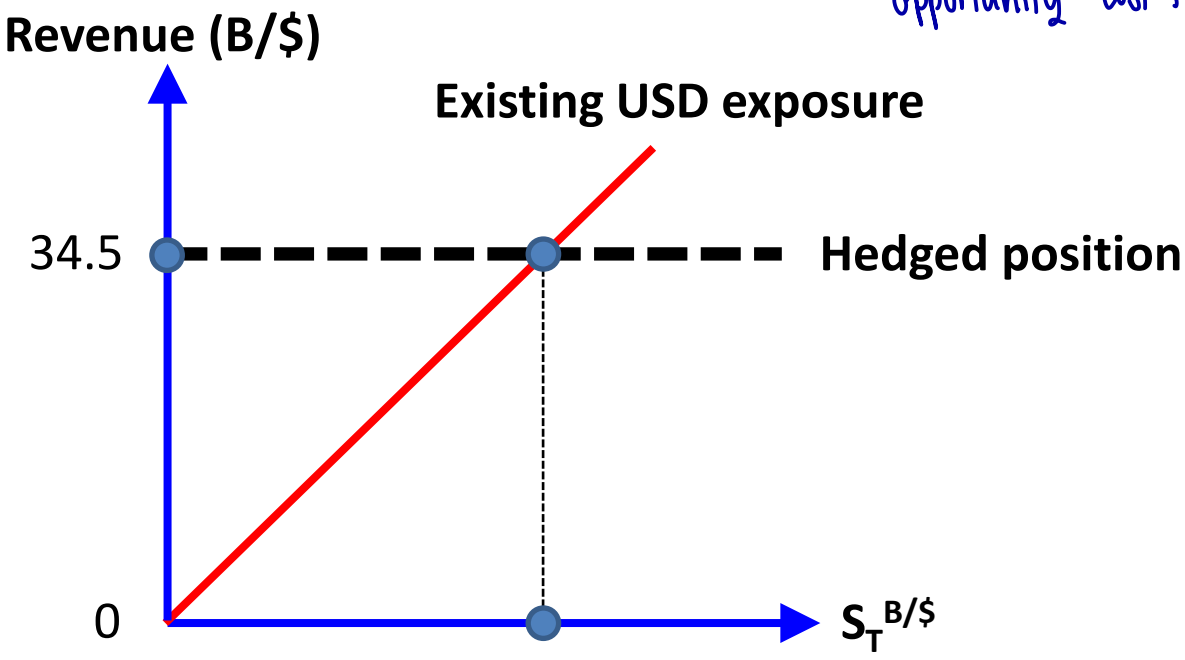
Spot rate: USD/THB:	34.00/34.25
3-month swap point:	0.50/0.55

  - What is ABC exposure to FX risk?
  - How could ABC use FX forward to hedge the risk and what could be the hedging outcome?
  - What is the opportunity cost of hedging with FX Forward?

FX Forward for Exporters

	Transaction	Cash Flows	
		3 Jan	3 April
1 Jan	Export rice ($ AR)		+$1 (deliver)
1 Jan	Sell USD 3 month forward at B34.50/$		–$1
			+B34.5 (fixed regardless exchange rate in future)
			+B34.5 million

opportunity cost → USD might appreciate



How is Forward Rate Calculated?

- The main objective of a bank in FX dealing services is to make profit from bid-ask spread, rather than speculation on future spot rate.
- The forward rate should reflect the cost of hedging exchange rate risk of a forward position.
- When selling (buying) USD/THB= forward, the dealer face the risk that USD may appreciate beyond (depreciate below) the forward rate determined today.
- EX: An importer and an exporter contact the bank to quote T-day forward rate on USD. Exchange rate is quoted as number of THB per USD.

IRP

$$F^{HC/FC}_{0,Bid} = S^{HC/FC}_{0,Bid} \times \frac{1 + i_{HC,Bid}}{1 + i_{FC,Ask}}$$

i_{Bid} = deposit rate

i_{Ask} = borrowing rate

$$F^{HC/FC}_{0,Ask} = S^{HC/FC}_{0,Ask} \times \frac{1 + i_{HC,Ask}}{1 + i_{FC,Bid}}$$

Bid Forward Rate (Bank's View)

Transactions		Settlement	
		Spot Date	Delivery Date
t=0	Buy USD 3-Month Forward ($F_{0,bid}$)		+\$1 $-BF_0$
t=0	Borrow USD equal to PV of \$1 at r_{US}	$+\$1/(1+r_{US})$	–\$1
	Sell USD for THB at spot rate	$-\$1/(1+r_{US})$ $+BS_0/(1+r_{US})$	
	Deposit THB at r_{TH}	$-BS_0/(1+r_{US})$	$+BS_0(1+r_{TH})/(1+r_{US})$
		0	$BS_0(1+r_{TH})/(1+r_{US}) - BF_0$

- The fair price for the forward is:

e.g. 3-month, 90 days per period

$$F^{B/\$}_{0,bid} = S^{B/\$}_{0,bid} \times \frac{(1 + r_{TH,bid} \times \frac{T}{365})}{(1 + r_{US,ask} \times \frac{T}{360})}$$

TH; US

Ask Forward Rate (Bank's View)

Transactions		Settlement	
		Spot Date	Delivery Date
t=0	Sell USD 3-Month Forward ($F_{0,ask}$)		$-\$1$ $+BF_0$
t=0	Borrow THB to buy PV of \$1 at r_{TH}	$+BS_0/(1+r_{US})$	$-BS_0(1+r_{TH})/(1+r_{US})$
	Buy USD at spot rate	$-BS_0/(1+r_{US})$ $+\$1/(1+r_{US})$	
	Deposit USD at r_{US}	$-\$1/(1+r_{US})$	$+\$1$
			$BF_0-BS_0(1+r_{TH})/(1+r_{US})$

- The fair price for the forward is:

$$F_{0,ask}^{B/\$} = S_{0,ask}^{B/\$} \times \frac{(1 + r_{TH,ask} \times \frac{T}{365})}{(1 + r_{US,bid} \times \frac{T}{360})}$$

Interest Rate Parity Condition

- A forward exchange rate is calculated from the IRP. The general form is (BC=Base currency and TC=Term currency);

$$F_0^{TC/BC} = S_0^{TC/BC} \times \frac{(1 + r_{TC} \times \frac{T}{B_{TC}})}{(1 + r_{BC} \times \frac{T}{B_{BC}})}$$

- It can be noted that
  - If $r_{TC} > r_{BC} \rightarrow F^{TC/BC} > S^{TC/BC}$
  - If $r_{TC} < r_{BC} \rightarrow F^{TC/BC} < S^{TC/BC}$
- A currency with higher interest rate should be traded at a forward discount, while a currency with lower interest rate should be traded at a forward premium.

Forward Swap Points

- The difference between forward and spot rates is “swap point”.

$$\text{Swap Point} = F_0 - S_0$$

- From IRP equation, formula for swap point can be derived.

$$\text{Swap Point}_0 = S_0^{TC/BC} \times \left[\frac{i_{TC} \times \frac{T}{B_{TC}} - i_{BC} \times \frac{T}{B_{BC}}}{1 + i_{BC} \times \frac{T}{B_{BC}}} \right]$$

$$\approx S_0^{TC/BC} \times \left(i_{TC} \frac{T}{B_{TC}} - i_{BC} \frac{T}{B_{BC}} \right)$$

Exercise: Forward Rate Calculation

- EX: What two-sided price can be constructed for the USD/THB 6-month forward rates, given the following? The 6-month period is 183 days.

  USD/THB spot: 34.250-280

  THB 6-month interest rate: 4.10/4.20%

  USD 6-month interest rate: 3.30/3.40%

$$F_{BID} = 34.25 \times \left(\frac{1 + 0.041\left(\frac{183}{365}\right)}{1 + 0.034\left(\frac{183}{360}\right)} \right)$$

$$F_{ASK} = 34.28 \times \left(\frac{1 + 0.042\left(\frac{183}{365}\right)}{1 + 0.033\left(\frac{183}{360}\right)} \right)$$

Exercise: Covered Interest Arbitrage

- EX: Suppose three banks quote the following rates. The 6-month period is 183 days.

  USD/THB spot: 34.250-280

  6-mth Swap: 0.30-0.34

  THB 6-month interest rate: 4.10/4.20%

  USD 6-month interest rate: 3.30/3.40%

- Identify arbitrage opportunity.

Value Date Earlier than Spot Date

- FX transactions that have value dates earlier than spot date are
  - Today transaction
  - Tomorrow (or Tom) transaction
- The outright rates for these transactions are calculated using the same rules as in longer dates.
- However, unlike the forward rate where the spot rate is the near date, in calculating Today or Tomorrow rates, the spot rate becomes the far date.

Value Date Earlier than Spot Date

- Here is the rule for computing Tomorrow rate
  - Reverse side and sign of T/N swap points, and
  - Add them to the spot rates
- Here is the rule for computing Today rate
  - Reverse side and sign of O/N and T/N swap points, and
  - Add both of them to the spot rates

Value Date Earlier than Spot Date

- EX: A bank quotes the following rates

  USD/THB spot: 34.480/520

  O/N swap: –0.010/–0.008 → Today: 34.498/542

  T/N swap: –0.012/–0.010 → Tomorrow: 34.490/532

  S/W swap: –0.050/–0.030 → 1-week: 34.430/490

- EX: A bank quotes the following rates

  USD/THB spot: 32.550/600

  O/N swap: 0.010/0.012 → Today: 32.524/578

  T/N swap: 0.012/0.014 → Tomorrow: 32.536/588

  S/W swap: 0.040/0.046 → 1-week : 32.590/646

Exercise: FX Forward Swap Points

- EX: Find outright rate for one day after spot, outright tomorrow rate and outright today rate, given the following are rates for EUR/USD:

  Spot: 0.8763/58

  O/N: 0.0013/0.0018

  T/N: 0.0016/0.0021

  S/N: 0.0017/0.0022

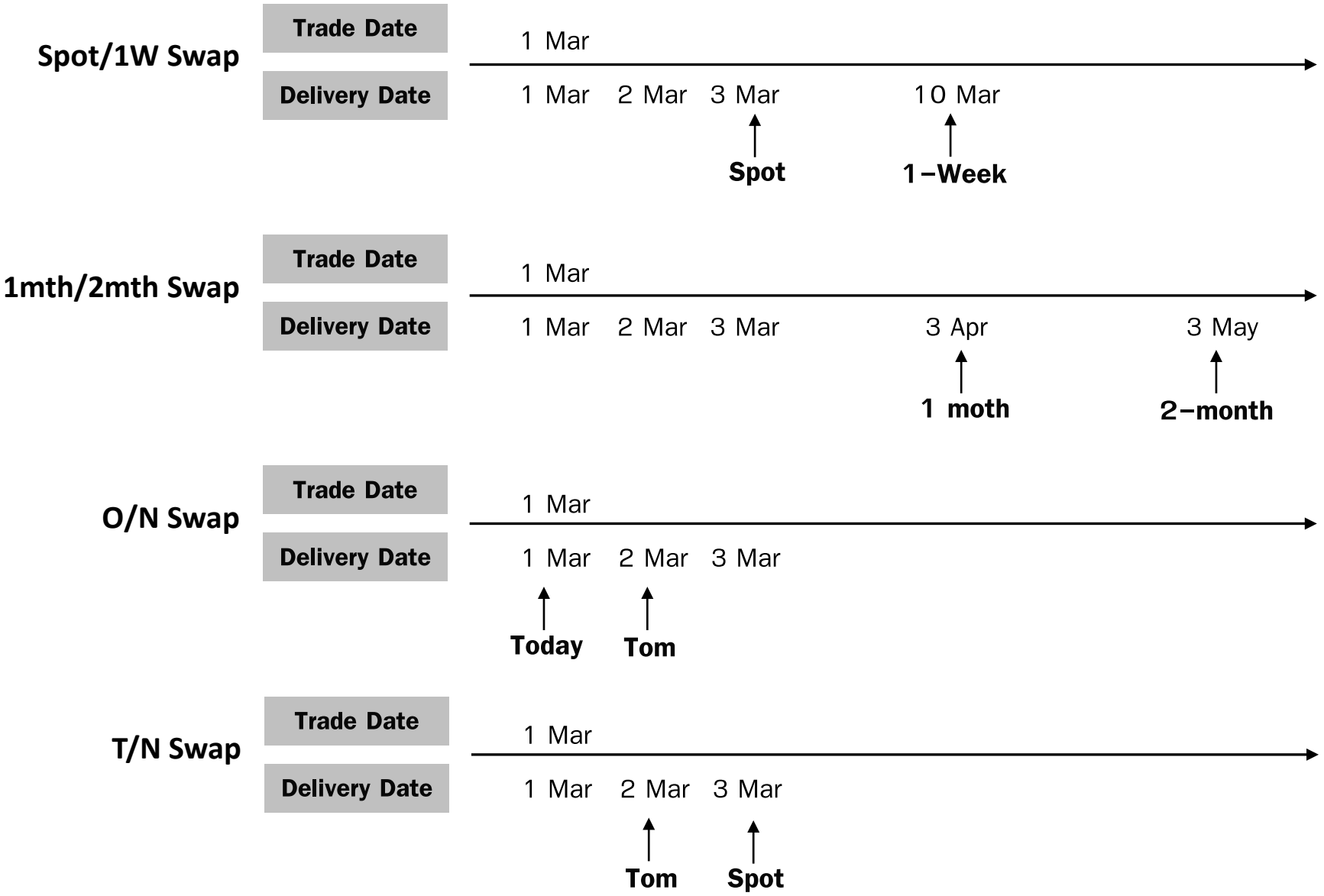
3.3 FX Swap

- An FX swap is a contract to buy (or sell) an amount of the base currency at an agreed rate, and simultaneously sell (or buy) the same amount of the base currency for a later value date to the same counterpart, also at an agreed rate.
- An FX swap transaction has 2 value dates (2 legs).
- In a spot/forward FX swap, the first value date is spot date, the second value date is forward date. A Forward/Forward FX swap consists of two forward transactions.
- The advantage to a customer is that the dealer in FX swap does not charge bid-ask spread.
- Exchange rates for both legs in an FX swap are based on the same spot rate.

3.3 FX Swap

- An FX swap can also be considered as a borrowing in one currency using another currency as collateral in full value.
- FX swap transaction is named in accordance with the value dates in the first and second leg.
  - Spot/Forward FX Swap
  - Forward/Forward FX Swap
  - Other short date FX Swap

Types of FX Swap Transaction



Spot/Forward FX Swap

- EX: On 1st April, a customer buys/sells spot/3-mth FX swap on $1 mio. A bank quotes the following exchange rate:

  Spot rate USD/THB: 34.00/34.25

  3-month swap point: 0.50/0.55

Transaction Date (T)	Cash Flows	
	Spot value date (3rd April)	**3-mth value date (3rd July)**
Buy/sell spot/3-mth FX swap on USD 1 mio	+USD 1,000,000 –THB 34,250,000	–USD 1,000,000 +THB 34,750,000

  - If the contract is separated into buy spot and sell 3-mth forward, the spot rate is B34.25 and forward is 34.50.

Uses of FX Swap

- **Ex:** A Thai firm will receive $1 in two days and make $1 payment in six months. The firm needs to keep its THB for liquidity purpose. A bank quotes the following rates:

  Spot rate USD/THB: 34.00/34.25

  6-month swap point: 0.50/0.55

  What should the firm do?

  a) Leave $1 in FCD and borrow B34.50 mio.

  b) Sell $1 spot at B34.0 and buy USD 6-mth forward at B34.80 to hedge FX risk.

  c) Enter a Sell/Buy Spot/6-mth FX swap

Uses of FX Swap

- The table shows the result from FX swap.

Transaction Date (T)	Cash Flows	
	Spot value date (3^{rd} April)	**6-mth value date (3^{rd} Oct)**
Existing exposure	+USD 1,000,000	–USD 1,000,000
Sell/buy spot/6-mth FX swap on USD 1 mio	–USD 1,000,000 +THB 34,000,000	+USD 1,000,000 –THB 34,550,000
Net	**+THB 34,000,000**	**–THB 34,550,000**

3.4 Bank Risk

- In providing dealing services in FX market, commercial banks are exposed to various kinds of risk.
  - Operating risk ↳ human error ↳ bank has to face → process to confirm error
  - Compliance risk ↳ BoT : commercial bank shall not do FX derivative to speculate ↳ only can hedge
  - Price risk face exchange rate risk : square the position everyday ↳ use trade document to confirm ↳ do position with another bank
  - Counterparty or credit risk ↳ bring back price risk

bank will only enter Forward contract only if their counterparty have enough line of credit

Operational Risk from FX Transactions

- Operating risks are exposure to damages and financial lost due to inadequate or failed procedures, systems or policies.
- Examples of operational risk from FX transactions
  - Miss-record of a transaction
  - Customer dissatisfaction
    - Customer's regret
    - Customer's misunderstanding of a clearing process
- This type of risk could be reduced by improving the bank's internal and external processes, improving knowledge and creating awareness among banks' staff.

Compliance Risk from FX Transactions

- Compliance risk is exposure to legal penalties, financial forfeiture and material loss an organization faces when it fails to act in accordance with industry laws and regulations, internal policies or prescribed best practices.
- Examples of compliance risk from FX transactions.
  - Breaching foreign exchange regulations
  - Failing to control customer's credit line
- This type of risk could be reduced by improving the bank's internal and external processes, improving knowledge and creating awareness among banks' staff.

Price Risk from FX Transactions

- Price risk refers to possible losses from future movement of market price (i.e., exchange rate) from existing transactions that create obligations to buy or sell assets in the futures.
- A short $-forward position creates possible loss if USD appreciates.
- A long $-forward position creates possible loss if USD depreciates.

Price Risk from FX Transactions

- EX: A bank sells $1 mio. valued 3-month forward at the forward rate (F_0) of USD/THB=B34.00.
  - How does this transaction expose the bank to exchange rate risk?
- This type of risk could be reduced by widening bid-ask spread and squaring FX positions (says, on a daily basis).

Counterparty Risk from FX Transactions

- Counterparty or credit risk refers to possible losses from future movement of market price (i.e., exchange rate) from existing transactions that create obligations to buy or sell assets in the futures.
- **Pre-settlement risk**: The bank enters a $-forward position to buy USD and sell THB with an exporter. This long $-forward creates possible loss if the exporter defaults on the delivery date (i.e., as USD appreciates).
- **Settlement risk**: On delivery date, the bank has to transfer THB to the export's account before 16:00. However, the bank has to wait for the USD from the exporter until 19:00 on the same day. The exporter may default after receiving THB from the bank.

Counterparty Risk from FX Transactions

- This type of risk could be reduced by assigning credit line to the bank's customers.

Ex: Counterparty Risk from FX Transactions

- **Ex:** A bank sells \$1 mio. to an importer at F_0 of USD/THB=34.00 and buys \$1 m. from an exporter at F_0 of USD/THB=33.85 both transactions valued at 3-month.
  - The following figure shows cash flows to the bank from the two transactions.

t_0: Buys \$1 at F_0 = B33.85	–B33.85
	+\$1.00
t_0: Sells \$1 at F_0 = B34.00	+B34.00
	–\$1.00
	+B0.15

  - If S_{3mth} = B34.50 and the exporter defaults the forward contract, what is value of the bank's loss? What is the value of the loss if the bank already transfers THB to the exporter account?