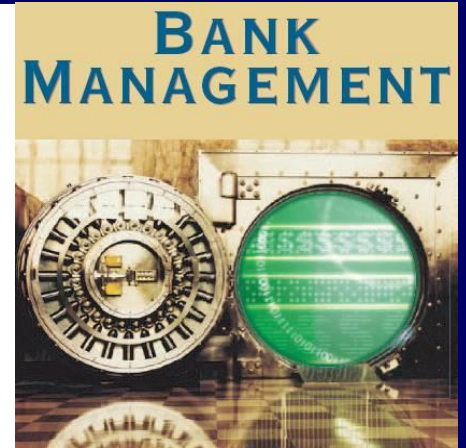


Using Derivatives to Manage Interest Rate Risk

Lecture 7



Derivatives

- **A derivative is any instrument or contract that derives its value from another underlying asset, instrument, or contract.**

Managing Interest Rate Risk

- **Derivatives Used to Manage Interest Rate Risk**
 - **Financial Futures Contracts**
 - **Forward Rate Agreements**
 - **Interest Rate Swaps**
 - **Options on Interest Rates**
 - **Interest Rate Caps**
 - **Interest Rate Floors**

Characteristics of Financial Futures

■ Financial Futures Contracts

- A commitment, between a buyer and a seller, on the quantity of a standardized financial asset or index

■ Futures Markets

- The organized exchanges where futures contracts are traded

■ Interest Rate Futures

- When the underlying asset is an interest-bearing security

Characteristics of Financial Futures

■ Buyers

- A buyer of a futures contract is said to be long futures
- Agrees to pay the underlying futures price or take delivery of the underlying asset
- Buyers gain when futures prices rise and lose when futures prices fall

Characteristics of Financial Futures

■ Sellers

- A seller of a futures contract is said to be short futures
- Agrees to receive the underlying futures price or to deliver the underlying asset
- Sellers gain when futures prices fall and lose when futures prices rise

Characteristics of Financial Futures

■ Cash or Spot Market

- Market for any asset where the buyer tenders payment and takes possession of the asset when the price is set

■ Forward Contract

- Contract for any asset where the buyer and seller agree on the asset's price but defer the actual exchange until a specified future date

Characteristics of Financial Futures

■ Forward versus Futures Contracts

■ Futures Contracts

- Traded on formal exchanges
 - Examples: Chicago Board of Trade and the Chicago Mercantile Exchange
- Involve standardized instruments
- Positions require a daily marking to market
- Positions require a deposit equivalent to a performance bond

Characteristics of Financial Futures

■ Forward versus Futures Contracts

■ Forward contracts

- Terms are negotiated between parties
- Do not necessarily involve standardized assets
- Require no cash exchange until expiration
- No marking to market

Types of Futures Traders

■ Speculator

- Takes a position with the objective of making a profit
- Tries to guess the direction that prices will move and time trades to sell (buy) at higher (lower) prices than the purchase price.

Types of Futures Traders

■ Hedger

- Has an existing or anticipated position in the cash market and trades futures contracts to reduce the risk associated with uncertain changes in the value of the cash position
- Takes a position in the futures market whose value varies in the opposite direction as the value of the cash position when rates change
- Risk is reduced because gains or losses on the futures position at least partially offset gains or losses on the cash position.

Types of Futures Traders

■ Hedger versus Speculator

- The essential difference between a speculator and hedger is the objective of the trader.
 - A speculator wants to profit on trades
 - A hedger wants to reduce risk associated with a known or anticipated cash position

Types of Futures Traders

- **Commission Brokers**

- **Execute trades for other parties**

- **Locals**

- **Trade for their own account**

- **Locals are speculators**

- **Scalper**

- **A speculator who tries to time price movements over very short time intervals and takes positions that remain outstanding for only minutes**

Types of Futures Traders

■ Day Trader

- Similar to a scalper but tries to profit from short-term price movements during the trading day; normally offsets the initial position before the market closes such that no position remains outstanding overnight

■ Position Trader

- A speculator who holds a position for a longer period in anticipation of a more significant, longer-term market move.

Types of Futures Traders

- **Spreader versus Arbitrageur**
 - Both are speculators that take relatively low-risk positions
- **Futures Spreader**
 - May simultaneously buy a futures contract and sell a related futures contract trying to profit on anticipated movements in the price difference
 - The position is generally low risk because the prices of both contracts typically move in the same direction

Types of Futures Traders

■ Arbitrageur

- Tries to profit by identifying the same asset that is being traded at two different prices in different markets at the same time
- Buys the asset at the lower price and simultaneously sells it at the higher price
- Arbitrage transactions are thus low risk and serve to bring prices back in line in the sense that the same asset should trade at the same price in all markets

Margin Requirements

■ Initial Margin

- A cash deposit (or U.S. government securities) with the exchange simply for initiating a transaction
- Initial margins are relatively low, often involving less than 5% of the underlying asset's value

■ Maintenance Margin

- The minimum deposit required at the end of each day

Margin Requirements

- Unlike margin accounts for stocks, futures margin deposits represent a guarantee that a trader will be able to make any mandatory payment obligations
- Same effect as a performance bond

Margin Requirements

■ Marking-to-Market

- The daily settlement process where at the end of every trading day, a trader's margin account is:
 - Credited with any gains
 - Debited with any losses

■ Variation Margin

- The daily change in the value of margin account due to marking-to-market

Expiration and Delivery

■ Expiration Date

- Every futures contract has a formal expiration date
- On the expiration date, trading stops and participants settle their final positions
- Less than 1% of financial futures contracts experience physical delivery at expiration because most traders offset their futures positions in advance

Example

- **90-Day Eurodollar Time Deposit Futures**
 - The underlying asset is a Eurodollar time deposit with a 3-month maturity.
 - Eurodollar rates are quoted on an interest-bearing basis, assuming a 360-day year.
 - Each Eurodollar futures contract represents \$1 million of initial face value of Eurodollar deposits maturing three months after contract expiration.

Example

- **90-Day Eurodollar Time Deposit Futures**
 - **Forty separate contracts are traded at any point in time, as contracts expire in March, June, September and December each year**
 - **Buyers make a profit when futures rates fall (prices rise)**
 - **Sellers make a profit when futures rates rise (prices fall)**

Example

- **90-Day Eurodollar Time Deposit Futures**
 - **Contracts trade according to an index that equals**
 - **100% - the futures interest rate**
 - **An index of 94.50 indicates a futures rate of 5.5 percent**
 - **Each basis point change in the futures rate equals a \$25 change in value of the contract ($0.001 \times \$1 \text{ million} \times 90/360$)**

Eurodollar Futures

Eurodollar (CME)-\$1,000,000; pts of 100%

	OPEN	HIGH	LOW	SETTLE	CHA	YIELD	CHA	OPEN INT
Mar	96.98	96.99	96.98	96.99	—	3.91	—	823,734
Apr	96.81	96.81	96.81	96.81	_.01	3.19	.01	19,460
June	96.53	96.55	96.52	96.54	—	3.46	—	1,409,983
Sept	96.14	96.17	96.13	96.15	_.01	3.05	.01	1,413,496
Dec	95.92	95.94	95.88	95.91	_.01	4.09	.01	1,146,461
Mr06	95.78	95.80	95.74	95.77	_.01	4.23	.01	873,403
June	95.64	95.60	95.62	95.64	_.01	4.34	.01	567,637
Sept	95.37	95.58	95.53	95.54	_.01	4.44	.01	434,034
Dec	95.47	95.50	95.44	95.47	—	4.53	—	300,746
Mr07	95.42	95.44	95.37	95.42	—	4.58	—	250,271
June	95.31	95.38	95.31	95.37	.01	4.63	_.01	211,664
Sept	95.27	95.32	95.23	95.31	.02	4.69	_.02	164,295
Dec	95.21	95.27	95.18	95.26	.03	4.74	_.03	154,123
Mr08	95.16	95.23	95.11	95.21	.04	4.79	_.04	122,800
June	95.08	95.17	95.07	95.14	.05	4.84	_.05	113,790
Sept	95.03	95.13	95.01	95.11	.06	4.89	_.06	107,792
Dec	94.95	95.06	94.94	95.05	.07	4.95	_.07	96,046
Mr09	94.91	95.02	94.89	95.01	.08	4.99	_.07	81,015
June	94.05	94.97	94.84	94.97	.08	5.03	_.08	76,224
Sept	94.81	94.93	94.79	94.92	.08	5.08	_.08	41,524
Dec	94.77	94.38	94.74	94.87	.08	5.15	_.08	40,594
Mr10	94.77	94.64	94.70	94.83	.09	5.27	_.09	17,481
Sept	94.66	94.76	94.62	94.75	.09	5.25	_.09	9,309
Sp11	94.58	94.60	94.47	94.60	.09	5.40	_.09	2,583
Dec	94.49	94.56	94.43	94.56	.09	5.44	_.09	2,358
Mr12	94.48	94.54	94.41	94.53	.09	5.47	_.09	1,392
Est vol	2,082,746; vol Wed 1,519,709; open int 8,631,643, 160,422.							

■ The first column indicates the settlement month and year

■ Each row lists price and yield data for a distinct futures contract that expires sequentially every three months

■ The next four columns report the opening price, high and low price, and closing settlement price.

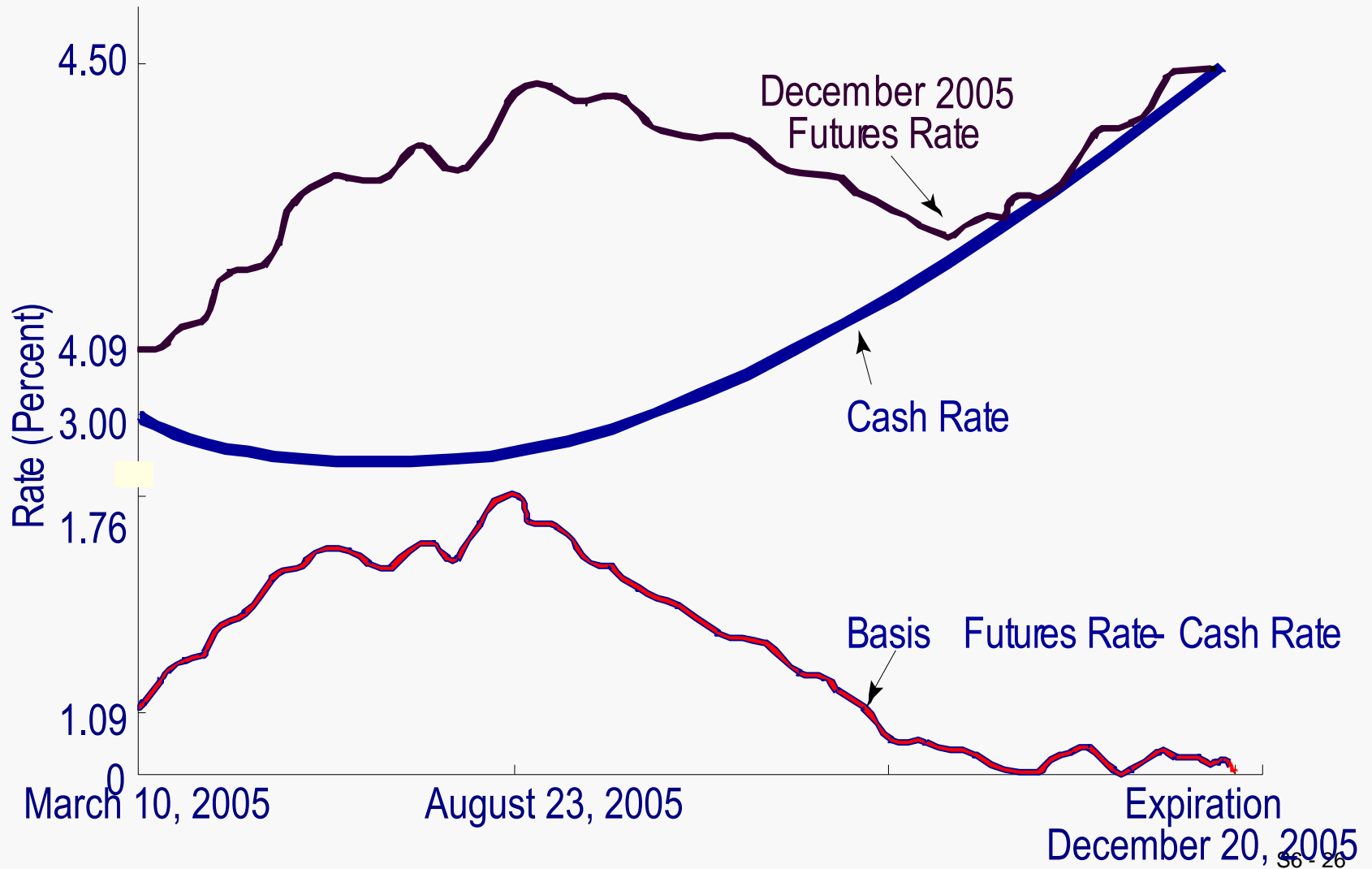
■ The next column, the change in settlement price from the previous day.

■ The two columns under Yield convert the settlement price to a Eurodollar futures rate as:
100 - Settlement Price = Futures Rate

The Basis

- **The basis is the cash price of an asset minus the corresponding futures price for the same asset at a point in time**
 - **For financial futures, the basis can be calculated as the futures rate minus the spot rate**
 - **It may be positive or negative, depending on whether futures rates are above or below spot rates**
 - **May swing widely in value far in advance of contract expiration**

The Relationship Between Futures Rates and Cash Rates - One Possible Pattern on March 10



Speculation versus Hedging

- **A speculator takes on additional risk to earn speculative profits**
 - **Speculation is extremely risky**
- **A hedger already has a position in the cash market and uses futures to adjust the risk of being in the cash market**
 - **The focus is on reducing or avoiding risk**

Speculation versus Hedging

■ Example

■ Speculating

- You believe interest rates will fall, so you buy Eurodollar futures
 - If rates fall, the price of the underlying Eurodollar rises, and thus the futures contract value rises earning you a profit
 - If rates rise, the price of the Eurodollar futures contract falls in value, resulting in a loss

Speculation versus Hedging

■ Example

■ Hedging

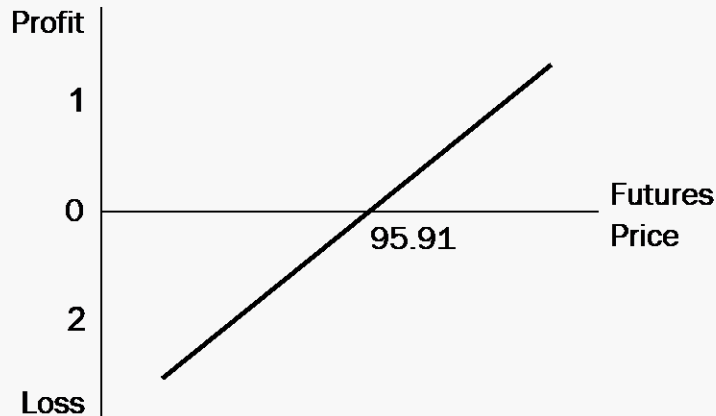
- A bank anticipates needing to borrow \$1,000,000 in 60 days. The bank is concerned that rates will rise in the next 60 days
 - A possible strategy would be to short Eurodollar futures.
 - If interest rates rise (fall), the short futures position will increase (decrease) in value. This will (partially) offset the increase (decrease) in borrowing costs

Speculation versus Hedging

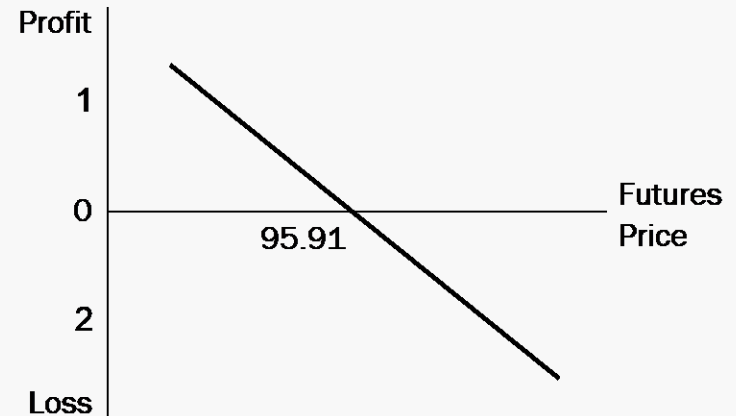
- **With financial futures, risk often cannot be eliminated, only reduced.**
 - **Traders normally assume basis risk in that the basis might change adversely between the time the hedge is initiated and closed**
- **Perfect Hedge**
 - **The gains (losses) from the futures position perfectly offset the losses (gains) on the spot position at each price**

Profit Diagrams for the December 2005 Eurodollar Futures Contract: Mar 10, 2005

A. Speculation

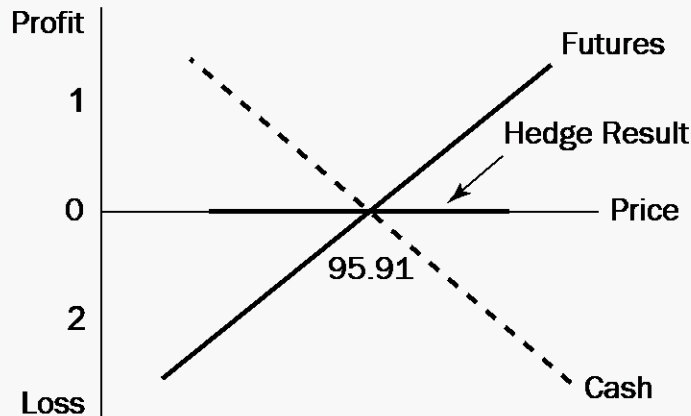


1. Buy Dec. 2005 Eurodollar Futures at \$95.91

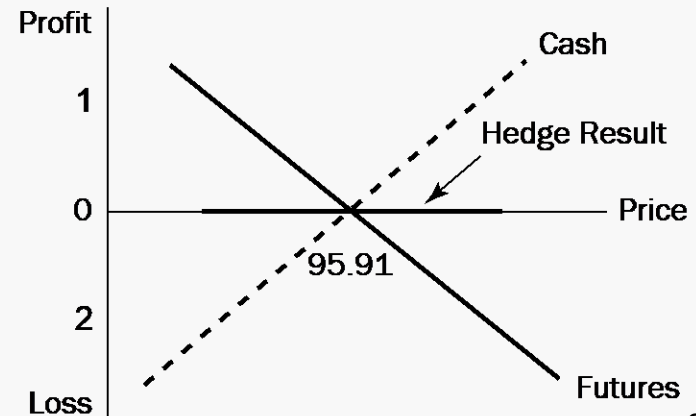


2. Sell Dec. 2005 Eurodollar Futures at \$95.91

B. Hedging



Hedge: Long Futures—Cash Loss When Rates Fall



Hedge: Short Futures—Cash Loss When Rates Rise

Steps in Hedging

- Identify the cash market risk exposure to reduce
- Given the cash market risk, determine whether a long or short futures position is needed
- Select the best futures contract
- Determine the appropriate number of futures contracts to trade.
- Buy or sell the appropriate futures contracts
- Determine when to get out of the hedge position, either by reversing the trades, letting contracts expire, or making or taking delivery
- Verify that futures trading meets regulatory requirements and the banks internal risk policies

A Long Hedge

- A long hedge (buy futures) is appropriate for a participant who wants to reduce spot market risk associated with a decline in interest rates
- If spot rates decline, futures rates will typically also decline so that the value of the futures position will likely increase.
- Any loss in the cash market is at least partially offset by a gain in futures

Long Hedge Example

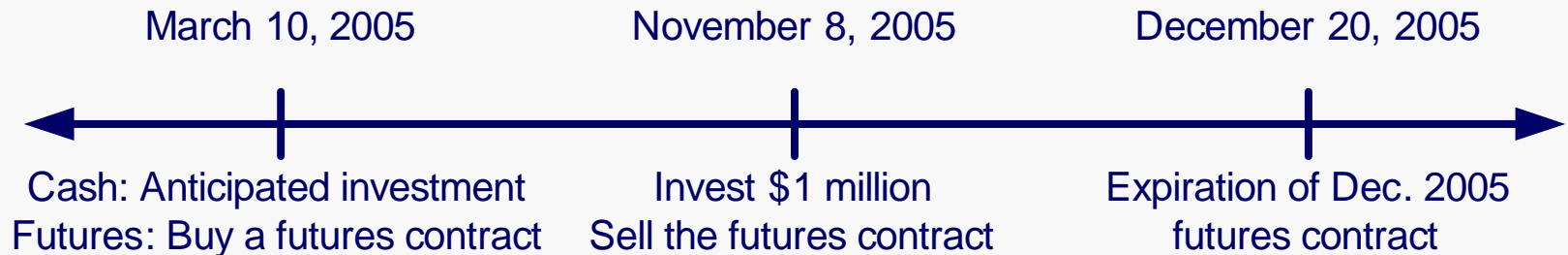
- On March 10, 2005, your bank expects to receive a \$1 million payment on November 8, 2005, and anticipates investing the funds in 3-month Eurodollar time deposits
 - The cash market risk exposure is that the bank will not have access to the funds for eight months.
 - In March 2005, the market expected Eurodollar rates to increase sharply as evidenced by rising futures rates.

Long Hedge Example

- **In order to hedge, the bank should buy futures contracts**
 - **The best futures contract will generally be the December 2005, 3-month Eurodollar futures contract, which is the first to expire after November 2005.**
 - **The contract that expires immediately after the known cash transactions date is generally best because its futures price will show the highest correlation with the cash price.**

Long Hedge Example

- The time line of the bank's hedging activities would look something like this:



Long Hedge Example

Date	Cash Market	Futures Market	Basis
3/10/05 (Initial futures position)	Bank anticipates investing \$1 million in Eurodollars in 8 months; current cash rate = 3.00%	Bank buys one December 2005 Eurodollar futures contract at 4.09%; price = 95.91	4.09% - 3.00% = 1.09%
11/8/05 (Close futures position)	Bank invests \$1 million in 3-month Eurodollars at 3.93%	Bank sells one December 2005 Eurodollar futures contract at 4.03%; price = 95.97%	4.03% - 3.93% = 0.10%
Net effect	Opportunity gain: 3.93% - 3.00% = 0.93%; 93 basis points worth \$25 each = \$2,325	Futures profit: 4.09% - 4.03% = 0.06%; 6 basis points worth \$25 each = \$150	Basis change: 0.10% - 1.09% = -0.99%

Cumulative investment income:

Interest at 3.93% = $\$1,000,000(.0393)(90/360) = \$9,825$
 Profit from futures trades = \$ 150
 Total = \$9,975

$$\text{Effective return} = \frac{\$9,975}{\$1,000,000} \frac{360}{90} = 3.99\%$$

A Short Hedge

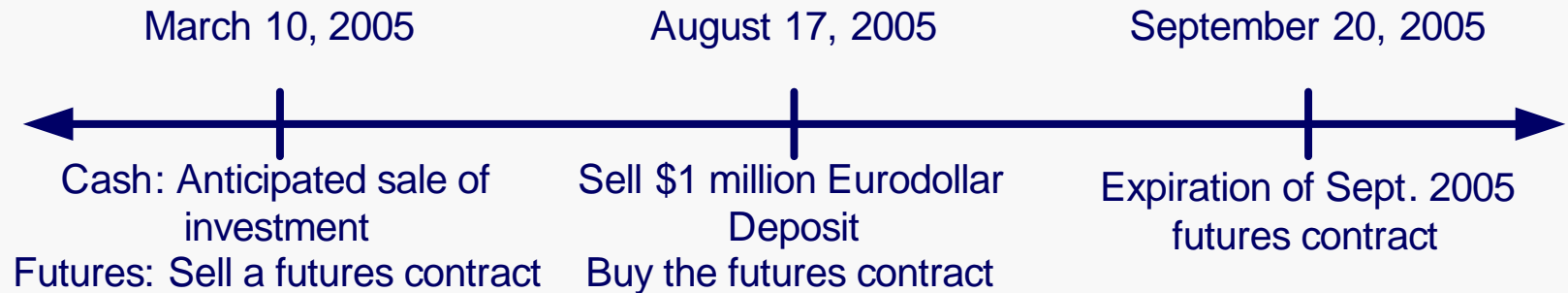
- A short hedge (sell futures) is appropriate for a participant who wants to reduce spot market risk associated with an increase in interest rates
- If spot rates increase, futures rates will typically also increase so that the value of the futures position will likely decrease.
- Any loss in the cash market is at least partially offset by a gain in the futures market

Short Hedge Example

- **On March 10, 2005, your bank expects to sell a six-month \$1 million Eurodollar deposit on August 15, 2005**
 - **The cash market risk exposure is that interest rates may rise and the value of the Eurodollar deposit will fall by August 2005**
 - **In order to hedge, the bank should sell futures contracts**

Short Hedge Example

- The time line of the bank's hedging activities would look something like this:



Short Hedge Example

Date	Cash Market	Futures Market	Basis
3/10/05	Bank anticipates selling \$1 million Eurodollar deposit in 127 days; current cash rate = 3.00%	Bank sells one Sept. 2005 Eurodollar futures contract at 3.85%; price = 96.15	$3.85\% - 3.00\% = 0.85\%$
8/17/05	Bank sells \$1 million Eurodollar deposit at 4.00%	Bank buys one Sept. 2005 Eurodollar futures contract at 4.14%; price = 95.86	$4.14\% - 4.00\% = 0.14\%$
Net result:	Opportunity loss: $4.00\% - 3.00\% = 1.00\%$; 100 basis points worth \$25 each = \$2,500	Futures profit: $4.14\% - 3.85\% = 0.29\%$; 29 basis points worth \$25 each = \$725	Basis change: $0.14\% - 0.85\%$ = -0.71%

Effective loss = $\$2,500 - \$725 = \$1,775$

Effective rate at sale of deposit = $4.00\% - 0.29\% = 3.71\%$

or $3.00\% - (0.71\%) = 3.71\%$

Change in the Basis

- Long and short hedges work well if the futures rate moves in line with the spot rate
- The actual risk assumed by a trader in both hedges is that the basis might change between the time the hedge is initiated and closed
 - In the long hedge position above, the spot rate increased by 0.93% while the futures rate fell by 0.06%. This caused the basis to fall by 0.99% (The basis fell from 1.09% to 0.10%, or by 0.99%)

Change in the Basis

- **Effective Return from a Hedge**
 - **Total income from the combined cash and futures positions relative to the investment amount**
- **Effective return**
 - **Initial Cash Rate - Change in Basis**
 - **In the long hedge example:**
 - **$3.00\% - (-0.99\%) = 3.99\%$**

Basis Risk and Cross Hedging

■ Cross Hedge

- Where a trader uses a futures contract based on one security that differs from the security being hedged in the cash market
 - Example
 - Using Eurodollar futures to hedge changes in the commercial paper rate
- Basis risk increases with a cross hedge because the futures and spot interest rates may not move closely together

Microhedging Applications

■ Microhedge

- The hedging of a transaction associated with a specific asset, liability or commitment

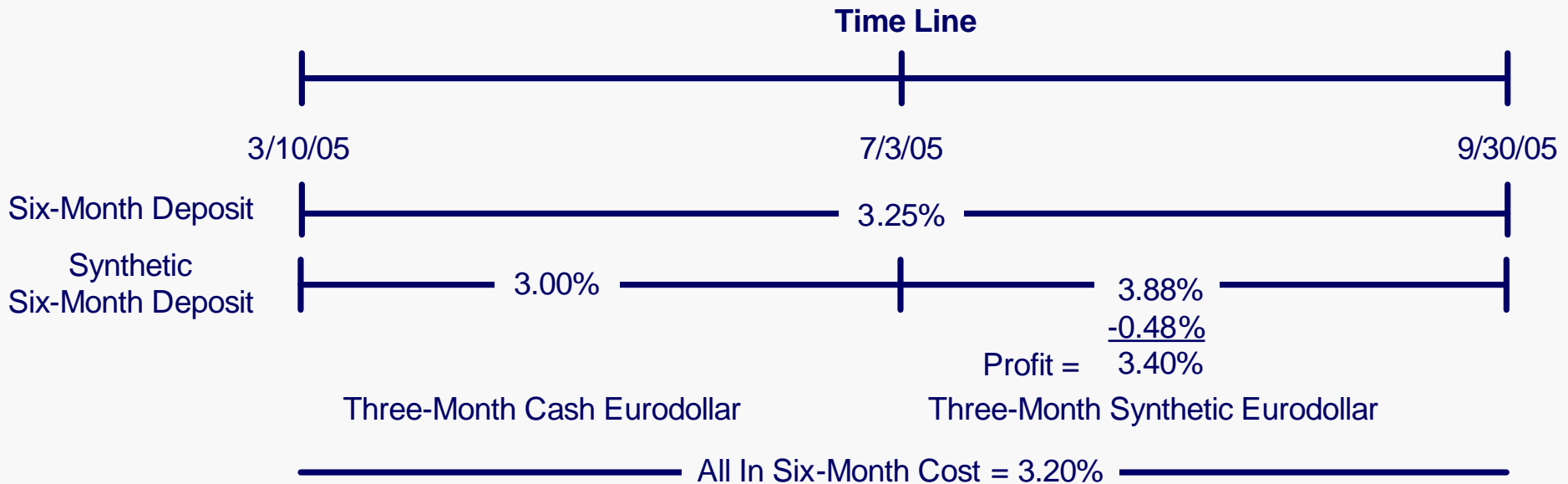
■ Macrohedge

- Taking futures positions to reduce aggregate portfolio interest rate risk

Microhedging Applications

- **Banks are generally restricted in their use of financial futures for hedging purposes**
 - **Banks must recognize futures on a micro basis by linking each futures transaction with a specific cash instrument or commitment**
 - **Many analysts feel that such micro linkages force microhedges that may potentially increase a firm's total risk because these hedges ignore all other portfolio components**

Creating a Synthetic Liability with a Short Hedge



Creating a Synthetic Liability with a Short Hedge

Summary of Relevant Eurodollar Rates and Transactions

March 10, 2005

3-month cash rate = 3.00%; bank issues a \$1 million, 91-day Eurodollar deposit

6-month cash rate = 3.25%

Bank sells one September 2005 Eurodollar futures; futures rate = 3.85%

July 3, 2005

3-month cash rate = 3.88%; bank issues a \$1 million, 91-day Eurodollar deposit

Buy: One September 2005 Eurodollar futures; futures rate = 4.33%

Date	Cash Market	Futures Market	Basis
3/10/05	Bank issues \$1 million, 91-day Eurodollar time deposit at 3.00%; 3-mo. interest expense = \$7,583.	Bank sells one September 2005 Eurodollar futures contract at 3.85%	0.85%
7/3/05	Bank issues \$1 million, 91-day Eurodollar time deposit at 3.88%; 3-mo. interest expense = \$9,808 (increase in interest expense over previous period = \$2,225).	Bank buys one September 2005 Eurodollar futures contract at 4.33%;	0.45%
Net effect:	6-mo. interest expense = \$17,391	Profit on futures = \$1,200	

$$\text{Effective borrowing cost} = \frac{\$17,391 - \$1,200}{\$1,000,000} \times \frac{360}{182} = 3.20\%$$

Interest on 6-month Eurodollar deposit issued March 10 = \$13,144 at 3.25%; vs. 3.20% from synthetic liability

The Mechanics of Applying a Microhedge

- 1. Determine the bank's interest rate position**
- 2. Forecast the dollar flows or value expected in cash market transactions**
- 3. Choose the appropriate futures contract**

The Mechanics of Applying a Microhedge

4. Determine the correct number of futures contracts

$$NF = \frac{A \times Mc}{F \times Mf} b$$

■ Where

- NF = number of futures contracts
- A = Dollar value of cash flow to be hedged
- F = Face value of futures contract
- Mc = Maturity or duration of anticipated cash asset or liability
- Mf = Maturity or duration of futures contract
- $b = \frac{\text{Expected rate movement on cash instrument}}{\text{Expected rate movement on futures contract}}$

The Mechanics of Applying a Microhedge

5. **Determine the Appropriate Time Frame for the Hedge**
6. **Monitor Hedge Performance**

Macrohedging

- **Macrohedging**

- **Focuses on reducing interest rate risk associated with a bank's entire portfolio rather than with individual transactions**

Macrohedging

- **Hedging: GAP or Earnings Sensitivity**
 - **If GAP is positive (negative), the bank is asset (liability) sensitive and its net interest income rises (falls) when interest rates rise (falls) and falls (rises) when interest rates fall (rise)**
 - **Positive GAP**
 - **Use a long hedge**
 - **Negative GAP**
 - **Use a short hedge**

Hedging: GAP or Earnings Sensitivity

■ Positive GAP

■ Use a long hedge

- If rates rise, the bank's higher net interest income will be offset by losses on the futures position
- If rates fall, the bank's lower net interest income will be offset by gains on the futures position

Hedging: GAP or Earnings Sensitivity

■ Negative GAP

■ Use a short hedge

- If rates rise, the bank's lower net interest income will be offset by gains on the futures position
- If rates fall, the bank's higher net interest income will be offset by losses on the futures position

Using Forward Rate Agreements to Manage Interest Rate Risk

■ Forward Rate Agreements

- A forward contract based on interest rates based on a notional principal amount at a specified future date

■ Buyer

- Agrees to pay a fixed-rate coupon payment (at the exercise rate) and receive a floating-rate payment

■ Seller

- Agrees to make a floating-rate payment and receive a fixed-rate payment

- The buyer and seller will receive or pay cash when the actual interest rate at settlement is different than the exercise rate

Forward Rate Agreements (FRA)

- **Similar to futures but differ in that they:**
 - **Are negotiated between parties**
 - **Do not necessarily involve standardized assets**
 - **Require no cash exchange until expiration**
 - **There is no marking-to-market**
 - **No exchange guarantees performance**

Notional Principal

- **The two counterparties to a forward rate agreement agree to a notional principal amount that serves as a reference figure in determining cash flows.**
 - **Notional**
 - **Refers to the condition that the principal does not change hands, but is only used to calculate the value of interest payments.**

Notional Principal

■ Buyer

- Agrees to pay a fixed-rate coupon payment and receive a floating-rate payment against the notional principal at some specified future date.

■ Seller

- Agrees to pay a floating-rate payment and receive the fixed-rate payment against the same notional principal.

Example: Forward Rate Agreements

- **Suppose that Metro Bank (as the seller) enters into a receive fixed-rate/pay floating-rating forward rate agreement with County Bank (as the buyer) with a six-month maturity based on a \$1 million notional principal amount**
- **The floating rate is the 3-month LIBOR and the fixed (exercise) rate is 7%**

Example: Forward Rate Agreements

- Metro Bank would refer to this as a “3 vs. 6” FRA at 7 percent on a \$1 million notional amount from County Bank
- The phrase “3 vs. 6” refers to a 3-month interest rate observed three months from the present, for a security with a maturity date six months from the present
- The only cash flow will be determined in six months at contract maturity by comparing the prevailing 3-month LIBOR with 7%

Example: Forward Rate Agreements

- Assume that in three months 3-month LIBOR equals 8%
 - In this case, Metro Bank would receive from County Bank \$2,451.
 - The interest settlement amount is \$2,500:
 - Interest = $(.08 - .07)(90/360) \$1,000,000 = \$2,500$.
 - Because this represents interest that would be paid three months later at maturity of the instrument, the actual payment is discounted at the prevailing 3-month LIBOR:
 - Actual interest = $\$2,500/[1+(90/360).08]=\$2,451$

Example: Forward Rate Agreements

- If instead, LIBOR equals 5% in three months, Metro Bank would pay County Bank:
 - The interest settlement amount is \$5,000
 - Interest = $(.07 - .05)(90/360) \$1,000,000 = \$5,000$
 - Actual interest = $\$5,000 / [1 + (90/360).05] = \$4,938$

Example: Forward Rate Agreements

- **The FRA position is similar to a futures position**
 - **County Bank would pay fixed-rate/receive floating-rate as a hedge if it was exposed to loss in a rising rate environment.**
 - **This is analogous to a short futures position**

Example: Forward Rate Agreements

- **The FRA position is similar to a futures position**
 - **Metro Bank would take its position as a hedge if it was exposed to loss in a falling (relative to forward rate) rate environment.**
 - **This is analogous to a long futures position**

Basic Interest Rate Swaps

- **Basic or Plain Vanilla Interest Rate Swap**
 - **An agreement between two parties to exchange a series of cash flows based on a specified notional principal amount**
 - **Two parties facing different types of interest rate risk can exchange interest payments**

Basic Interest Rate Swaps

- **Basic or Plain Vanilla Interest Rate Swap**
 - **One party makes payments based on a fixed interest rate and receives floating rate payments**
 - **The other party exchanges floating rate payments for fixed-rate payments**
 - **When interest rates change, the party that benefits from a swap receives a net cash payment while the party that loses makes a net cash payment**

Basic Interest Rate Swaps

- **Conceptually, a basic interest rate swap is a package of FRAs**
 - **As with FRAs, swap payments are netted and the notional principal never changes hands**

Basic Interest Rate Swaps

- **Using data for a 2-year swap based on 3-month LIBOR as the floating rate**
 - **This swap involves eight quarterly payments.**
 - **Party FIX agrees to pay a fixed rate**
 - **Party FLT agrees to receive a fixed rate with cash flows calculated against a \$10 million notional principal amount**

Basic Interest Rate Swaps

**Two-Year Maturity, \$10 Million Notional Principal
with Eight Quarterly Swap Payments**

**FIX: Pay 4.05 Percent, Receive LIBOR
FLT: Pay LIBOR, Receive 4.05 Percent**

	0	1	2	3	4	5	6	7	8
<i>Party FIX</i>									
Pay		\$100,973	100,973	100,973	100,973	100,973	100,973	100,973	100,973
Rec.		75,833	LIB ₂	LIB ₃	LIB ₄	LIB ₅	LIB ₆	LIB ₇	LIB ₈
Net		\$25,140	?	?	?	?	?	?	?
<i>Party FLT</i>									
Pay		\$75,833	LIB ₂	LIB ₃	LIB ₄	LIB ₅	LIB ₆	LIB ₇	LIB ₈
Rec.		100,723	100,723	100,723	100,723	100,723	100,723	100,723	100,723
Net		\$24,890	?	?	?	?	?	?	?
Dealer		\$250							

Party FIX: Period 1

Pay: 0.0405 (91/365) \$10,000,000 = \$100,973

Rec: 0.0300 (91/360) \$10,000,000 = \$75,833

Net Payment = \$25,140

Party FLT: Period 1

Pay: 0.0300 (91/360) \$10,000,000 = \$75,833

Rec: 0.0404 (91/365) \$10,000,000 = \$100,723

Net Receipt = \$24,890

Basic Interest Rate Swaps

- **Firms with a negative GAP can reduce risk by making a fixed-rate interest payment in exchange for a floating-rate interest receipt**
- **Firms with a positive GAP take the opposite position, by making floating-interest payments in exchange for a fixed-rate receipt**

Basic Interest Rate Swaps

- **Basic interest rate swaps are used to:**
 - **Adjust the rate sensitivity of an asset or liability**
 - **For example, effectively converting a fixed-rate loan into a floating-rate loan**
 - **Create a synthetic security**
 - **For example, enter into a swap instead of investing in a security**
 - **Macrohedge**
 - **Use swaps to hedge the bank's aggregate interest rate risk**

Basic Interest Rate Swaps

■ Swap Dealers

- Handle most swap transactions
- Make a market in swap contracts
- Offer terms for both fixed-rate and floating rate payers and earn a spread for their services

Basic Interest Rate Swaps

■ Comparing Financial Futures, FRAs, and Basic Swaps

Objective	Position	
	Financial Futures	FRAs & Basic Swaps
Profit If Rates Rise	Sell Futures	Pay Fixed, Receive Floating
Profit If Rates Fall	Buy Futures	Pay Floating, Receive Fixed

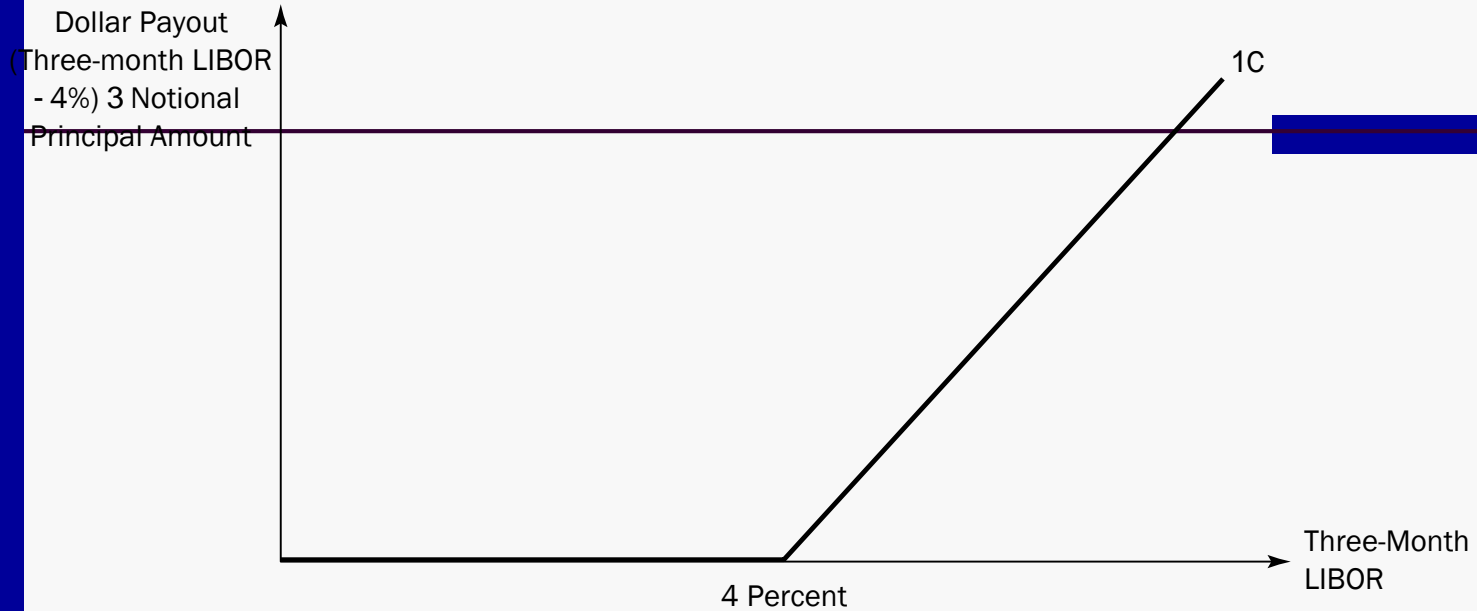
- **There is some credit risk with swaps in that the counterparty may default on the exchange of the interest payments**
 - **Only the interest payment exchange is at risk, not the principal**

Interest Rate Caps and Floors

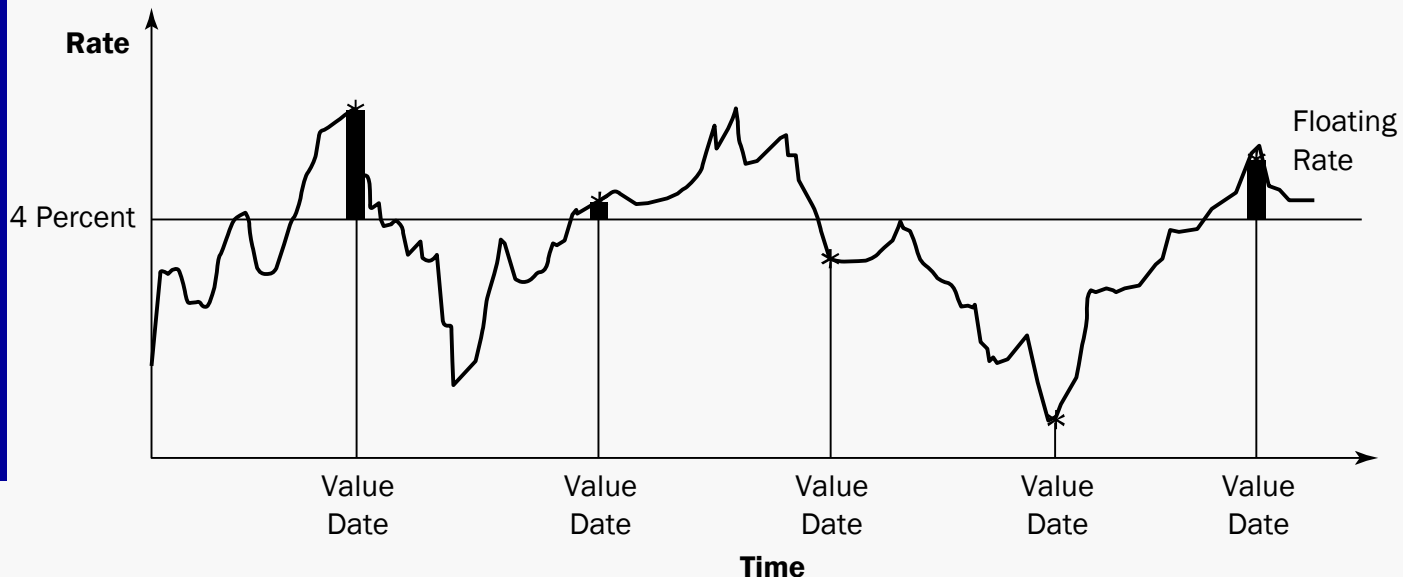
- **Interest Rate Cap**
 - **An agreement between two counterparties that limits the buyer's interest rate exposure to a maximum limit**
 - **Buying a interest rate cap is the same as purchasing a call option on an interest rate**

Buying a Floor on 3-Month LIBOR at 4 Percent

A. Cap 5 Long Call Option on Three-Month LIBOR



B. Cap Payoff: Strike Rate 5 4 Percent*



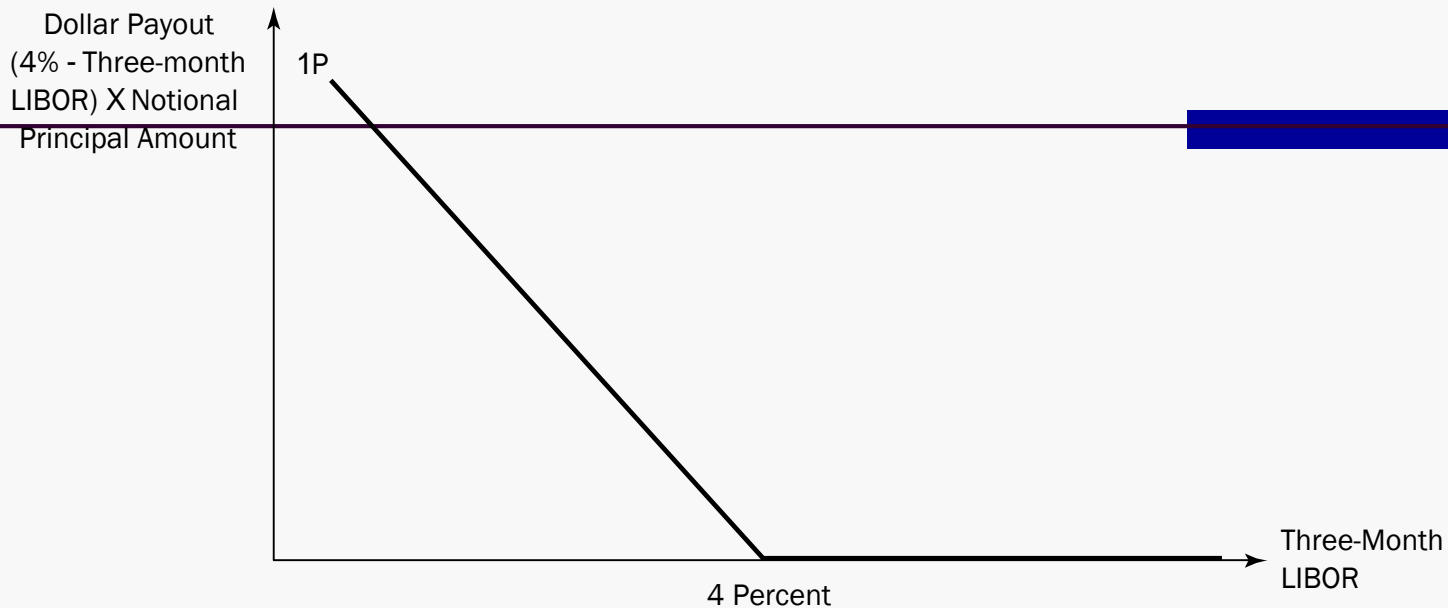
Interest Rate Caps and Floors

■ Interest Rate Floor

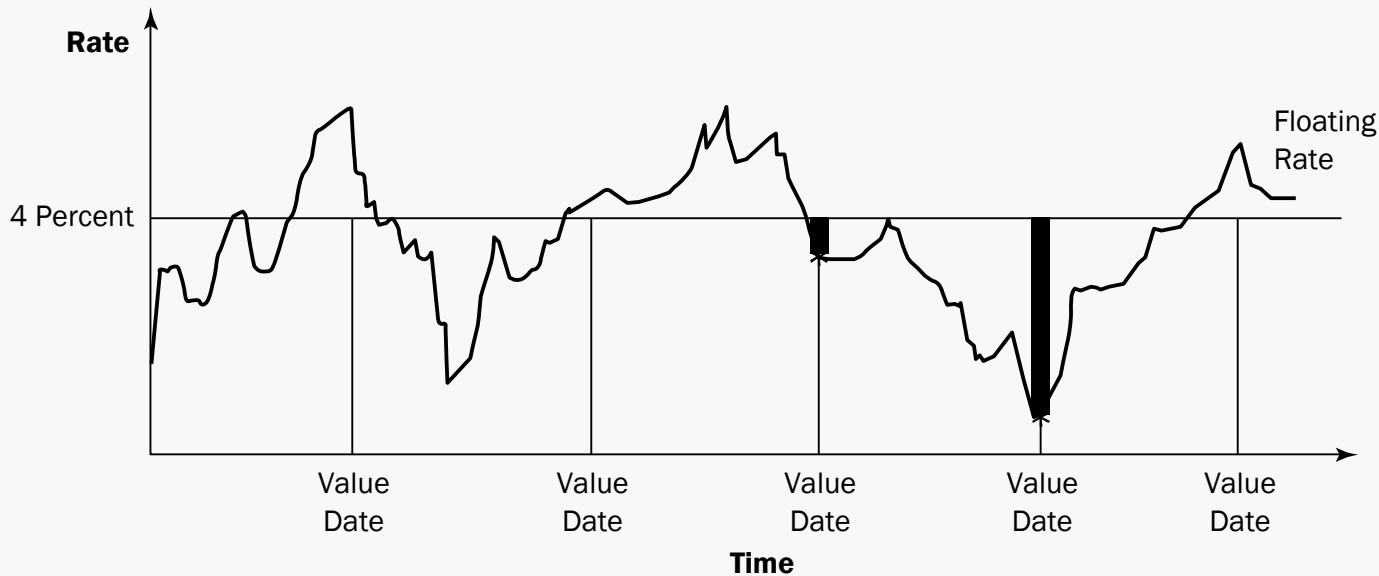
- An agreement between two counterparties that limits the buyer's interest rate exposure to a minimum rate
 - Buying an interest rate floor is the same as purchasing a put option on an interest rate

Buying a Floor on 3-Month LIBOR at 4 percent

A. Floor = Long Put Option on Three-Month LIBOR



B. Floor Payoff: Strike Rate = 4 Percent*



Interest Rate Caps and Floors

■ Interest Rate Collar

- The simultaneous purchase of an interest rate cap and sale of an interest rate floor on the same index for the same maturity and notional principal amount
- A collar creates a band within which the buyer's effective interest rate fluctuates
- It protects a bank from rising interest rates

Interest Rate Caps and Floors

■ Zero Cost Collar

- A collar where the buyer pays no net premium
- The premium paid for the cap equals the premium received for the floor

■ Reverse Collar

- Buying an interest rate floor and simultaneously selling an interest rate cap
- It protects a bank from falling interest rates

Pricing Interest Rate Caps and Floors

- **The size of the premiums for caps and floors is determined by:**
 - **The relationship between the strike rate and the current index**
 - **This indicates how much the index must move before the cap or floor is in-the-money**
 - **The shape of yield curve and the volatility of interest rates**
 - **With an upward sloping yield curve, caps will be more expensive than floors**

Pricing Interest Rate Caps and Floors

A. Caps/Floors

Term	Bid	Offer	Bid	Offer	Bid	Offer
Caps	4.00%		5.00%		6.00%	
1 year	24	30	3	7	1	2
2 years	51	57	36	43	10	15
3 years	105	115	74	84	22	29
5 years	222	240	135	150	76	5
7 years	413	433	201	324	101	116
10 years	549	573	278	308	157	197
Floors	1.50%		2.00%		2.50%	
1 year	1	2	15	19	57	55
2 years	1	6	31	37	84	91
3 years	7	16	40	49	128	137
5 years	24	39	75	88	190	205
7 years	38	60	92	106	228	250
10 years	85	115	162	192	257	287

Basic Swap to Hedge Aggregate Balance Sheet Risk of Loss from Falling Rates

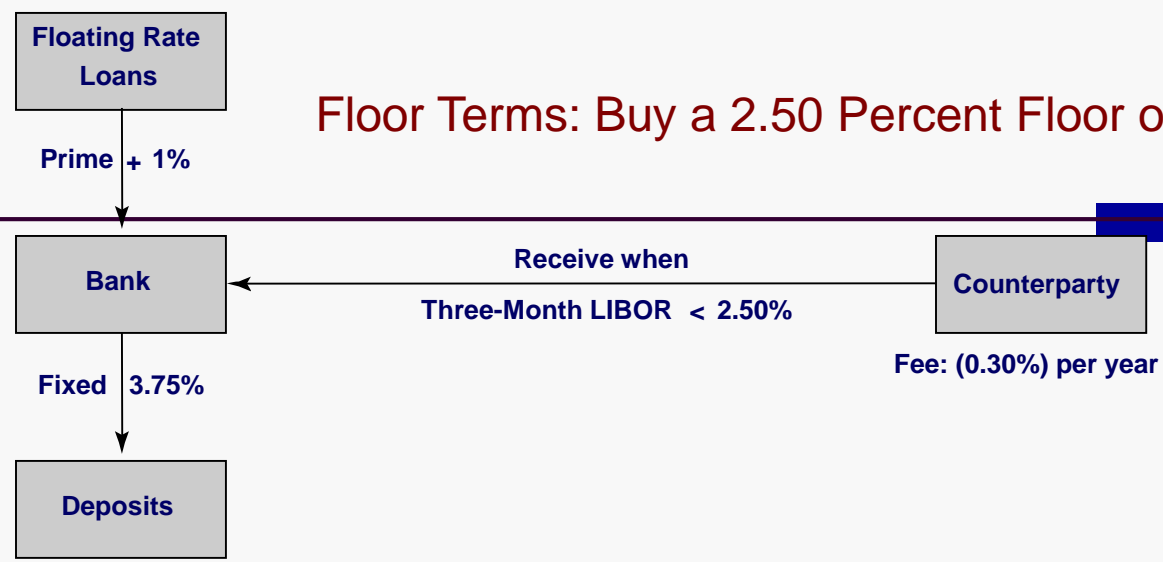


Bank Swap Terms: Pay LIBOR, Receive 4.18 Percent

	<u>Current Rates Constant</u>	<u>Rates Fall 100 Basis Points</u>	<u>Rates Rise 100 Basis Points</u>
	<u>PRIME 5.50%</u> <u>LIBOR 3.00%</u>	<u>PRIME 4.50%</u> <u>LIBOR 2.00%</u>	<u>PRIME 6.50%</u> <u>LIBOR 4.00%</u>
<u>Balance Sheet Flows:</u>			
Loan	6.50%	5.50%	7.50%
Deposit	(3.75%)	(3.75%)	(3.75%)
Spread	2.75%	1.75%	3.75%
<u>Interest Rate Swap Flows:</u>			
Fixed	4.18%	4.18%	4.18%
Floating	(3.00%)	(2.00%)	(4.00%)
Spread	1.18%	2.18%	0.18%
Margin	3.93%	3.93%	3.93%

Buying a Floor on 3-Month LIBOR to Hedge Aggregate Balance Sheet Risk of Loss From Falling Rates

Floor Terms: Buy a 2.50 Percent Floor on 3-Month LIBOR



	<u>Current Rates Constant</u>	<u>Rates Fall 100 Basis Points</u>	<u>Rates Rise 100 Basis Points</u>
	PRIME 5.50%	PRIME 4.50%	PRIME 6.50%
	LIBOR 3.00%	LIBOR 2.00%	LIBOR 4.00%
Balance Sheet			
Flows:			
Loan	6.50%	5.50%	7.50%
Deposit	(3.75%)	(3.75%)	(3.75%)
Spread	2.75%	1.75%	3.75%
Floor Flows:			
Payout	0.00%	0.50%	0.00%
Fee Amort.	(0.30%)	(0.30%)	(0.30%)
Spread	(0.30%)	0.20%	(0.30%)
Margin	2.45%	1.95%	3.45%

Buying a Reverse Collar to Hedge Aggregate Balance Sheet Risk of Loss from Falling Rates

Floating Rate Loans

Prime + 1%

Bank

Fixed 3.75%

Deposits

Strategy: Buy a Floor on 3-Month LIBOR at 2.00 Percent, and Sell a Cap on 3-Month LIBOR at 3.50 Percent

Pay when

Three-Month LIBOR > 3.50%

Receive when

Three-Month LIBOR < 2.00%

Premium: 0.38% per year

Counterparty

		Rates Fall 100 Basis Points	Rates Rise 100 Basis Points
	<u>PRIME 5.50%</u>	<u>PRIME 4.50%</u>	<u>PRIME 6.50%</u>
	<u>LIBOR 3.00%</u>	<u>LIBOR 2.00%</u>	<u>LIBOR 4.00%</u>
Balance Sheet			
Flows:			
Loan	6.50%	5.50%	7.50%
Deposit	(3.75%)	(3.75%)	(3.75%)
Spread	2.75%	1.75%	3.75%
Reverse Collar			
Flows:			
Payout	0.00%	0.50%	(0.50%)
Fee Amort.	0.38%	0.38%	0.38%
Spread	0.38%	0.88%	(0.12%)
Margin	3.13%	2.63%	3.63%

Using a Basic Swap to Hedge Aggregate Balance Sheet Risk of Loss From Rising Rates

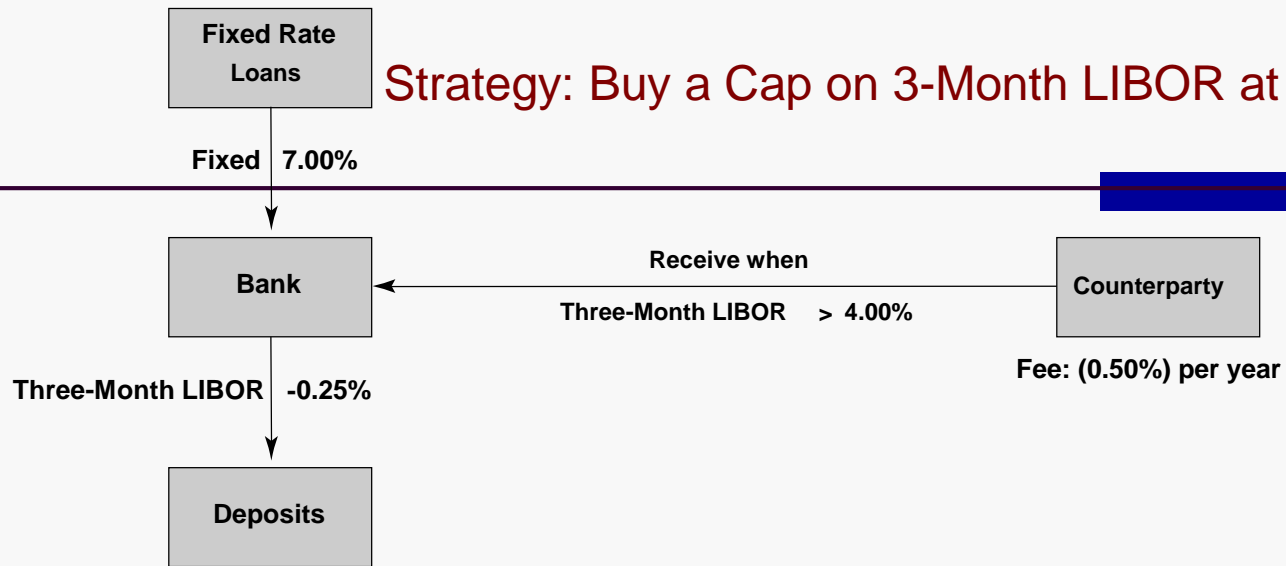
Strategy: Pay 4.19 Percent, Receive 3-Month LIBOR



	Current Rates Constant	Rates Fall 100 Basis Points	Rates Rise 100 Basis Points
LIBOR	<u>3.00%</u>	<u>2.00%</u>	<u>4.00%</u>
Balance Sheet			
Flows:			
Loan	7.00%	7.00%	7.00%
Deposit	<u>(2.75%)</u>	<u>(1.75%)</u>	<u>(3.75%)</u>
Spread	4.25%	5.25%	3.25%
Interest Rate			
Swap Flows:			
Fixed	(4.19%)	(4.19%)	(4.19%)
Floating	<u>3.00%</u>	<u>2.00%</u>	<u>4.00%</u>
Spread	(1.19%)	(2.19%)	(0.19%)
Margin	3.06%	3.06%	3.06%

Buy a Cap on 3-Month LIBOR to Hedge Balance Sheet Rate Risk of Loss from Rising Rates

Strategy: Buy a Cap on 3-Month LIBOR at 4.00 Percent



	<u>Current Rates Constant</u>	<u>Rates Fall 100 Basis Points</u>	<u>Rates Rise 100 Basis Points</u>
	<u>LIBOR 3.00%</u>	<u>LIBOR 2.00%</u>	<u>LIBOR 4.00%</u>
Balance Sheet			
<u>Flows:</u>			
Loan	7.00%	7.00%	7.00%
<u>Deposit</u>	<u>(2.75%)</u>	<u>(1.75%)</u>	<u>(3.75%)</u>
Spread	4.25%	5.25%	3.25%
<u>Cap</u>			
<u>Flows:</u>			
Payout	0.00%	0.00%	0.50%
<u>Fee Amort.</u>	<u>(0.50%)</u>	<u>(0.50%)</u>	<u>(0.50%)</u>
Spread	(0.50%)	(0.50%)	0.00%
Margin	3.75%	4.75%	3.25%

Using a Collar on 3-Month LIBOR to Hedge Balance Sheet Risk of Loss from Rising Rates

Strategy: Buy a Cap at 3.00 Percent, and Sell a Floor at 2.00 Percent



	<u>Current Rates Constant</u>	<u>Rates Fall 100 Basis Points</u>	<u>Rates Rise 100 Basis Points</u>
	<u>LIBOR 3.00%</u>	<u>LIBOR 2.00%</u>	<u>LIBOR 4.00%</u>
<u>Balance Sheet</u>			
<u>Flows:</u>			
Loan	7.00%	7.00%	7.00%
Deposit	(2.75%)	(1.75%)	(3.75%)
Spread	4.25%	5.25%	3.25%
<u>Collar</u>			
<u>Flows:</u>			
Payout	0.00%	(0.00%)	1.00%
Fee Amort.	(0.75%)	(0.75%)	(0.75%)
Spread	(0.75%)	(0.75%)	0.25%
Margin	3.50%	4.50%	3.50%