FINA2204 Tutorial 5: Interest rate swaps

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UWA Business School

Aug 2025

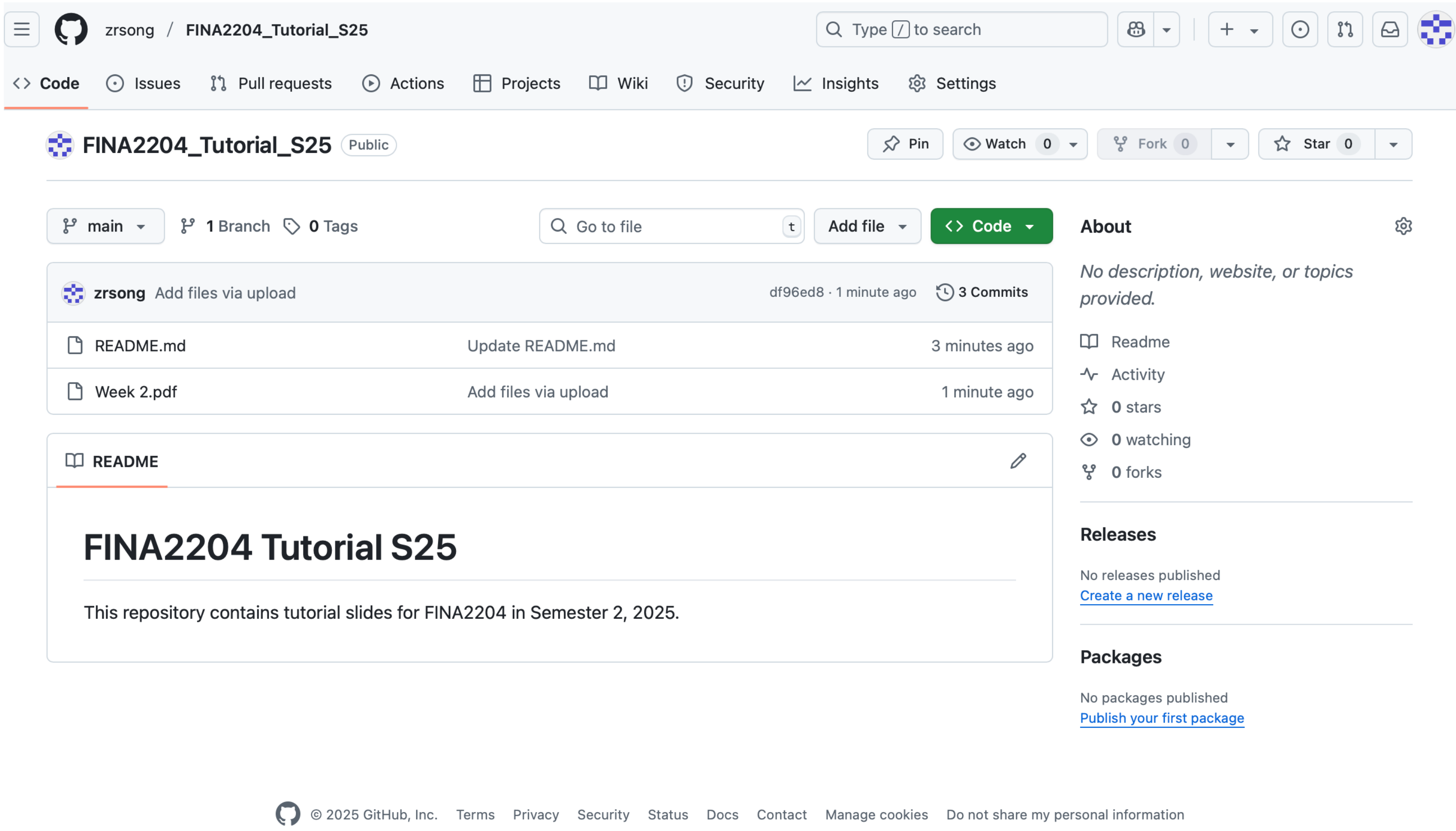
Unit Schedule

Week #	Date Starting	Topic	Preparation	Assessment	Notes
1	21/07/2025	Introduction Forward markets	Ch 1		
2	28/07/2025	Futures markets	Ch 2		Tutorial 1
3	04/08/2025	Hedging with futures	Ch 3		Tutorial 2
4	11/08/2025	Pricing futures contracts	Ch 5	Quiz 1 due	Tutorial 3
5	18/08/2025	Interest rate swaps	Ch 7		Tutorial 4
6	25/08/2025	Currency swaps	Ch 7	Quiz 2 due	Tutorial 5
7	08/09/2025	Mechanics of options	Ch 9	Mid-semester test on 12 September 2025	Tutorial 6
8	15/09/2025	Properties of options	Ch 10		Tutorial 7
9	22/09/2025	Option trading strategies	Ch 11	Quiz 3 due	Tutorial 8
10	29/09/2025	Binomial model	Ch 12, 18		Tutorial 9 The King's Birthday public holiday falls on Monday, 29 September 2025. An alternative lecture will be scheduled for that week.
11	06/10/2025	Black-Scholes-Merton model	Ch 13, 15	Quiz 4 due	Tutorial 10
12	13/10/2025	Option Greeks	Ch 17		Tutorial 11

No tutorial (8.5) in study break week

- The **mid-semester test** contributes 35% towards your final grade and covers material from lectures 1 - 6.
- Time:
- **Friday 12 September, 6.00pm - 8.00pm**
- Venues:
- All students, with the exception of those who have a UniAccess Academic Adjustment Plan (UAAP), will sit their test in **Wesfarmers Lecture Theatre (BUSN 441: G91)**. Students with a UAAP will sit their test in the **Fox Lecture Hall (ARTS 106: G59)**. Students should bring their ID card and be ready to be admitted to their test venue at 6pm.
- Format of Test:
- The test will be of 90 minutes duration and will comprise:
- * 25 multiple choice questions , each worth 1 mark (25 marks)
- * one question where students are required define any five of eight terms, each worth 1 mark (5 marks)
- * one multi-part question based on material in either lecture 3 or lecture 4 (10 marks)
- * one multi-part question based on material in either lecture 5 or lecture 6 (10 marks)
- The test is out of a total of 50 marks.
- Students are permitted a UWA-approved calculator and one single-sided A4 page of notes, typed or handwritten. A formula sheet will be attached to the test paper.

- Slides: **https://github.com/zrsong/FINA2204_Tutorial_S25**



Agenda

- Problem 7.1
- Problem 7.2
- Problem 7.10
- Problem 7.16
- Problem 7.20
- Problem 7.21

Recap: Interest rate swaps

- Interest rate swaps are over-the-counter (OTC) derivatives agreement between two parties to exchange **cash flows** in the future.
- A '***plain vanilla***' interest rate swap is an exchange of a cash flow based on a fixed interest rate for a cash flow based on a floating interest rate for a predetermined number of years.
- *The London Interbank Offered Rate* (**LIBOR**) **was** the most commonly used floating rate in such swaps ('floating rate', e.g., 3m LIBOR; 6m LIBOR). It was the rate of interest at which a AA-rated bank can borrow money from other banks.

Recap: Interest rate swaps

Home / News and publications / The end of LIBOR

The end of LIBOR

Joint press release from the Bank of England, the Financial Conduct Authority (FCA) and the Working Group on Sterling Risk-Free Reference Rates (Working Group)

Published on 01 October 2024

News release

Yesterday, 30 September 2024, the remaining synthetic LIBOR settings were published for the last time and LIBOR came to an end. All 35 LIBOR settings have now permanently ceased.

The transition away from LIBOR, once referenced in an estimated $400 trillion of financial contracts, has made financial markets safer, more stable and fit for modern

Source: Bank of England

Libor scandal + Add to myFT

Tom Hayes asks UK Supreme Court to overturn Libor-rigging conviction

Ex-UBS trader jailed over benchmark-rate manipulation takes fight to Britain's highest court

Tom Hayes was the first person in the world to be found guilty by a jury over the Libor-rigging scandal © Hollie Adams/Bloomberg

Alistair Gray in London

Published MAR 25 2025

Source: Financial Times

Recap: Interest rate swaps

- BBSW (Bank bill swap rates) is one of the key short-term interest rates in Australia.

Bank Bill Swap Rates (Mid) - 10 Day History

ASX

DATE	1 month	2 month	3 month	4 month	5 month	6 month
20/06/2024	4.2950	4.3325	4.3800	4.4988	4.5728	4.6439
19/06/2024	4.2977	4.3319	4.3768	4.4869	4.5550	4.6350
18/06/2024	4.3012	4.3321	4.3714	4.4657	4.5498	4.6090
17/06/2024	4.2950	4.3269	4.3709	4.4475	4.5300	4.5989
14/06/2024	4.2944	4.3259	4.3678	4.4400	4.5225	4.5907
13/06/2024	4.2908	4.3022	4.3659	4.4425	4.5343	4.5900
12/06/2024	4.2940	4.3067	4.3598	4.4550	4.5327	4.6135
11/06/2024	4.2914	4.3050	4.3573	4.4539	4.5250	4.6184
07/06/2024	4.2925	4.3025	4.3537	4.4296	4.5125	4.5900
06/06/2024	4.2882	4.3000	4.3458	4.4420	4.5150	4.5989

3m BBSW **6m BBSW**

Recap: using the swap to transform a liability (case 1 - floating to fixed)

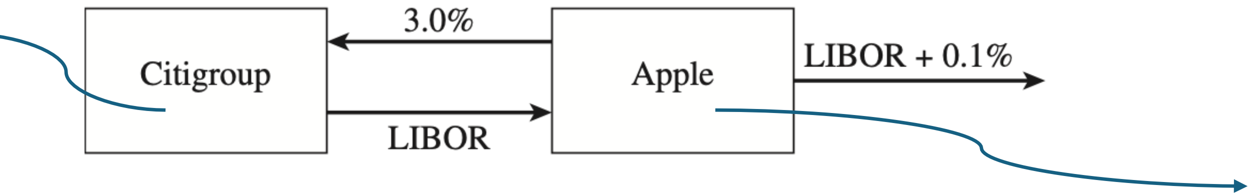
For Apple, the swap could be used to transform a floating-rate loan into a fixed-rate loan, as indicated in Figure 7.2. Suppose that Apple has arranged to borrow \$100 million for three years at LIBOR plus 10 basis points. (One basis point is 0.01%, so the rate is LIBOR plus 0.1%.) After Apple has entered into the swap, it has three sets of cash flows:

1. It pays LIBOR plus 0.1% to its outside lenders.
2. It receives LIBOR under the terms of the swap.
3. It pays 3% under the terms of the swap.

$$\textit{Net cost of fund} = (\textit{LIBOR} + 0.1\%) + 3\% - \textit{LIBOR} = 3.1\%$$

These three sets of cash flows net out to an interest rate payment of 3.1%. Thus, for Apple the swap could have the effect of transforming borrowings at a floating rate of LIBOR plus 10 basis points into borrowings at a fixed rate of 3.1%.

Floating rate payer



Fixed rate payer

Figure 7.2 Apple uses the swap in Figure 7.1 to convert floating-rate borrowings into fixed-rate borrowings

Recap: using the swap to transform a liability (case 1 - floating to fixed)

- In a ‘plain vanilla’ swap, the floating rate must **be benchmark rate itself** (e.g., 6m LIBOR, 3m BBSW), because any adjustment (like +/– basis points) is already captured in the fixed rate, and adding a spread would turn it into a customized swap.
- In Apple’s case, the +0.1% **credit spread** stays with its original borrowing, while the swap with Citigroup exchanges fixed 3.0% for pure LIBOR only.

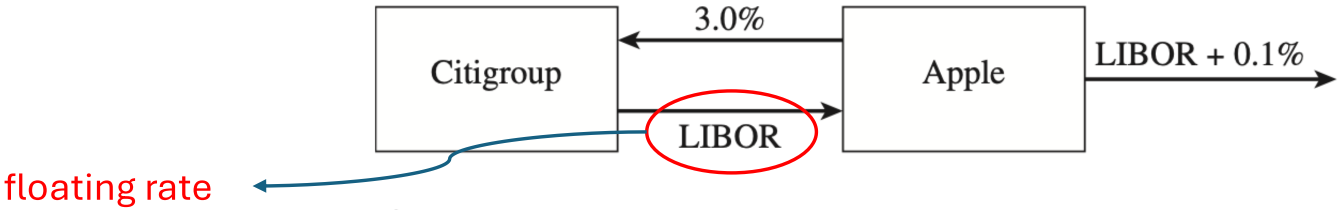


Figure 7.2 Apple uses the swap in Figure 7.1 to convert floating-rate borrowings into fixed-rate borrowings

Recap: using the swap to transform a liability (case 2 - fixed to floating)

A company wishing to transform a fixed-rate loan into a floating-rate loan would enter into the opposite swap. Suppose that Intel has borrowed \$100 million at 3.2% for three years and wishes to switch to a floating rate linked to LIBOR. Like Apple it contacts Citigroup. We assume that it agrees to enter into the swap shown in Figure 7.3. It pays LIBOR and receives 2.97%. Its position would then be as indicated Figure 7.4. It has three sets of cash flows:

1. It pays 3.2% to its outside lenders.
2. It pays LIBOR under the terms of the swap.
3. It receives 2.97% under the terms of the swap.

$$\boldsymbol{Net\ cost\ of\ fund = LIBOR + (3.2\% - 2.97\%)}$$

These three sets of cash flows net out to an interest rate payment of LIBOR plus 0.23% (or LIBOR plus 23 basis points). Thus, for Intel the swap could have the effect of transforming borrowings at a fixed rate of 3.2% into borrowings at a floating rate of LIBOR plus 23 basis points.

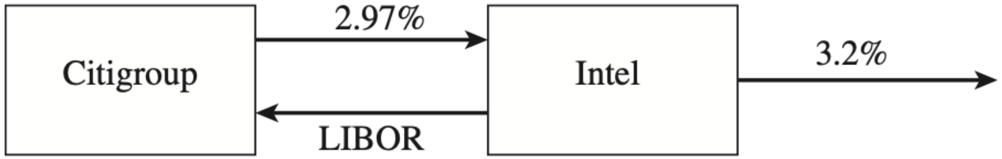


Figure 7.4 Intel uses the swap in Figure 7.3 to convert fixed-rate borrowings into floating-rate borrowings

Recap: using the swap to transform an asset (case 3 - floating to fixed)

Consider next the swap entered into by Intel in Figure 7.3. The swap could have the effect of transforming an asset earning a floating rate of interest into an asset earning a fixed rate of interest. Suppose that Intel has an investment of $100 million that yields LIBOR minus 20 basis points. After it has entered into the swap, it is in the position shown in Figure 7.6. It has three sets of cash flows:

1. It receives LIBOR minus 20 basis points on its investment.
2. It pays LIBOR under the terms of the swap.
3. It receives 2.97% under the terms of the swap.

These three sets of cash flows net out to an interest rate inflow of 2.77%. Thus, one possible use of the swap for Intel is to transform an asset earning LIBOR minus 20 basis points into an asset earning 2.77%.

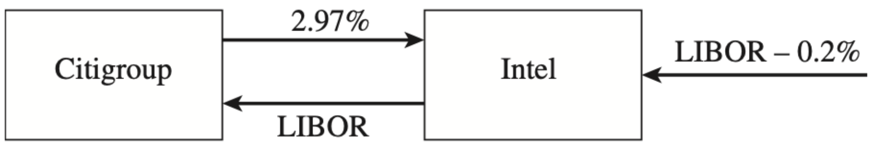


Figure 7.6 Intel uses the swap in Figure 7.3 to convert a floating-rate investment into a fixed-rate investment

Recap: using the swap to transform an asset (case 4 - fixed to floating)

Swaps can also be used to transform the nature of an asset. Consider Apple in our example. The swap in Figure 7.1 could have the effect of transforming an asset earning a fixed rate of interest into an asset earning a floating rate of interest. Suppose that Apple owns $100 million in bonds that will provide interest at 2.7% per annum over the next three years. After Apple has entered into the swap, it is in the position shown in Figure 7.5. It has three sets of cash flows:

1. It receives 2.7% on the bonds.
2. It receives LIBOR under the terms of the swap.
3. It pays 3% under the terms of the swap.

These three sets of cash flows net out to an interest rate inflow of LIBOR minus 30 basis points. The swap has therefore transformed an asset earning 2.7% into an asset earning LIBOR minus 30 basis points.

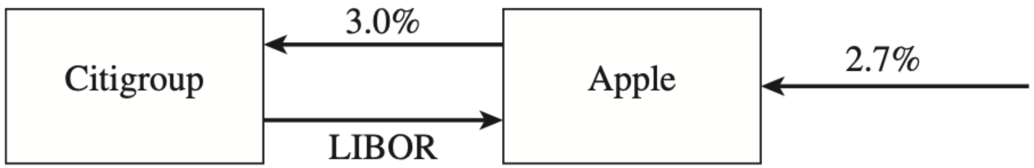


Figure 7.5 Apple uses the swap in Figure 7.1 to convert a fixed-rate investment into a floating-rate investment

Recap: quotes of a swap 'market maker'

- Bid: the fixed rate the dealer is willing to pay if the counterparty wants to **receive fixed** and pay floating.
- Offer (Ask): the fixed rate the dealer is willing to receive if the counterparty wants to **pay fixed** and receive floating.

Table 7.3 Bid and offer fixed rates in the swap market for a swap where payments are exchanged semiannually (percent per annum)

Maturity (years)	*Bid*	*Offer*	*Swap rate*
2	2.55	2.58	2.565
3	2.97	3.00	2.985
4	3.15	3.19	3.170
5	3.26	3.30	3.280
7	3.40	3.44	3.420
10	3.48	3.52	3.500

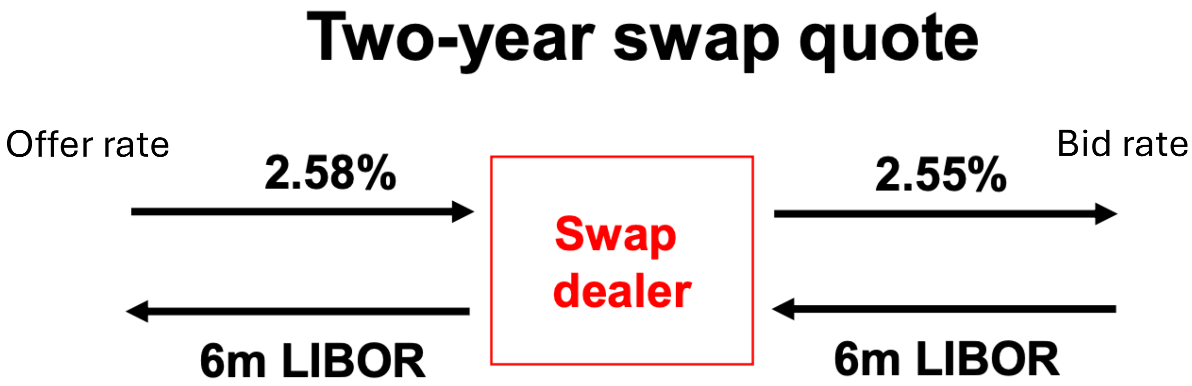
$$= \frac{bid + offer}{2}$$

The actual quotes used when entering into a swap contract with a dealer.

Benchmark rate for valuing swaps, constructing swap yield curve, and as a market reference.

Recap: quotes of a swap ‘market maker’

- The dealer earns money from the bid-offer spread.
- If one client wants to receive fixed, the dealer pays fixed at 2.55%.
- If another client want to pay fixed, the dealer receives fixed at 2.58%.
- The dealer locks in a spread of 0.03% (3 basis points).



Problem 7.20

*(a) Company A has been offered the rates shown in Table 7.3. It can **borrow** for three years at 3.45%. What floating rate can it swap this fixed rate into?*

*(b) Company B has been offered the rates shown in Table 7.3. It can **borrow** for 5 years at LIBOR plus 75 basis points. What fixed rate can it swap this floating rate into? Explain the rollover risks that Company B is taking*

Table 7.3 Bid and offer fixed rates in the swap market for a swap where payments are exchanged semiannually (percent per annum)

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7	3.40	3.44	3.420
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Source: textbook, p.185

Answer 7.20

- (a) Company A can pay LIBOR and receive 2.97% for three years. It can therefore exchange a loan at 3.45% into a loan at LIBOR plus 0.48%.
- Cost of funds = 3.35% + (LIBOR – 2.79%) = LIBOR + 0.48%

	Company A
Funding	3.45%
Swap: Pay (+)	LIBOR
Receive (-)	2.97%
Net cost of fund	LIBOR+0.48%

Answer 7.20

- (b) Company B can receive LIBOR and pay 3.30% for five years. It can therefore exchange a loan at LIBOR plus 0.75% for a loan at 4.05%. But there is a danger that the spread it pays over LIBOR on the loan increases during the five years.
- Cost of funds = LIBOR + 0.75% + (3.30% – LIBOR) = 4.05%

	Company B
Funding	LIBOR+0.75%
Swap: Pay (+)	3.30%
Receive (-)	LIBOR
Net cost of fund	4.05%

Problem 7.21

*(a) Company X has been offered the rates shown in Table 7.3. It can **invest** for four years at 2.8%. What floating rate can it swap this fixed rate into?*

*(b) Company Y has been offered the rates shown in Table 7.3. It is confident that it will be able to **invest** at LIBOR minus 50 basis points for the next ten years. What fixed rate can it swap this floating rate into?*

Table 7.3 Bid and offer fixed rates in the swap market for a swap where payments are exchanged semiannually (percent per annum)

Maturity (years)	*Bid*	*Offer*	*Swap rate*
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7	3.40	3.44	3.420
10	$\boxed{3.48}$	3.52	3.500

Answer 7.21

- (a) Company X can pay 3.19% for four years and receive LIBOR. It can therefore exchange the investment at 2.8% for an investment at LIBOR minus 0.39%.
- Return = 2.8% + (LIBOR – 3.19%) = LIBOR – 0.39%

	Company X
Investment	2.8%
Swap: Pay (-)	3.19%
Receive (+)	LIBOR
Net **return** of investment	LIBOR-0.39%

Answer 7.21

- Company Y can receive 3.48% and pay LIBOR for 10 years. It can therefore exchange an investment at LIBOR minus 0.5% for an investment at 2.98%.
- Return = (LIBOR – 0.50%) + (3.48% – LIBOR) = 2.98%

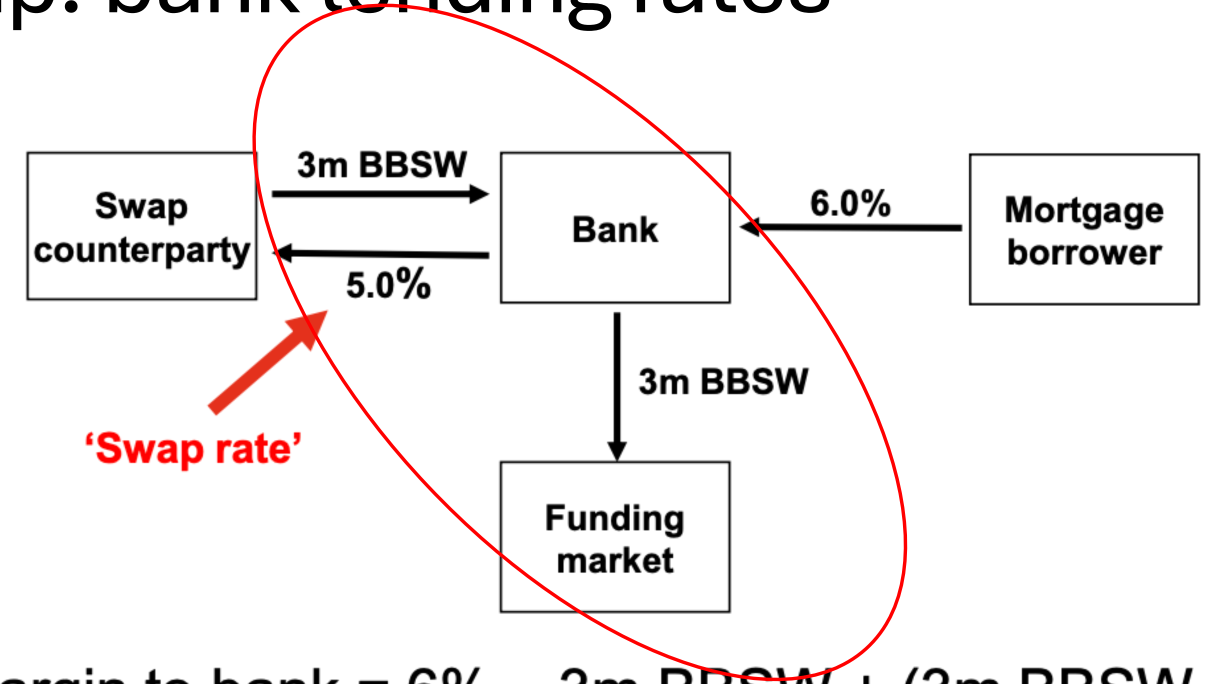
	Company Y
Investment	LIBOR-0.50%
Swap: Pay (-)	LIBOR
Receive (+)	3.48%
Net **return** of investment	2.98%

Recap: bank lending rates

Why banks use swaps when lending fixed-rate loans?

- Banks usually fund themselves at floating rates (e.g., BBSW).
- If they lend at fixed rate, their cost (floating) and income (fixed) don’t match → interest rate risk.
- By entering a swap (pay fixed, receive floating), banks convert their floating funding into fixed, so assets and liabilities are aligned.

Recap: bank lending rates



Net margin to bank = 6% – 3m BBSW + (3m BBSW – 5%) = 1%

Loan rate = Swap rate + 1%

Problem 7.16

- *A bank finds that its assets are not matched with its liabilities. It is taking floating-rate deposits and making fixed-rate loans. How can swaps be used to offset the risk?*

Answer 7.16

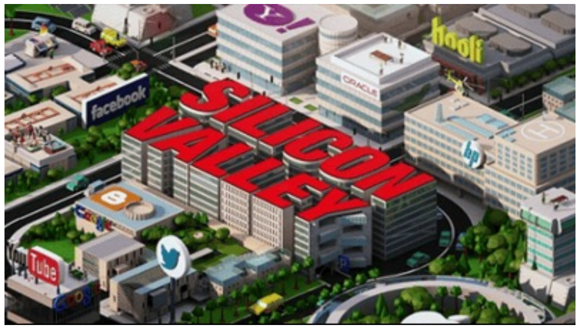
- The bank is paying a floating-rate on the deposits and receiving a fixed-rate on the loans. It can offset its risk by entering into interest rate swaps (with other financial institutions or corporations) in which it contracts to **pay fixed and receive floating**.

Recap: comparative advantage

- Definition: A situation where an individual, business, or country can produce a good or service at a lower opportunity cost than another producer (*Principles Of Economics by N Gregory Mankiw*).

Western Australia, Australia $\xleftrightarrow{\text{trade}}$ **California, U.S.**

Iron



Software

Recap: comparative advantage

- Suppose that two companies, AAACorp (with AAA credit rating) and BBBCorp (with BBB credit rating), both wish to borrow $10 million for five years.
- We assume that BBBCorp wants to borrow at a fixed rate of interest, whereas AAACorp wants to borrow at a floating rate of interest linked to six-month LIBOR.

AAA Corp and BBB Corp face the following funding rates:

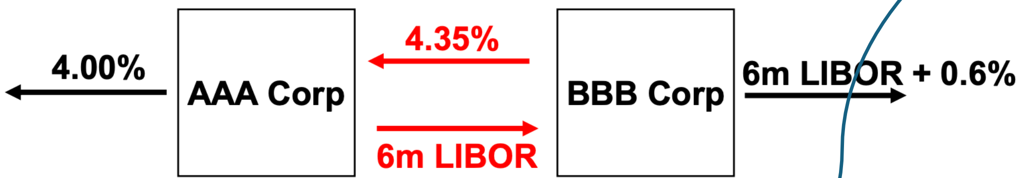
	AAA Corp	BBBB Corp	Spread
Fixed rate	4.0%	5.2%	1.2%
Floating rate	6m LIBOR-0.1%	6m LIBOR+0.6%	0.7%
		Credit spread differential	0.5%

Recap: comparative advantage

- Even though BBB Corp pays more than AAA Corp in both the fixed-rate and floating-rate markets (1.2% and 0.7%), comparative advantage is about the **relative gap** (1.2% > 0.7%), not who is absolutely cheaper.
- Analogy: running race — AAA always wins, but in the 100-meter race it wins by 12 seconds, while in the 200-meter race it wins by only 7 seconds. Even though BBB never wins outright, it loses by less in the 200-meter race.

Recap: comparative advantage

- By entering a swap where AAA pays 6m LIBOR and receives 4.35% fixed from BBB, both firms end up better off:



Step		AAA Corp	BBB Corp
1	Funding:	4.0%	6m LIBOR + 0.6%
	Swap: Receive	4.35%	6m LIBOR
5	Pay	6m LIBOR	4.35%
4	**Net cost of funds**	6m LIBOR – 0.35%	4.95%
3	Direct cost of funds	6m LIBOR – 0.10%	5.20%
2	**Savings**	0.25%	0.25%

Recap: comparative advantage

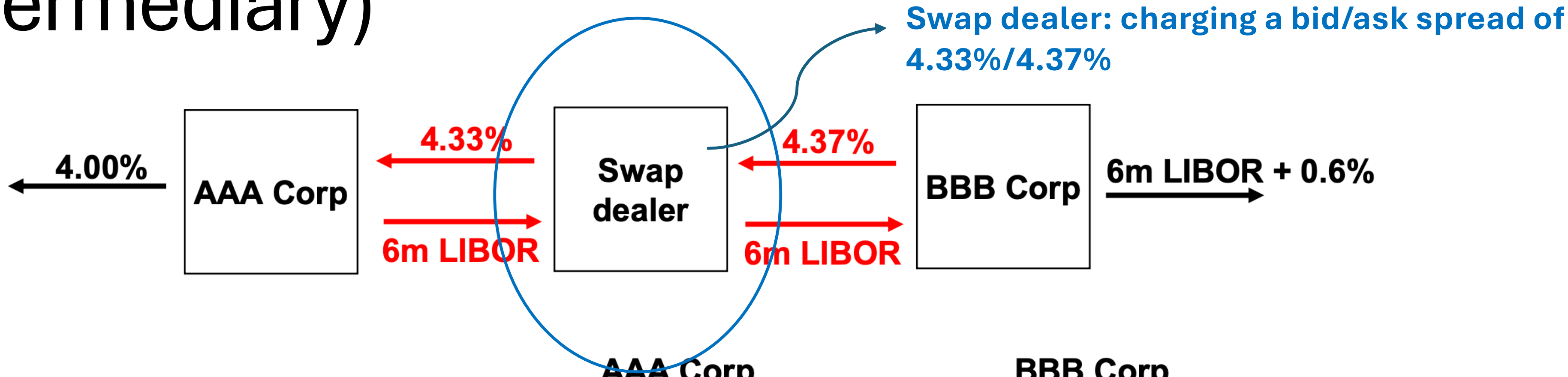
For AAA Corp,

- Step 1 (funding): AAA borrows in the fixed-rate market at 4%, where it has a comparative advantage;
- Step 2 (savings): the spread differential is 0.5%, so AAA can expect to save half of this (0.25%) from the swap;
- Step 3 (Direct cost of funds): if AAA borrows directly in floating, it would pay LIBOR – 0.1%;

Recap: comparative advantage

- Step 4 (Net cost of funds): Instead, AAA's effective floating rate cost becomes LIBOR – 0.35% (direct floating LIBOR – 0.1% minus savings 0.25%) by entering into a swap with BBB;
- Step 5 (Pay; receive): In a plain vanilla interest rate swap, the floating leg is always be pure LIBOR, so AAA pays LIBOR to BBB; To net out at LIBOR – 0.35%, AAA must receive 4.35% fixed in the swap.

Recap: comparative advantage (with intermediary)



	AAA Corp	BBB Corp
Funding:	4.0%	6m LIBOR + 0.6%
Swap: Receive	4.33%	6m LIBOR
Pay	6m LIBOR	4.37%
Net cost of funds	6m LIBOR – 0.33%	4.97%
Direct cost of funds	6m LIBOR – 0.10%	5.20%
Savings	0.23%	0.23%

Note: AAA Corp, BBB Corp and swap dealer have shared gains of 0.50% in the ratio 0.23%:0.23%:0.04% (4.37%-4.33%).

Problem 7.1

- *Companies A and B have been offered the following rates per annum on a $20 million five year loan:*

	Fixed rate	Floating rate
Company A	5.0%	LIBOR + 0.1%
Company B	6.4%	LIBOR + 0.6%

- *Company A requires a floating-rate loan; Company B requires a fixed rate loan. Design a swap that will net a bank, acting as intermediary, 0.1% per annum and that will appear equally attractive to both companies.*

Answer 7.1

- A has an apparent **comparative advantage** in fixed-rate markets but wants to borrow floating. B has an apparent comparative advantage in floating-rate markets but wants to borrow fixed. This provides the basis for the swap.
- There is a 1.4% per annum differential between the fixed rates offered to the two companies and a 0.5% per annum differential between the floating rates offered to the two companies. The total gain to all parties from the swap is therefore 1.4 − 0.5 = 0.9% per annum. Because the bank gets 0.1% per annum of this gain, the swap should make each of A and B 0.4% per annum better off.

Answer 7.1

- The swap terms can be found by solving the following table. Solve in order: 1, 2, 3, 4 then 5. Remember the floating rate leg of the swap is always the floating rate flat, in this case LIBOR.

	Step	Company A	Company B
Funding:	1	5.0%	LIBOR + 0.6%
Swap: Pay	5	**LIBOR**	**?**
Receive		**?**	**LIBOR**
Net cost of funds	4	LIBOR – 0.3%	6.0%
Direct cost	3	LIBOR + 0.1%	6.4%
Saving	2	0.4%	0.4%

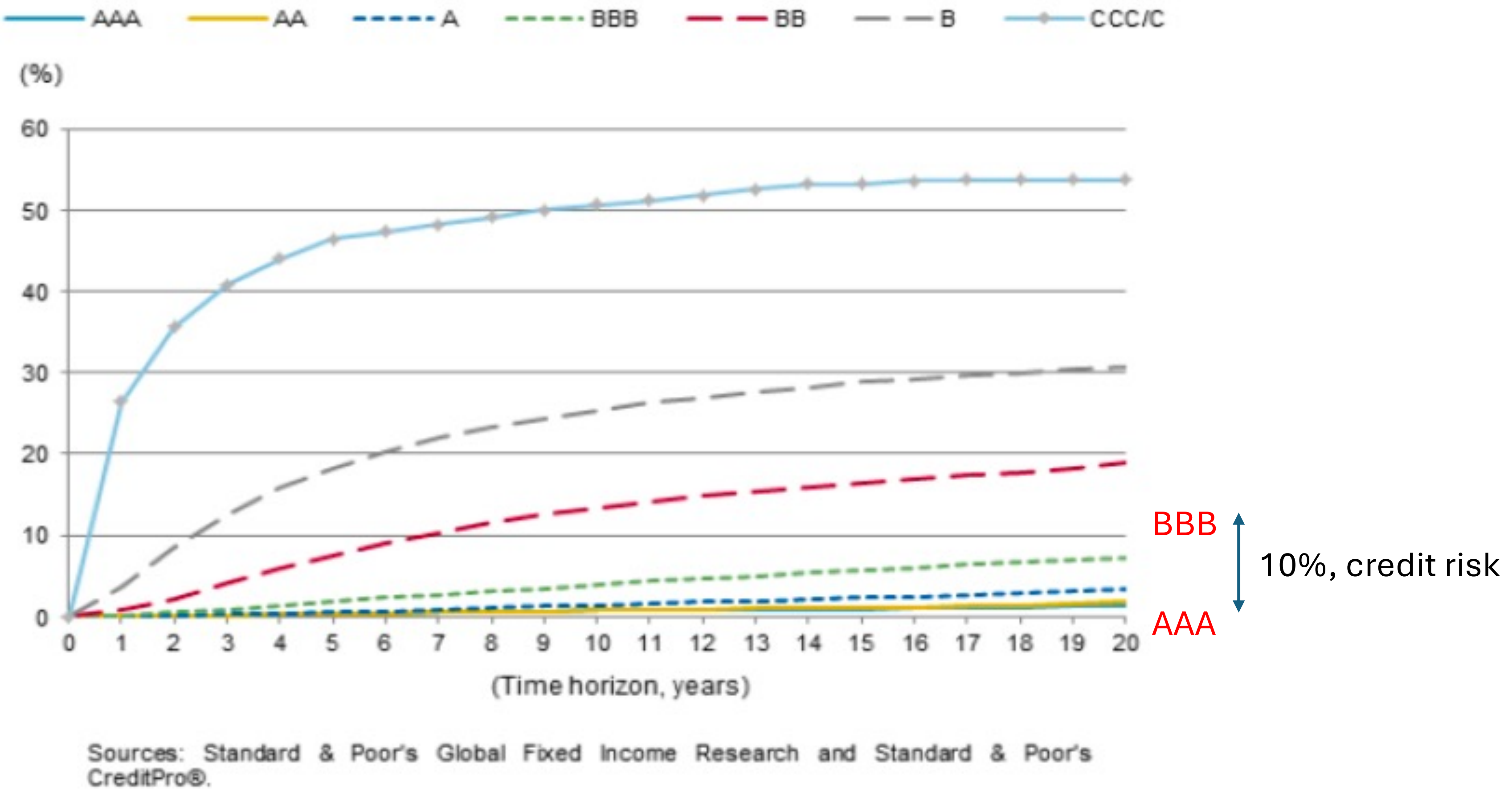
$$5\% + LIBOR - Receive = LIBOR - 0.3\%$$
$$Receive = 5.3\%$$

$$LIBOR + 0.6\% + Pay - LIBOR = 6\%$$
$$Pay = 5.4\%$$

Answer 7.1

- Company B must pay the financial institution 5.4% and the latter pays Company A 5.3%. The difference is the financial institution's spread of 0.1%.
- This means that it should lead to A borrowing at LIBOR − 0.3% and to B borrowing at 6%. The appropriate arrangement is therefore as shown in the diagram below.

Recap: criticism of comparative advantage



Cumulative default rates, 1981 - 2015

Recap: criticism of comparative advantage

- The comparative advantage argument is **illusory**.
- For BBB, the swap only delivers a "cheap" fixed rate if it can keep borrowing at LIBOR +0.6%, but as its credit spread likely widens, its effective cost may become higher than borrowing fixed directly.
- For AAA, while it appears to lock in LIBOR – 0.3%, it now bears **counterparty default risk** from the swap, which it would not face if it borrowed floating directly.

Recap: valuation of interest rate swaps

- The value of a swap is the net present value (NPV) of the two cash flow streams that are being exchanged:

  Value of swap = PV(cash inflows) – PV(cash outflows) = PV(net cash flows)

- On initiation, a swap has a value of **zero**. But subsequently, as interest rates change, the value of the swap will be either positive or negative.
- We can use the portfolio of FRAs (Forward Rate Agreement) approach to value a swap. why?

Recap: valuation of interest rate swaps

- Three-step procedure for valuing a swap:

1. calculate forward rates from the LIBOR curve;
2. calculate floating rate cash flows on the swap under the assumption that future LIBOR rates will equal forward rates
3. discount the **net cash flows** of the swap using the risk-free yield curve and zero-coupon valuation technique.

Example 7.1 Valuing an interest rate swap using FRAs

Swap objective: Pay fixed, receive floating

Suppose that some time ago a financial institution entered into a swap where it agreed to make semiannual payments at a rate of 3% per annum and receive LIBOR on a notional principal of \$100 million. The swap now has a remaining life of 1.25 years. Payments will therefore be made 0.25, 0.75, and 1.25 years from today. The risk-free rates with continuous compounding for maturities of 3 months, 9 months, and 15 months are 2.8%, 3.2%, and 3.4%. We suppose that the forward LIBOR rates for the 3- to 9-month and the 9- to 15-month periods are 3.4% and 3.7%, respectively, with continuous compounding. Using equation (4.4), the 3- to 9-month forward rate becomes $2 \times (e^{0.034 \times 0.5} - 1)$ or 3.429% with semiannual compounding. Similarly, the 9- to 15-month forward rate becomes 3.734% with semiannual compounding. The LIBOR rate applicable to the exchange in 0.25 years was determined 0.25 years ago. Suppose it is 2.9% with semiannual compounding. The calculation of swap cash flows on the assumption that LIBOR rates will equal forward rates and the discounting of the cash flows are shown in the following table (all cash flows are in millions of dollars).

FRA (c.c) → FRA (s.a)

$$R_m = m \times \left(e^{R_c/m} - 1\right) \quad (4.4)$$

$\text{FRA (s. a.)} = 2 \times \left(e^{0.0340/2} - 1\right) = 0.03429 \text{ or } 3.429\%$

$\text{Fixed cash flow} = \$100\text{m} \times \frac{0.0300}{2} = \$1.5000\text{m}$

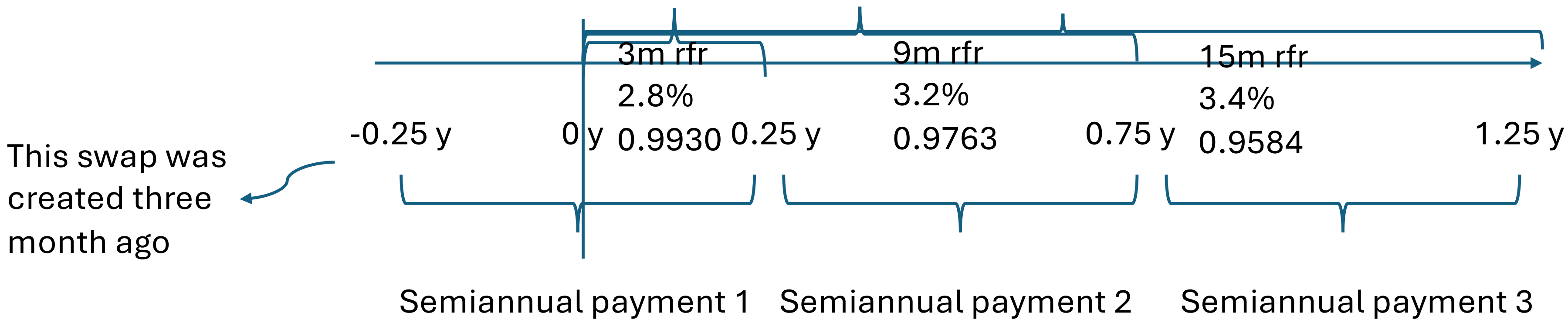
$\text{Floating cash flow} = \$100\text{m} \times \frac{0.03429}{2} = \$1.7145m$

$\text{Discount factor} = e^{-0.032 \times 0.75} = 0.9763$

Time (years)	*Fixed cash flow*	*Floating cash flow*	*Net cash flow*	*Discount factor*	*Present value of net cash flow*
0.25	–1.5000	+1.4500	–0.0500	0.9930	–0.0497
0.75	–1.5000	+1.7145	+0.2145	0.9763	+0.2094
1.25	–1.5000	+1.8672	+0.3672	0.9584	+0.3519
Total					0.5117

The value of the swap is obtained by summing the present values. It is \$0.5117 million.

Source: textbook, p.190



item	Amount		
Fixed rate	3%		
Fixed payment	$100\ milion \times \frac{3\%}{2} = 1.5000m$		
Floating rate	2.9%	3.4%	3.7%
Floating payment	$100\ milion \times \frac{2.9\%}{2} = 1.4500m$	$100\ milion \times \frac{3.4\%}{2} = 1.7145m$	$100\ milion \times \frac{3.7\%}{2} = 1.8672m$
NPV of Net cash flow	(1.4500-1.500)*0.9930 +	(1.7145-1.500)*0.9763 +	(1.8672-1.500)*0.9584
NPV of Net cash flow (counterparty)	-(1.4500-1.500)*0.9930 +	-(1.7145-1.500)*0.9763 +	-(1.8672-1.500) *0.9584

Zero-sum game

+0.5117

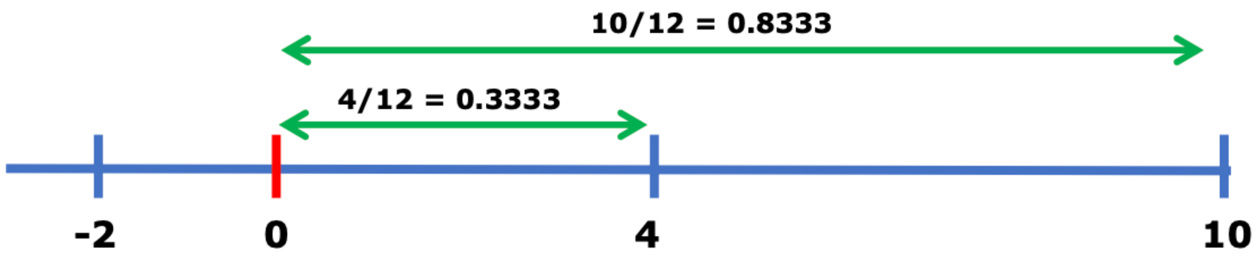
-0.5117

Problem 7.2

- *A $100 million interest rate swap has a remaining life of 10 months. Under the terms of the swap, six-month LIBOR is exchanged for 4% per annum (compounded semi-annually). Six-month LIBOR forward rates for all maturities are 3% (with semi-annual compounding). The six-month LIBOR rate was 2.4% two months ago. OIS rates for all maturities are 2.7% with continuous compounding. What is the current value of the swap to the party paying floating? What is the value to the party paying fixed?*

Answer 7.2

- Since the floating rate is six-month LIBOR, the swap is a semi-annual swap i.e. interest payments are exchanged at six-monthly intervals.



Principal ($m)	100
Fixed rate	4.00%
Floating rate	6m LIBOR

Answer 7.2

Time (Years)	Risk-free rate (c.c.)	FRA (s.a.)	Fixed cash flow	Floating cash flow	Net cash flow	Discount factor	PV of net cash flow
0.3333	2.70%	2.40%	2.0000	-1.2000	0.8000	0.9910	0.7928
0.8333	2.70%	3.00%	2.0000	-1.5000	0.5000	0.9778	0.4889
						Value of swap	1.2817

- The value of the swap to the party paying floating is \$1.2817 million. For the party paying fixed, the value is −\$1.2817.
- Consider the party paying floating. The first forward contract involves paying \$1.2 million and receiving \$2.0 million in four months. It has a value of

$$100\times(0.04\times0.5-0.024\times0.5)e^{-0.027\times4/12}=\$0.7928\,million$$

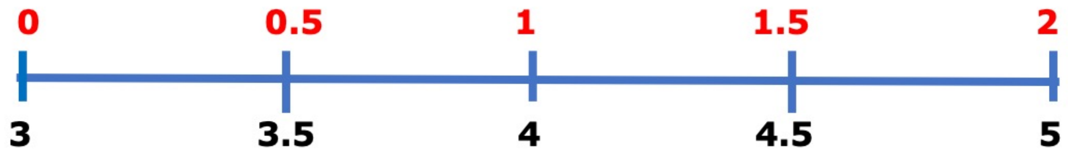
Answer 7.2

- To value the second forward contract, we note that the forward interest rate is 3% per annum with semi-annual compounding. The value of the forward contract is
$$100\times(0.04\times0.5-0.03\times0.5)e^{-0.027\times10/12}=\$0.4889\,million$$
- The total value of the forward contracts is therefore \$0.7928 + \$0.4889 = \$1.2817 million. This is the value of the swap to the party paying floating. For the party paying fixed, the value is −\$1.2817.

Problem 7.10

- *A financial institution has entered into an interest rate swap with company X. Under the terms of the swap, it receives 4% per annum and pays six-month LIBOR on a principal of $10 million for five years. Payments are made every six months. Suppose that company X* ***defaults*** *on the sixth payment date (end of year 3) when the six-month forward LIBOR rates for all maturities are 2% per annum. What is the loss to the financial institution? Assume that six-month LIBOR was 3% per annum halfway through year 3 and that at the time of default all OIS rates are 1.8% per annum. OIS rates are expressed with continuous compounding; other rates are expressed with semi-annual compounding.*

Answer 7.10



Principal ($m)	10
Fixed rate	4.00%
Floating rate	6m LIBOR

Time (Years)	Risk-free rate (c.c.)	FRA (s.a.)	Fixed cash flow	Floating cash flow	Net cash flow	Discount factor	PV of net cash flow
0.0	1.80%	3.00%	0.2000	-0.1500	0.0500	1.0000	0.0500
0.5	1.80%	2.00%	0.2000	-0.1000	0.1000	0.9910	0.0991
1.0	1.80%	2.00%	0.2000	-0.1000	0.1000	0.9822	0.0982
1.5	1.80%	2.00%	0.2000	-0.1000	0.1000	0.9734	0.0973
2.0	1.80%	2.00%	0.2000	-0.1000	0.1000	0.9646	0.0965
						Value of swap	0.4411

- The cost of the default to the financial institution is $0.441 million.

Answer 7.10

- At the end of year 3 the financial institution was due to receive \$200,000 (=0.5×4% of \$10 million) and pay \$150,000 (=0.5×3% of \$10 million). The immediate loss is therefore \$50,000.
- To value the remaining swap we assume that LIBOR forward rates are realized. All forward rates are 2% per annum. The remaining cash flows are therefore valued on the assumption that the floating payment is 0.5×0.02×10,000,000 = \$100,000. The fixed payment is \$200,000 and the net payment that would be received is 200,000−100,000=\$100,000. The total cost of default is therefore the cost of foregoing the following cash flows:

Answer 7.10

- Discounting these cash flows to year 3 at 1.8% per annum, we obtain the cost of the default as \$441,120.

$$50{,}000 + 100{,}000 \times e^{-0.018\times 6/12} + 100{,}000 \times e^{-0.018\times 12/12} + 100{,}000 \times e^{-0.018\times 18/12} + 100{,}000 \times e^{-0.018\times 24/12} = \$441{,}120$$