EC372 Bond and Derivatives Markets
Topic #8: Swap contracts & swap markets

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Outline

Contents

Reading: *Economics of Financial Markets*, chapter 17

1 Swap contracts

Swaps: examples

- Simple example (currency swap):
  - A and B agree that 6 months from now A will pay £1m to B in return for \$1.44m
  - This trivial currency swap is a forward contract
  - Swaps are almost always for a sequence of exchanges
  - Swaps are often expressed as interest rate flows
- More realistic example (currency swap):
  - Current exchange rate: £1=\$1.60
  - Sterling interest rate: £10%, Dollar interest rate \$9%
  - Swap agreement: £10% on £20m for \$9% on \$32m
  - Notional principal = £20m
  - £1m $= \frac{1}{2} \times 10\% \times$£20m swapped for \$1.44m $= \frac{1}{2} \times 9\% \times$\$32m, every 6 months
- Intermediary: swaps are commonly arranged by an intermediary
- Swaps are Over The Counter, OTC, 'tailor-made' for the parties

Swaps, continued

- Plain vanilla interest rate swap:
  - fixed interest rate payments are exchanged for a stream of floating interest payments
  - Floating rate determined according to an agreed rule, e.g. LIBOR+40b.p.
  - Interest rate swap $\equiv$ sequence of forward contracts: – 'long' swaps fixed in return for floating rate – 'short' swaps floating in return for fixed rate
- Credit Default Swap (CDS):
  - A makes regular payments to B
  - A receives nothing from B, unless default occurs on a 'specified asset' (e.g. a bond)
  - If A holds the specified asset, the CDS is an 'insurance policy' against bond default
  - *Naked* CDS: A does not hold the specified asset
    – *speculation* on default of the specified asset?

Credit default swap: more detail

In a typical credit default swap one party makes regular payments but receives nothing in return unless default occurs on an asset specified in the contract. In the event of default, the first party (that made the sequence of payments) receives a lump-sum amount from the counterparty, and the swap terminates. Thus a credit default swap is a form of insurance contract for which each regular payment is effectively a premium and 'default' is the contingency against which insurance is obtained.

More formally, suppose that the parties to the swap are identified as companies A and B. A third company (or sovereign state), C, has issued a debt instrument, C-bonds, which are risky in the sense that C might renege on some aspect of the bond contract (e.g. fail to make coupon payments or the repay the principal). A credit default swap could specify that (i) A pays an *agreed amount* to B every six months during the life of the C-bonds; (ii) B pays nothing to A unless a *credit event* occurs, at which time B makes a *one-off payment* to A. The *agreed amount* would be fixed in advance (it would depend on the notional number of C-bonds) or determined according to a stipulated rule (commonly based on the value of a floating rate of interest at each payment date). The *credit event* is typically defined to be the failure of C to fulfil some aspect of its contractual obligation with respect to the C-bonds.The *one-off payment* by B to A triggered by the credit event is typically the payoff promised (but not delivered) in the C-bond contract. It could, for example, be the face value of the C-bonds if the credit event is a default at their redemption date.

Swaps: more illustrations

- Other common types:
  1. *Commodity* swap: exchange of market values
  2. *Total return* swap: exchange returns on two assets
- *Longevity* swaps – an emerging market?
  - Exchange of a fixed stream for a stream that depends on the mortality of a defined pool of individuals
- Some swap-related contracts:

1. 'Calendar strips': bundles of futures contracts
2. 'Swap futures': futures on swaps (a variety of bond futures)
3. 'Swaptions': options on swap agreements (not swaps of options!)

- *Why* do swaps occur?
  - Trivial answer: investors find them worthwhile. But why do they find them worthwhile?
  - One justification: to exploit *comparative advantage*

Swaptions: more detail

Swaptions are options on swap agreements. For example, a company may know that in 6 months time it will seek to enter into a swap agreement but does not know, today, the terms of such an agreement (in particular, the level of the fixed rate or the mark-up over the the floating rate). The company could enter into an agreement (perhaps via an intermediary) to take an option on a swap, the terms of which are stipulated at the outset. The company would naturally pay a fee (premium) for this privilege. In 6 months time the option would be exercised, or allowed to die, according to changes to interest rates over the intervening period and alterations in the company's plans.

A swaption is similar to a forward rate agreement (in which the swap is agreed today but begins at future date), except that it can be allowed to lapse, whereas a forward rate agreement is an unconditional contract to implement the swap. The option premium is the payment for the freedom to let the swaption lapse at expiry. Swaptions, like swaps, are customized OTC agreements, not normally traded on organized exchanges.

2 Why swaps occur: 'comparative advantage'

2.1 Example: plain vanilla interest rate swap

Plain vanilla interest rate swap

- Example: A and B both plan to borrow £10m for 8 years

	Fixed	Floating
Company A	10.00%	LIBOR+ 80b.p.
Company B	8.50%	LIBOR+ 30b.p.

- B has an *absolute* advantage (lower borrowing cost)
- Interest rate differentials:
  - Fixed rate: 150b.p.
  - Floating rate: 50b.p.
  - A has a *comparative* advantage in floating rate market
- Whether a swap is justified depends on *preferences*:
  - Assume that preferences are *contrary* to comparative advantage
  - Assume: A prefers to borrow at a fixed rate
  - Assume: B prefers to borrow at a floating rate

Interest rate swap, continued

- Mutually beneficial agreement:
  1. A borrows £10m for 8 years at LIBOR + 80b.p. (floating rate)
  2. B borrows £10m for 8 years at 8.50% (fixed rate)
  3. *Swap*: – A pays 9.25% in return for LIBOR + 45b.p. – B pays LIBOR + 65b.p. in return for 9.25%. – Intermediary collects 20b.p.
- All parties gain:
  - A's net cost is at a fixed rate $9.60\% < 10\%$
  - B's net cost is: LIBOR− 10b.p. < LIBOR+ LIBOR 30b.p.
  - Intermediary gains 20b.p.
- Note: the agreement is just an *example*, not the only outcome
  - What matters is that A and B pay according to their *preferences*
  - And at rates less than they would pay by directly *without* the swap

The payoffs on the plain vanilla interest rate swap are as follows:

Company A	Capital market:	Pay	LIBOR+ 80b.p.
	Swap agreement:	Pay	9.25%
	Swap agreement:	Receive	LIBOR+ 45b.p.
		Net cost= 9.60%	
Company B	Capital market:	Pay	8.50%
	Swap agreement:	Pay	LIBOR+ 65b.p.
	Swap agreement:	Receive	9.25%
		Net cost= LIBOR− 10b.p.	
Intermediary	Swap agreement:	Pay	LIBOR+ 45b.p.
	Swap agreement:	Receive	LIBOR+ 65b.p.
		Net gain= 20b.p.	

Both A and B gain from the swap. Company A borrows, in accordance with its preference, at a fixed rate. Moreover, it borrows at a rate equal to 9.60%, i.e. 40b.p. less than the 10% it would pay in the capital market. Company B borrows, in accordance with its preferences, at a floating rate. Moreover it borrows at a rate equal to LIBOR− 10b.p., i.e. 40b.p. less than the LIBOR+ 30b.p. it would pay in the capital market.

Two conditions must be satisfied for the swap to be attractive to both A and B:

1. The parties face different *comparative* costs of capital. In the example, the comparative cost of borrowing is higher for A in the fixed rate market, and higher for B in the floating rate market.
2. Each party prefers to borrow in the market for which is comparative cost is higher. In the example, A prefers to borrow at a fixed rate, while B prefers to borrow at a floating rate.

Note that the swap outlined above does not characterize the *unique* arrangement that would be attractive to both parties. The swap described is only one of many that would benefit both A and B.

All that must be satisfied is that A ends up paying a fixed rate less than 10%, and that B ends up paying a floating rate less than LIBOR+ 30b.p.

Similarly, the payoff of 20b.p. to the intermediary is also by way of example. It might be higher or lower.

Additional note:

The payoffs on the plain vanilla interest rate swap could equivalently be achieved if the floating component is LIBOR alone, as follows:

Company A	Capital market:	Pay	LIBOR+ 80b.p.
	Swap agreement:	Pay	8.80%
	Swap agreement:	Receive	LIBOR
		Net cost=	9.60%
Company B	Capital market:	Pay	8.50%
	Swap agreement:	Pay	LIBOR
	Swap agreement:	Receive	8.60%
		Net cost=	LIBOR− 10b.p.%
Intermediary	Swap agreement:	Pay	8.60%
	Swap agreement:	Receive	8.80%
		Net gain=	20b.p.

2.2 Example: foreign exchange (currency) swap

Currency swap

- Example: current exchange rate £1=$1.60
  - A plans to borrow Sterling £10m for five years
  - B plans to borrow Dollars $16m for five years
  - Borrowing costs:

	Dollar	Sterling
Company A	10%	12%
Company B	9%	8%

  - B has an *absolute* advantage (lower borrowing cost)
  - Interest rate differentials:
    - Dollar rate: 100b.p.
    - Sterling rate: 400b.p.
    - A has a *comparative* advantage in dollar market
- A mutually advantageous currency swap may be feasible:
  - A plans to borrow sterling *contrary* to comparative advantage
  - B plans to borrow dollars *contrary* to comparative advantage

Currency swap, continued

- Mutually advantageous agreement:

1. A borrows \$16m for 5 years at \$9% (dollar)
2. B borrows £10m for 5 years at £8% (sterling)
3. *Swap*: – A swaps \$16m for £10m from B at the outset – A swaps £11% in return for \$10% for 5 years – B swaps \$8% in return for £8% for 5 years – Intermediary collects 1% (= £3 − \$2%

- All parties gain:
  - A's net cost is in sterling: £11% < £12%
  - B's net cost is dollars \$8% < \$9%
  - Intermediary gains 1% but bears *foreign exchange rate risk*
- Note: the agreement is just an *example*, not the only outcome
  - What matters is that A and B pay according to their *preferences*
  - And at rates less than they would pay by directly *without* the swap

The payoffs on the currency swap are as follows:

Company A	Capital market:	Pay	10% (\$) = \$1.60m
	Swap agreement:	Pay	11% (£) = £1.10m
	Swap agreement:	Receive	10% (\$) = \$1.60m
		Net cost=	11% (£) = £1.1m
Company B	Capital market:	Pay	8% (£) = £0.80m
	Swap agreement:	Pay	8% (\$) = \$1.28m
	Swap agreement:	Receive	8% (£) = £0.80m
		Net cost=	8% (\$) = \$1.28m
Intermediary	Swap agreement:	Pay	2% (\$) = \$0.32m
	Swap agreement:	Receive	3% (£) = £0.30m
		Net gain=	1%

Notice that the intermediary is exposed to the risk of exchange rate fluctuations, i.e. that the exchange rate will not remain at £1=\$1.60 throughout the life of the swap. In order to manage this risk, the intermediary could hedge using forward contracts in the foreign exchange market.

Both A and B gain from the swap. Company A effectively borrows in accordance with its preference (in sterling). Moreover, it borrows at a rate of 11%, i.e. 1% less than the 12% it would pay in the capital market. Company B effectively borrows in accordance with its preferences (in dollars). Moreover it borrows at a rate of 8%, i.e. 1% less than the 9% it would pay in the capital market. Just as for the interest rate swap, the percentage gains of the parties to the swap are purely illustrative. (Insufficient information is provided above to determine the precise terms of the agreement.) The principle is that A makes a net outlay in sterling but at a rate lower than it would pay in the capital market, and that B makes a net outlay in dollars but at a rate lower than it would pay in the capital market. Also, the intermediary is compensated for its services.

Explaining the interest differentials

What accounts for the interest rate differentials?

1. Asymmetric information may cause borrowing costs to differ
2. Unexploited arbitrage opportunities (market disequilibrium)
3. Market frictions (including regulation)

3 Risks associated with swaps

Risks associated with swaps

1. Credit risk: that one of the parties defaults
2. Funding risk: risk that one party cannot make any required 'good faith' deposit
3. Market risk (basis risk): risk of changes in market conditions. This is the sort of risk that swaps are meant to share among the parties

4 Valuation of swaps

Valuation of swaps

- Swaps are normally designed with zero initial value, i.e. no 'side-payment' is needed between the parties
- During the life of a swap,the value of a swap commonly becomes positive for one party and, hence, negative for the other
- Example: plain vanilla interest rate swap
  - Suppose that interest rates (e.g. LIBOR) increase
  - The party that receives the floating rate is better off – the swap has a positive value
  - The party that pays the floating rate is worse off – the swap has a negative value for this party
- What is the value of a swap at each date?
  - Compare the NPV of the two 'legs' of the swap
  - Example: fixed and floating rates in an interest rate swap
  - Compare the values of fixed and floating rate bonds
  - Difference between the two = value of the swap

5 Metallgesellschaft: A Case Study

Metallgesellschaft (MG-RM): A Case Study

- MG-RM, now part of GEA Group Aktiengesellschaft, was a large German conglomerate
- In late 1993, MG-RM (a division of the company) incurred large losses in oil and oil-based financial derivatives.
- MG-RM's main business – to refine and sell oil products:
  1. Long-term (up to 10yrs) fixed-price contracts to deliver refined oil
  2. Purchased oil at spot market prices

3. Derivatives: long in oil futures, and swaps in which MG-RM paid fixed in return for floating prices for oil products

- Late 1993 – early '94: spot oil prices fell
- MG-RM lost heavily on its derivatives contracts

MG-RM, continued

- Should the MG-RM management be blamed?
- Case *for* MG-RM management
  - Derivatives trades could be viewed as *hedging*
  - Gains/losses on oil supply agreements balanced by losses (gains) in derivatives contracts
  - Complication: hedge was *risky* because duration of derivatives was much shorter than the supply agreements
- Case *against* MG-RM
  - View derivatives contracts as *separate* from oil trading
  - Interpret derivatives trading as *speculation*
- As it happened the derivatives contracts resulted in losses – *risky assets are not always profitable*

Summary

1. Swap contracts are agreements to exchange flows of funds that vary over a specified period of time according to the terms of the contract. Typically, one party agrees to make a stream of fixed payments in return for a variable stream of payments linked to the price of an underlying asset.
2. Swaps can be interpreted as a package, or sequence, of forward contracts. Like forward contracts, swaps are traded over-the-counter, and can be customized in a host of ways.
3. Among the most common swaps are: interest rate swaps (e.g. the exchange of a floating interest rate for a fixed interest rate on a given notional principal); foreign exchange swaps (of one currency for another); commodity swaps (of the price of one commodity for another or for a sequence of fixed payments); total return swaps (of the total return on one asset for that of another); credit default swaps (in which a sequence of payments is made in return for a payoff in the event of default on a designated security).
4. Swaps can be justified on a variety of grounds one of which is that comparative costs of borrowing and lending differ across investors. Alternatively, swaps can be viewed merely as extending the range of financial instruments available to satisfy whatever motives drive investors.
5. The experience of Metallgesellschaft in late 1993 illustrates how swaps could be undertaken for hedging purposes but also how difficult it can be to achieve complex strategies, and why it is likely to be difficult to infer the motives for investment decisions from observed actions.

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