Interest Rate Swaps

- An **interest rate swap** is a contract between two counterparties who agree to exchange the future interest rate payments they make on loans or bonds. These two counterparties are banks, businesses, hedge funds, or investors.
- The most common is the so-called vanilla swap. It's when a counterparty swaps floating-rate payments with the other party's fixed-rate payments.
- The floating-rate payment is tied to the **Libor,** which is the interest rate banks charge each other for short-term loans.
- The counterparty that wants to swap its floating-rate payments and receive fixed-rate payments is called a *receiver or seller*. The counterparty that wants to swap its fixed-rate payments is the *payer*.
- The counterparties make payments on loans or bonds of the same size. This is called the *notional principle*.
- In a swap, they only exchange interest payments, not the bond itself.

- A smaller number of swaps are between two counter parties with floating-rate payments.
- Also, the present value of the two payment streams must also be the same. That means that over the length of the bond, each counterparty will pay the same amount. It’s easy to calculate the NPV for the fixed-rate bond because the payment is always the same. It's more difficult to predict with the floating rate bond. The payment stream is based on Libor, which can change. Based on what they know today, both parties have to agree then on what they think will probably happen with interest rates.
- A typical swap contract lasts for one to 15 years. It's called the ***tenor***.
- In the past, receivers and sellers either found each other or were brought together by investment and commercial banks. These banks charged a fee for administering the contract.
- In the **modern swap market**, large banks act as *market makers* or *dealers.* They act as either the buyer or seller themselves. Counterparties only have to worry about the creditworthiness of the bank and not that of the other counterparty. Instead of charging a fee, banks set up bids and ask prices for each side of the deal.

Example

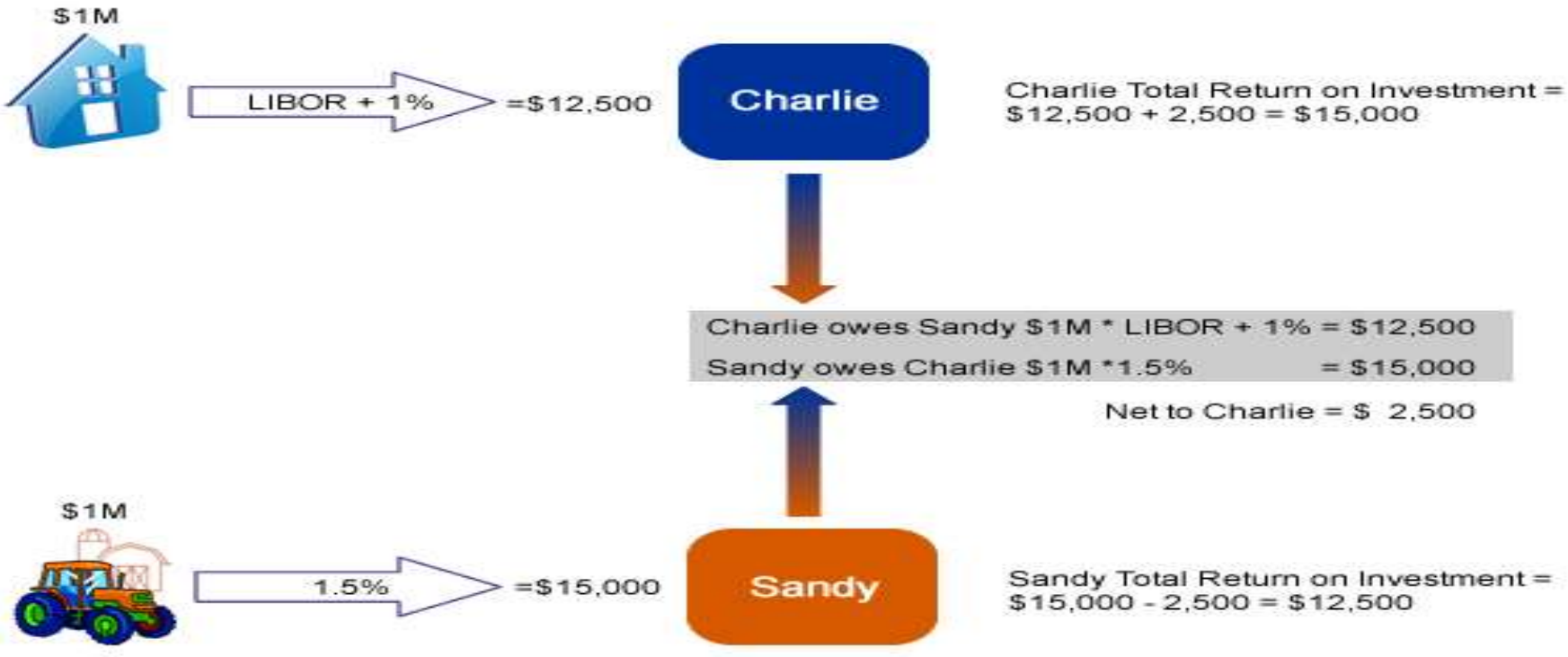
- The most common type of interest rate swap is one in which Party A agrees to make payments to Party B based on a fixed interest rate, and Party B agrees to make payments to Party A based on a floating interest rate. The floating rate is tied to a reference rate (in almost all cases, the London Interbank Offered Rate, or LIBOR).

1. Lets assume that Charlie owns a $1,000,000 investment that pays him LIBOR + 1% every month. As LIBOR goes up and down, the payment Charlie receives changes.
2. Now assume that Sandy owns a $1,000,000 investment that pays her 1.5% every month. The payment she receives never changes.
3. Charlie decides that that he would rather lock in a constant payment and Sandy decides that she'd rather take a chance on receiving higher payments. So Charlie and Sandy agree to enter into an **interest rate swap contract.**
4. Under the terms of their contract, Charlie agrees to pay Sandy LIBOR + 1% per month on a $1,000,000 principal amount (called the "notional principal" or "notional amount").
5. Sandy agrees to pay Charlie 1.5% per month on the $1,000,000 notional amount.

- Let's see what this deal looks like under different scenarios.

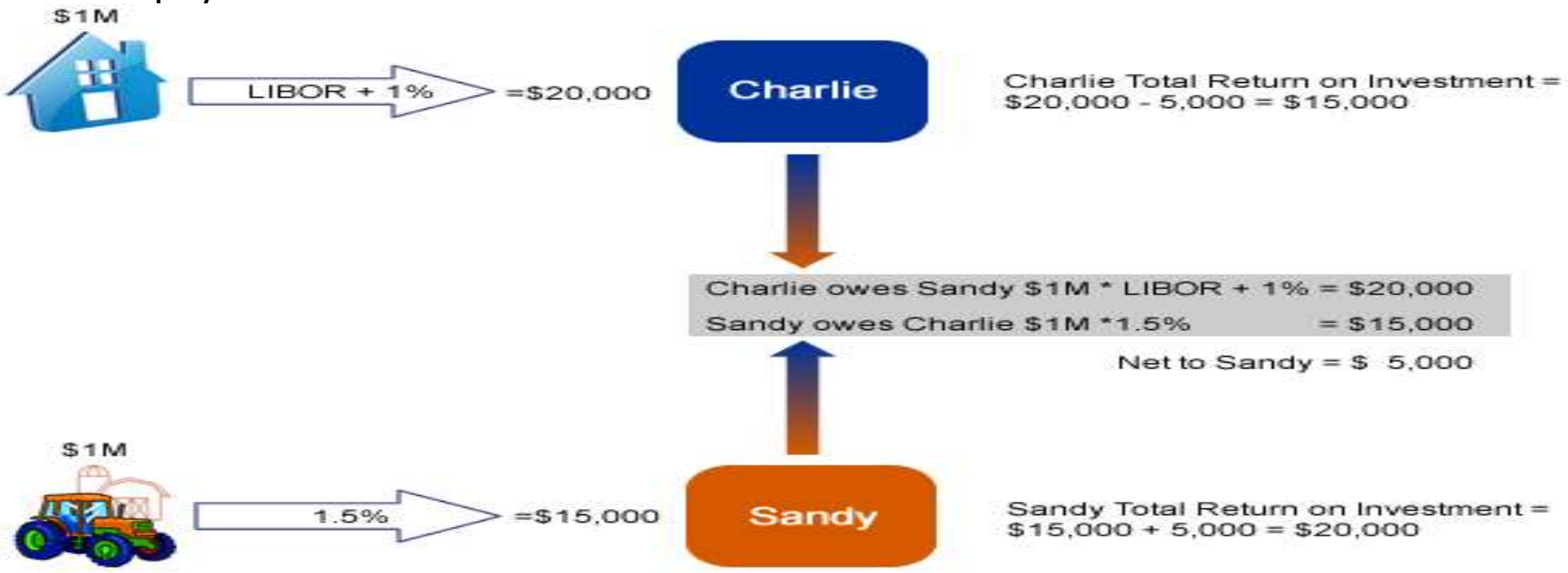
Scenario A: LIBOR = 0.25%

1. **Under initial investment**, Charlie receives a monthly payment of $12,500 from his investment ($1,000,000 x (0.25% + 1%)). Sandy receives a monthly payment of $15,000 from her investment ($1,000,000 x 1.5%).
2. Now, **under the terms of the swap agreement**, Charlie owes Sandy $12,500 ($1,000,000 x LIBOR+1%) , and she owes him $15,000 ($1,000,000 x 1.5%). The two transactions partially offset each other and Sandy owes Charlie the difference: $2,500.



Scenario B: LIBOR = 1.0%

1. **Under Original Investment**: Now, with LIBOR at 1%, Charlie receives a monthly payment of $20,000 from his investment ($1,00,000 x (1% + 1%)). Sandy still receives a monthly payment of $15,000 from her investment ($1,000,000 x 1.5%).
2. With LIBOR at 1%, Charlie is obligated **under the terms of the swap** to pay Sandy $20,000 ($1,000,000 x LIBOR+1%), and Sandy still has to pay Charlie $15,000. Two transactions partially offset each other and now Charlie owes Sandy $5000 i.e. difference between swap interest payments



Observations:

1. Note that the interest rate swap has allowed Charlie to guarantee himself a $15,000 payout; if LIBOR is low, Sandy will owe him under the swap, but if LIBOR is higher, he will owe Sandy money. Either way, he has locked in a 1.5% monthly return on his investment.
2. Sandy has exposed herself to variation in her monthly returns. Under Scenario A, she made 1.25% after paying Charlie $2,500, but under Scenario B she made 2% after Charlie paid her an additional $5,000. Charlie was able to transfer the risk of interest rate fluctuations to Sandy, who agreed to assume that risk for the potential for higher returns.
3. One more thing to note is that in an interest rate swap, the parties never exchange the principal amounts. On the payment date, it is only the difference between the fixed and variable interest amounts that is paid; there is no exchange of the full interest amounts.

Advantages of Interest Rate Swaps

1. *Interest rate swaps* provide a way for businesses to hedge their exposure to changes in interest rates. If a company believes long-term interest rates are likely to rise, it can hedge its exposure to interest rate changes by exchanging its floating rate payments for fixed rate payments.
2. **Banks use Interest swaps as they** need to have their revenue streams match their liabilities.

- For example, if a bank is paying a floating rate on its liabilities (deposits) but receives a fixed payment on the loans it paid out, it may face significant risks if the floating rate liabilities increase significantly. As a result, the bank may choose to hedge against this risk by swapping the fixed payments it receives from their loans for a floating rate payment that is higher than the floating rate payment it needs to pay out. Effectively, this bank will have guaranteed that its revenue will be greater than it expenses and therefore will not find itself in a cash flow crunch.

3. **Hedge funds**, which rely on speculation and can reduce some risk through interest swaps without losing too much potential reward as swaps require minimal payment upfront. More specifically, a speculative hedge fund with an expertise in forecasting future interest rates may be able to make huge profits by engaging in high-volume, high-rate swaps.

4. Comparative advantages: Companies can sometimes receive either a fixed- or floating-rate loan at a better rate than most other borrowers. However, that may not be the kind of financing they are looking for in a particular situation.

- A company may, for example, have access to a loan with a 5% rate when the current rate is about 6%. But they may need a loan that charges a floating rate payment. If another company, meanwhile, can gain from receiving a floating rate interest loan, but is required to take a loan that obligates them to make fixed payments, then two companies could conduct a swap, where they would both be able to fulfill their respective preferences.

Interest Rate Cap

- An **Interest Rate Cap** is a derivative product based on a contractual agreement between the Borrower- the buyer, and the Bank -the seller, to hedge against rising interest rates.
- The Bank agrees to insure the Borrower against a rise in the rate of interest above an agreed strike rate, the Cap.
- The Buyer receives a payment for each period the rate exceeds the strike price, effectively setting a limit on its interest rate payments.
- In exchange for the Cap, the borrower is required to pay a cash premium to the Bank, usually upfront.
- An example of a cap would be an agreement to receive a payment for each month the LIBOR rate exceeds 2.5%.
- The **purpose of the Cap** is to establish a ceiling on the cost of finance for a Borrower with floating rate borrowings. This allows the Borrower to enjoy interest rates lower than the Cap and the protection of the strike rate should they rise.

- The interest rate cap can be analyzed as a series of European call options, known as caplets, which exist for each period the cap agreement is in existence.

Example

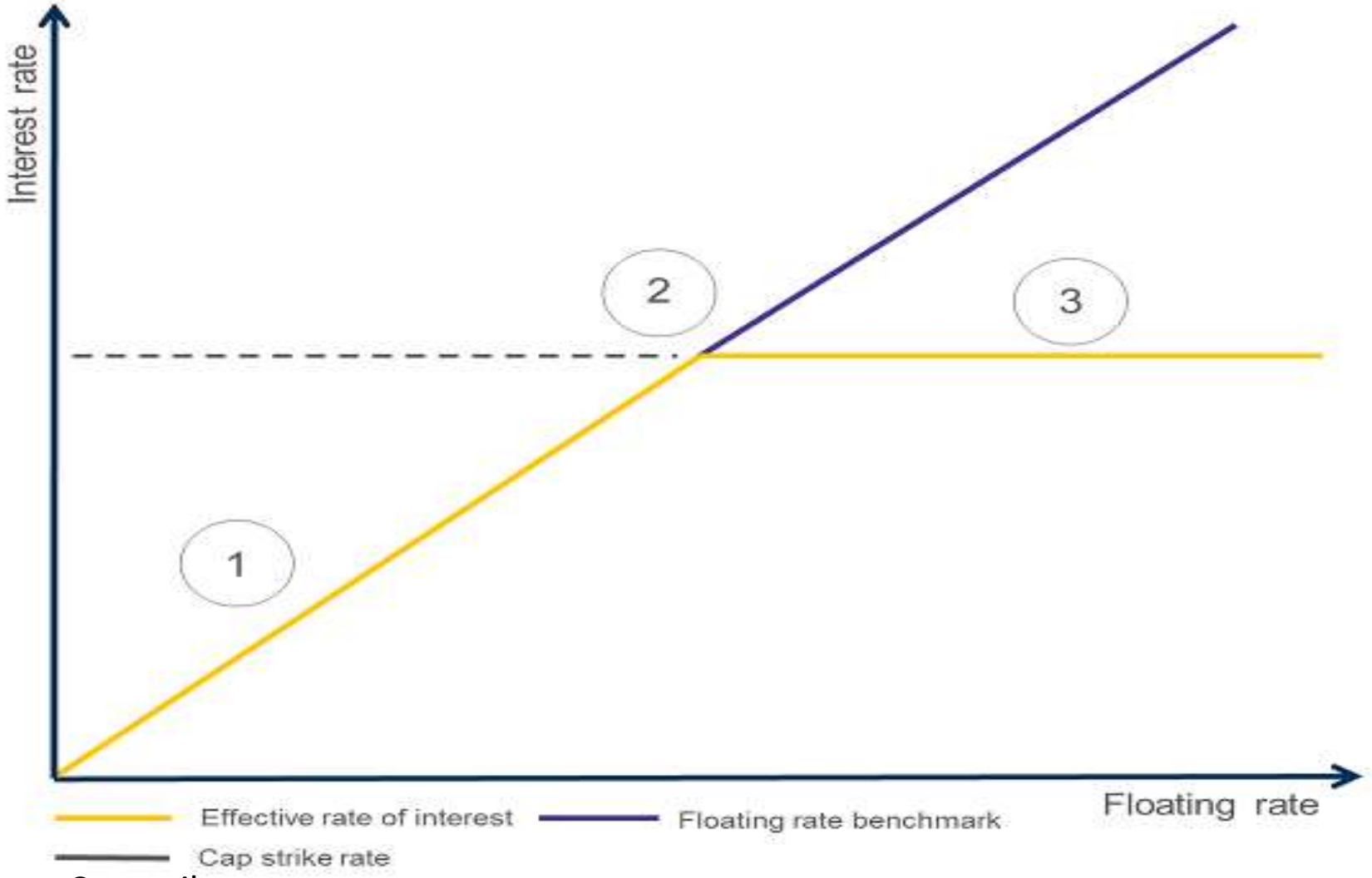
TRADE DESCRIPTION	
Instrument:	Interest Rate Cap
Purchaser	Borrower
Seller	Bank
Trade date:	13-Aug-2013
Effective date:	13-Aug-2013
Maturity date:	13-Aug-2018
Reset dates:	13th Aug, Nov, Feb, May
Strike rates:	2.50%
Floating rate:	3 Month GBP LIBOR
Principal:	£50,000,000
Premium payable:	£950,000

How does it work?

- On the reset date, if the rate is above the Cap strike rate, the Bank will pay the Borrower the difference. If the rate is equal to or below the Cap strike rate, the Borrower will not receive a payment.

Scenario	Conditions	Result
One	Floating rate is **below** Cap strike rate	Borrower pays floating rate on debt
Two	Floating rate is **equal** to Cap strike rate	Borrower pays Cap strike rate on debt
Three	Floating rate is **above** Cap strike rate	Borrower pays Cap strike rate on debt and the bank compensates borrower for difference between floating rate and strike rate

Graph



Cap strike rate = -------

Evaluation

Advantages

- It provides the Borrower with a pre-agreed maximum rate of interest.
- The Borrower benefits from floating rates lower than the Cap strike rate.
- There are no additional costs arising from early termination. The Borrower will be entitled to receive any residual value attributable to the Cap.

Disadvantages

- The Borrower will incur a premium cost, usually paid up front.
- If the floating rate remains below the Cap strike rate during the tenor of the Swap, the Borrower may feel they received no value.

Interest rate floor

- An **interest rate floor** is a series of European put options or **floorlets** on a specified reference rate, usually LIBOR.
- Interest rate floors are utilized in derivative contracts and loan agreements. Interest rate floors are often used in the adjustable rate mortgage (ARM) market.
- An OTC interest rate derivative, or specifically a contract on an interest rate whereby the seller (or the writer) pays the buyer (lender of loan), at periodic payment dates, the negative difference between the market interest rate (the reference interest rate) and the agreed strike price (the floor).
- The floor, in other words, is the minimum interest rate that may be effected on, or affixed to, a contract.
- **For example**, a lender may buy an interest rate floor stipulating that the interest rate should not go below 4% even if market rates necessitate lower levels. This way, an interest rate floor reduces the risk to lenders receiving the interest payments and guarantees a minimum rate for their loaned money.

- Interest rate floor contracts are one of three common interest rate derivative contracts, the other two being interest rate caps and interest rate swaps.
- Interest rate floor contracts and interest rate cap contracts are derivative products typically bought on market exchanges similar to put and call options

Example

- The buyer of the floor receives money if on the maturity of any of the floorlets, the reference rate is below the agreed strike price of the floor.
- As a hypothetical example, assume that a lender is securing a floating rate loan and is looking for protection against lost income that would arise if interest rates were to decline.
- Suppose the lender buys an interest rate floor contract with an interest rate floor of 8%.
- The floating rate on the $1 million negotiated loan then falls to 7%.
- The interest rate floor derivative contract purchased by the lender results in a payout of $10,000 = (($1 million *.08) - ($1 million*.07)).

Interest rate Collar

- An **Interest Rate Collar** is an option used to hedge exposure to interest rate moves.
- It protects a Borrower against rising rates and establishes a floor on declining rates through the purchase of an Interest Rate Cap and the simultaneous sale of an Interest Rate Floor.
- Typically, the premium of the Cap is designed to exactly match that of the Floor to result in a Zero Cost Collar.
- A Borrower who enters into a Zero Cost Collar establishes the maximum interest rate payable (Cap strike rate) at the cost of agreeing to pay a known minimum rate (Floor strike rate).
- Between those two levels, the cost of finance will remain on a floating rate basis over the agreed period of time.

Example

TRADE DESCRIPTION	
Instrument:	Interest Rate Collar
Purchaser	Borrower
Seller	Bank
Trade date:	23-Sep-12
Effective date:	23-Sep-12
Maturity date:	23-Sep -17
Reset dates:	23rd Dec, Mar, Jun, Sep
Strike rates:	Cap: 1.75%, Floor: 1%
Floating rate:	3 Month LIBOR
Principal:	£50,000,000
Premium payable:	£0

How does it work?

- On each reset date, the floating rate is checked. If the floating rate is above the Cap strike, the Bank will pay the Borrower the difference for the period. If the floating rate is below the Floor strike, the Borrower will pay the Bank the difference.

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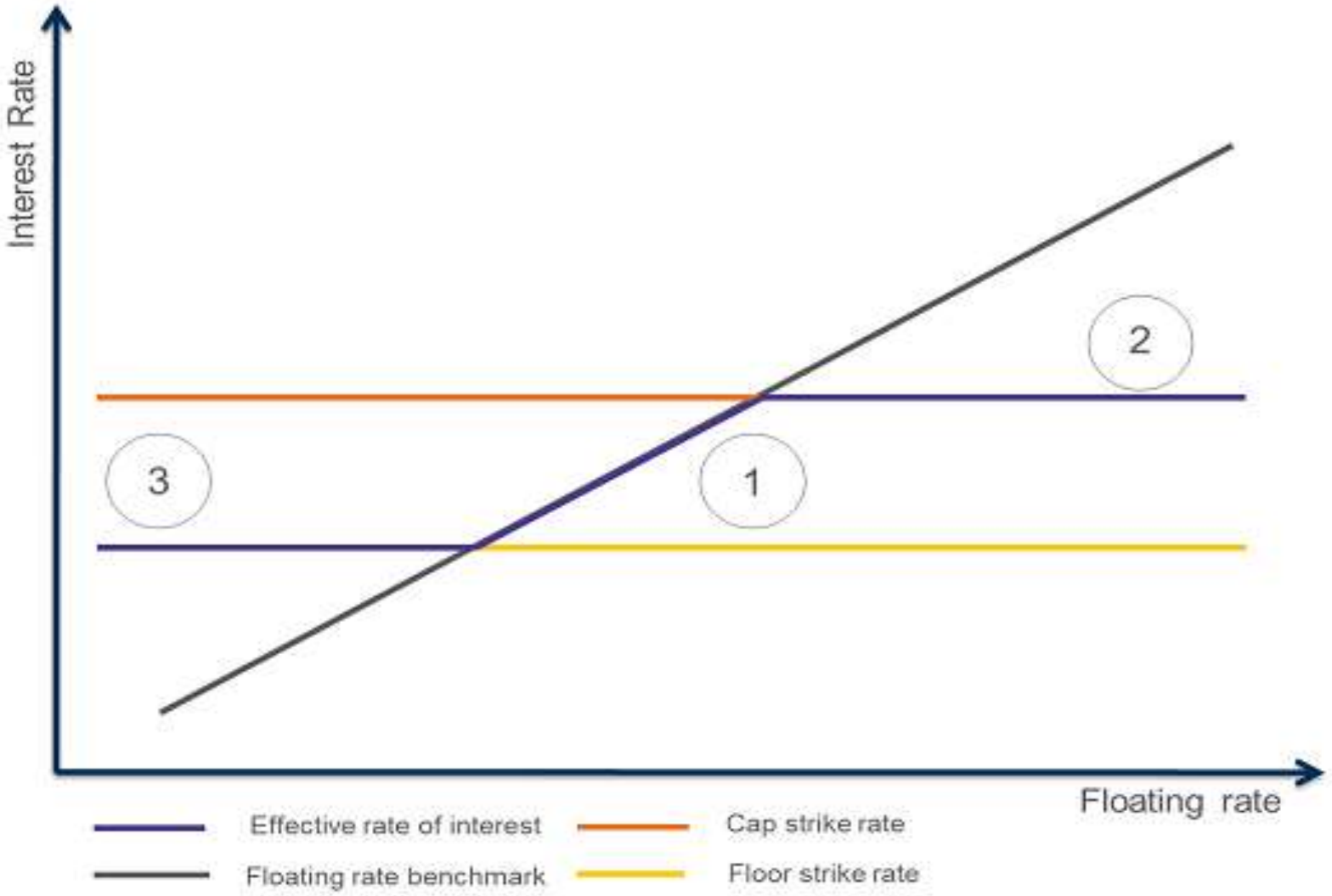
Scenario	Conditions	Result
One	Floating rate is **below** Cap strike rate and **above** Floor strike rate	Borrower pays floating rate on debt
Two	Floating rate is **above** Cap strike rate	Borrower pays Cap strike rate on debt, the bank compensates borrower for difference between floating rate and strike rate
Three	Floating rate is **below** Floor strike rate	Borrower pays Floor strike rate on debt, borrower compensates bank for difference between strike rate and floating rate

Graph


Interest Rate
Floating rate
2
3
1
Effective rate of interest
Cap strike rate
Floating rate benchmark
Floor strike rate

Advantages

- The Borrower benefits from a pre-agreed maximum rate of interest
- The Borrower has the flexibility to benefit from low floating rates down to the minimum Floor level
- Unlike a Cap, a Collar can be structured such that there is no upfront premium cost

Disadvantages

- On early termination, if the Borrower has to buy back the Floor they may incur additional costs. However, they will be entitled to receive any residual value attributable to the Cap.
- If the floating rate fails to rise above the Cap strike rate and/or remains below the Floor strike rate during the tenor of the Collar, the Borrower may feel they received no value.

FX Collar

- An FX Collar involves buying a Cap and selling a Floor on the same currencies with the same expiration date. The two Options set the upper and lower strike prices.
- It allows the Holder to manage foreign exchange risk and minimise the cost of the hedging.

How does it work?

- A UK firm of exporters will be receiving $10 million in a year's time. They want to enter into a hedging contract to protect the conversion rate and buy a dollar Put/sterling Call option.
- However, they do not want to pay a premium so they offset that by selling a dollar Call/sterling Put option with an equal premium.
- The dollar Put option limits the risk of dollar depreciation, while the dollar Call option restricts any benefit from any dollar appreciation.

Example

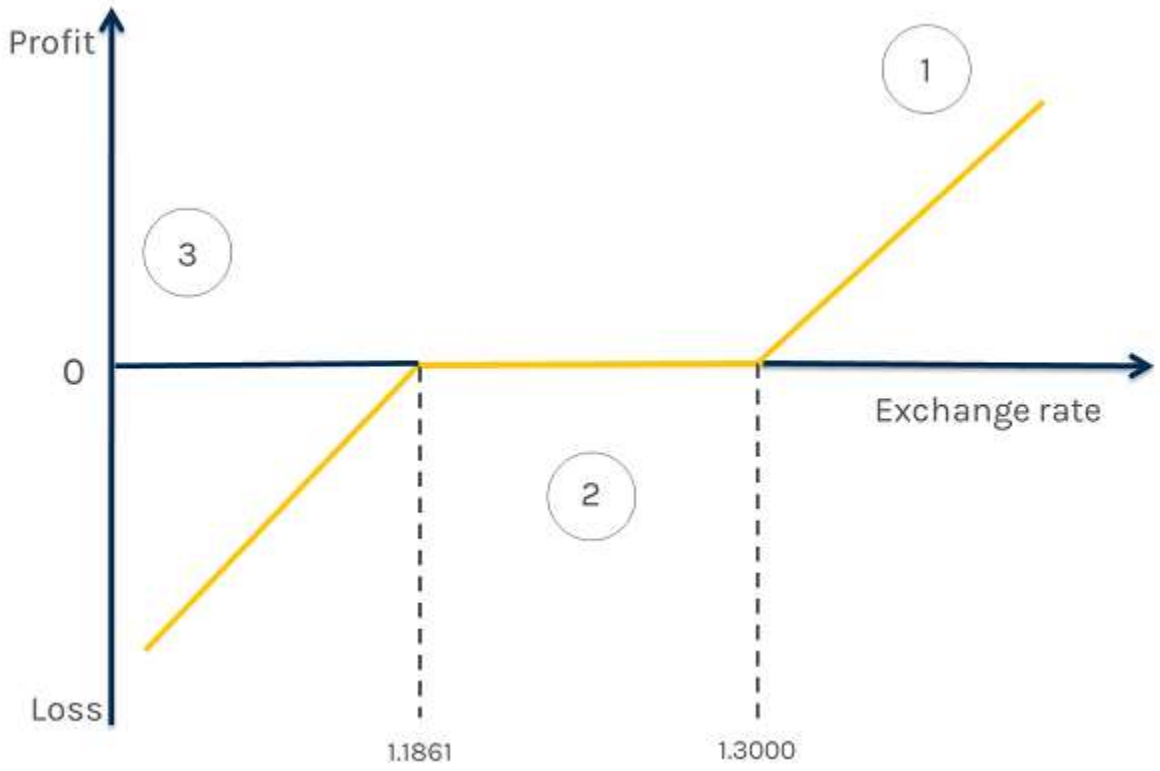
Instrument	Derivative
Instrument 1	European USD Put/GBP Call
Purchaser	Holder
Seller	Bank
GBPUSD Spot	1.2375
Trade date	20 January 2017
Expiry date	20 January 2018
Delivery date	24 January 2018
Strike rate	1.3000
Notional	USD 10,000,000
Premium	GBP 205,998

Instrument 2	European GBP Put/USD Call
Purchaser	Bank
Seller	Holder
Trade date	20 January 2017
Expiry date	20 January 2018
Delivery date	24 January 2018
Strike rate	1.1861
Principal	USD 10,000,000
Premium	GBP 205,998
Net premium	Zero

FX Collar scenarios:

Scenario	Conditions	Result
One	Exchange rate is above 1.3000	Holder sells USD at 1.3000
Two	Exchange rate is between 1.3000 and 1.1861	No obligation for either party, holder sells USD at market rate
Three	Exchange rate is below 1.1861	Holder sells USD at 1.1861

Graph



- **Advantages**
- The Holder pays no upfront premium
- Offers protection against unfavourable currency moves
- The Holder can benefit from rates between the cap and the Floor

- **Disadvantages**
- Limits the Holder's ability to benefit from currency appreciation
- Using a Forward contract could offer a better rate
- Termination could incur extra costs depending on the market rate at that time

Forward rate agreement

- A **Forward Rate Agreement**, or **FRA**, is an agreement between two parties who want to protect themselves against future movements in interest rates.
- By entering into an FRA, the parties lock in an interest rate for a stated period of time starting on a future settlement date, based on a specified notional principal amount.
- The forward rate agreement could have a maturity as long as five years however the duration of a FRA is usually equal to one interest rate period.
- For example, the borrower/investor may wish to stay floating for the long term but wish to lock in the interest rate for a particular interest rate payment period of the borrowing or investment in the future ie. a 90 day period starting in 2 months time.
- The notional amount is not exchanged, but rather a cash amount based on the rate differentials and the notional value of the contract.

- The FRA is a very flexible instrument and can be tailored to meet the needs of both the buyer and seller to protect themselves against the volatility of interest rates which affect their future borrowings or investments.
- **The principle advantages of FRAs are:**

1. contracts can be structured to meet the specific needs of the user;
2. counterparty exposure is limited to the interest rate differential between the market rate and the contract rate;
3. administration costs are minimized as there is only one cash flow on the settlement date as opposed to daily futures settlement;
4. they are off-balance sheet items; and
5. they can easily be reversed or closed out using an offsetting FRA at a new price.

Notation

- A forward rate agreement is denoted as A x B, for instance 3 x 9.
- The first number denotes the time of commencement of the loan, while the difference in the two numbers represents the maturity of the loan. In this case, the rate is for a six-month loan, scheduled to commence after three months.
- The rate of interest for a forward rate agreement is termed as the contract rate.
- The party who agrees to pay this rate is known as the buyer of the FRA or the long, while the counterparty is known as the seller of the FRA or the short.
- If the actual rate of interest after A months is higher than the contract rate, the long will receive a payment from the short. And, if the rate were to be lower, the long would have to make a payment to the short.

- A borrower might enter into a forward rate agreement with the goal of locking in an interest rate if the borrower believes rates might rise in the future. In other words, a borrower might want to fix their borrowing costs today by entering into an FRA. The cash difference between the FRA and the reference rate or floating rate is settled on the value date or settlement date.
- **For example**, if the Federal Reserve Bank is in the process of hiking U.S. interest rates, called a monetary tightening cycle, corporations would likely want to fix their borrowing costs before rates rise too dramatically.
- The sellers hedges against falling interest rates.
- Forward rate agreements (FRA) are over-the-counter contracts between parties that determine the rate of interest to be paid on an agreed upon date in the future. An FRA is an agreement to exchange an interest rate commitment on a notional amount.
- The FRA determines the rates to be used along with the termination date and notional value.
- FRAs are cash-settled with the payment based on the net difference between the interest rate of the contract and the floating rate in the market called the reference rate.

Calculation

$$\text{Formula for payment to the long at settlement} = \left(\text{notional principal}\right) \times \frac{(\text{floating rate} - \text{forward rate})\left(\frac{\text{days}}{360}\right)}{1 + (\text{floating rate})\left(\frac{\text{days}}{360}\right)}$$

- Use decimal in interest rates.
- Floating rate is generally LIBOR while forward rate is FRA rate.
- If the payment amount is positive, the FRA seller pays this amount to the buyer. Otherwise, the buyer pays the seller. The day-count convention is typically 360 days.

Example

- Consider a 3×6 FRA on a notional principle amount of $1million. The FRA rate is 6%. The FRA settlement date is after 3 months (90 days) and the settlement is based on a 90 day LIBOR.
- Assume that on the settlement date, the actual 90-day LIBOR is 8%. This means that the long is able to borrow at a rate of 6% under the FRA, which is 2% less than the market rate.

- Solving using formula

- FRA payment to buyer= $4,904.72

Example II

- Assume the following data:
- FRA = 3.5%
- Reference rate= 4%
- Notional Principal = $5 million
- Period of FRA = 181 days
- Y/day count = 360 days

- FRA Payment= $\frac{(.04-.035)\times\$5\text{ million}\times 181}{360} \times \frac{1}{1+.04\times\left(\frac{181}{360}\right)}$

Answer= $12,321.64

Example III

- For instance, assume that a 3 x 9 FRA has a contract rate of 6% per annum, and assume that the day-count convention is 30/360. Let the notional principal be $5 million. If, after three months, the LIBOR were to be 7.50%, the short would need to make a payment $36,145 to the long.

Example IV

- You go short on a 1X7 FRA with contract rate of 8% and notional amount $10 million. If, after six months, the LIBOR were to be 7%, the short would receive a payment $48309 from the long.