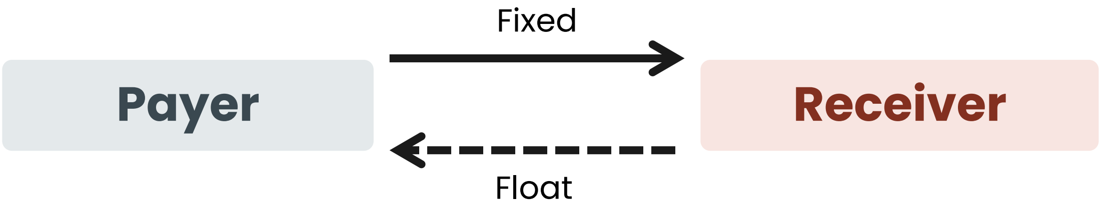
Introduction to Interest Rate Swaps

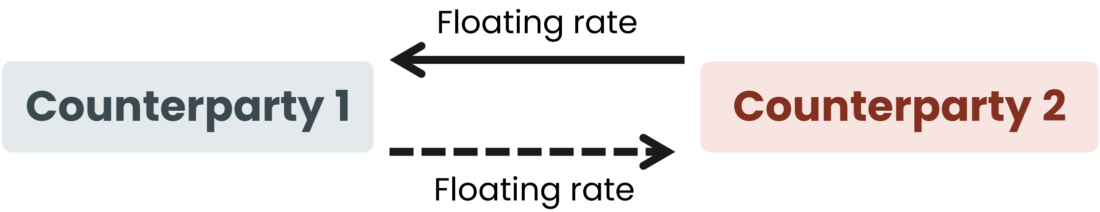
What Are Interest Rate Swaps?

A financial swap is the agreement between two counterparties to exchange two series of cash flows (the “swap legs”). In the case of interest rate swaps these payment streams are linked to interest rates

Fixed for floating swaps –
the most common type of interest rate swap:



Basis swaps –
both cash flow streams are variable:



Reference rate basis swap:
Exchange of different reference rates with same tenor and in the same currency (for example SOFR vs. EFFR)

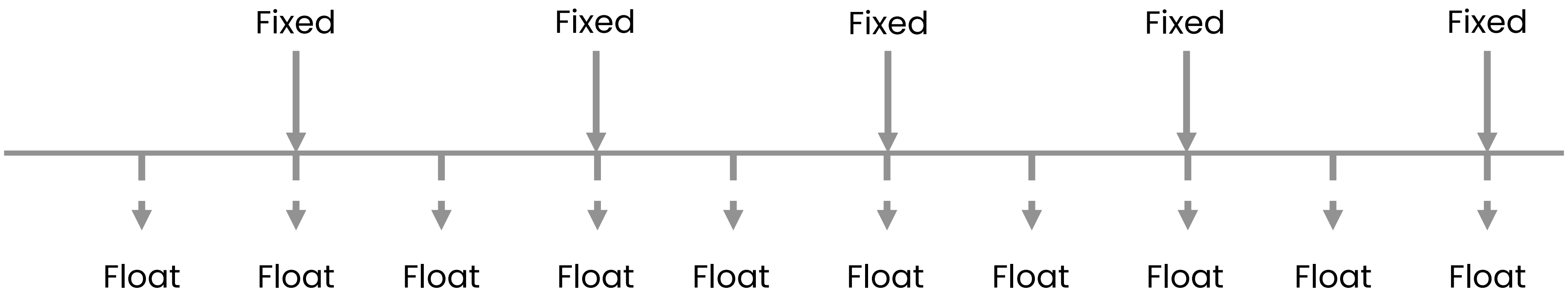
Tenor basis swap:
Exchange of different floating rates in the same currency (for example 3M EURIBOR vs. 6M EURIBOR LIBOR)

Cross currency basis swap:
Exchange of floating rates with the same tenor but in different currencies (for example SOFR vs. ESTR)

Single Currency Fixed For Floating Swaps

Notional	Tenor/Maturity	Fixed rate	Reference rate	Reset frequency	Payment frequency
Calculation basis for the interest rate payments of the swap – not exchanged at trade inception	Interest accrues and payments are exchanged over the lifetime (tenor) of the swap. The final exchange occurs on the last day of the swap (maturity date)	The fixed rate paid by the “payer” in exchange for the series of floating interest rate payments	The agreed upon benchmark rate is used to determine payments on the floating leg (IBOR, overnight rates)	How often the floating rate is reset – determined by the reference rate	How regular payments are exchanged

Fixed and **floating frequencies** don’t need to be the same, we could have the following:



‘IRS’ or ‘OIS’?

You will see ‘**IRS**’ and ‘**OIS**’ both used to describe fixed-float swaps

IRS = Interest Rate Swap

OIS = Overnight Index Swap

The difference has to do with the mechanics of the floating leg resets:

Name	Reference rate	Floating leg mechanics
IRS	IBOR (e.g. EURIBOR) Term RFRs (limited)	**Single** reset rate Set in **advance**
OIS	RFRs (SOFR, €STR, SONIA…)	Set in **arrears** **Multiple** overnight rate resets

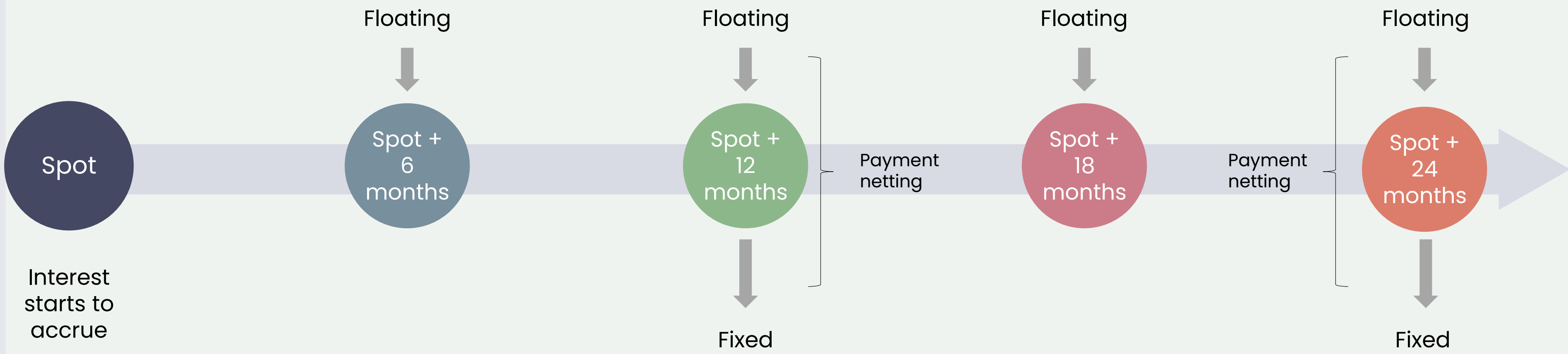
IRS Cash Flow Mechanics

In case of IRS the payment frequency of the floating leg is determined by the reference rate

Example

2Y payer IRS, annual fixed vs. 6M EURIBOR

IRS Cash Flows



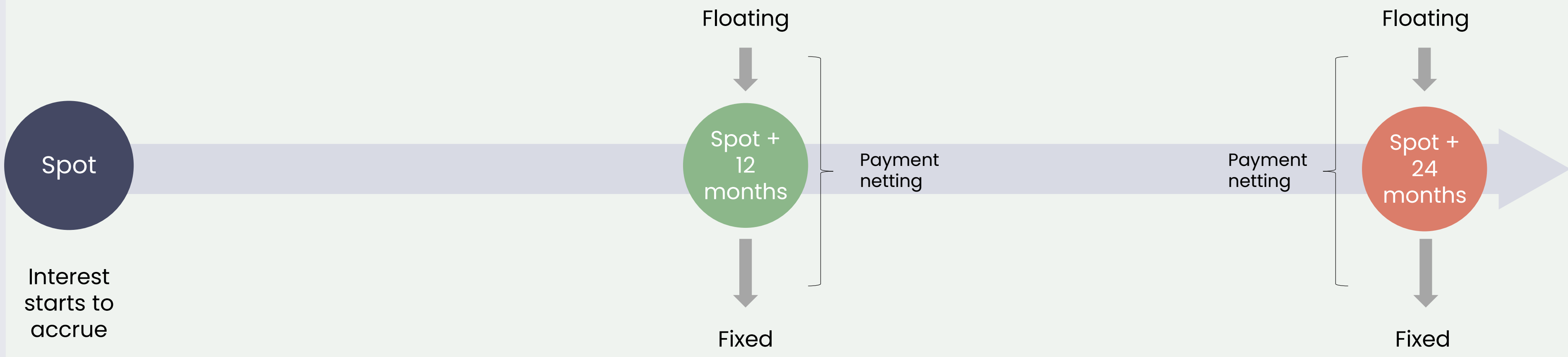
OIS Cash Flow Mechanics

In case of most OIS payment frequency of both fixed and floating leg is aligned

Example

2Y payer OIS, annual fixed vs. annual ESTR (reset daily)

OIS Cash Flows



What factors make the cash flow mechanics of OIS more complex compared to IRS?

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OIS Mechanics

Misaligned reset and payment frequencies make the floating leg cash flows of OIS swaps more complex

Compounded averaging is the usual convention

Fixed Rate

$$\left[\prod_{i=1}^{n}\left(1+\frac{R_i^{RFR}}{360}*d_i\right)-1\right]*\frac{360}{\sum d_i}$$

7-day example

Day	Day weight	SOFR	Compounded return
			1
Monday	1	5.250%	1.000145833
Tuesday	1	5.260%	1.000291966
Wednesday	1	5.270%	1.000438397
Thursday	1	5.260%	1.000584573
Friday	3	5.250%	1.001022328

1w term rate	5.25769%

An Intuitive Look at Interest Rate Risk in IRS

Q

Assume you entered into a 2Y USD OIS, receiving a fixed rate of 3.75% vs. SOFR (paid annually) this morning

In the afternoon, 2Y USD OIS trade at 3.73%. How can you calculate the current MTM of your position?

A

Intuitively, the receiver in an IRS would prefer to see the floating rate decrease in the future (receivables will remain constant while payables decline)

Fixed rate payers would prefer to see an increase in the floating rate

It follows that:

- Fixed rate receivers benefit from a decline in interest rates
- Fixed rate payers benefit from a rise in interest rates

An Intuitive Look at Mark-to-Market Valuation of IRS

Q

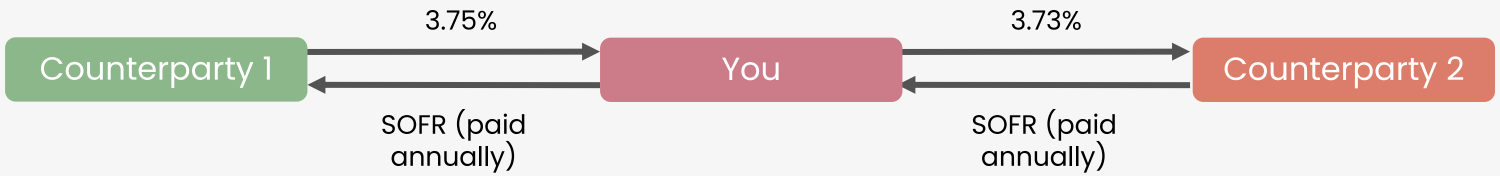
Assume you entered into a 2Y USD OIS, receiving a fixed rate of 3.75% vs. SOFR (paid annually) this morning

In the afternoon, 2Y USD OIS trade at 3.73%. How can you calculate the current MTM of your position?

A

As we are still on the trade date, we could close out the position by entering into a 2Y payer swap

The two SOFR legs would neutralize each other, leaving you with a net positive cash flow of 0.02% per annum:



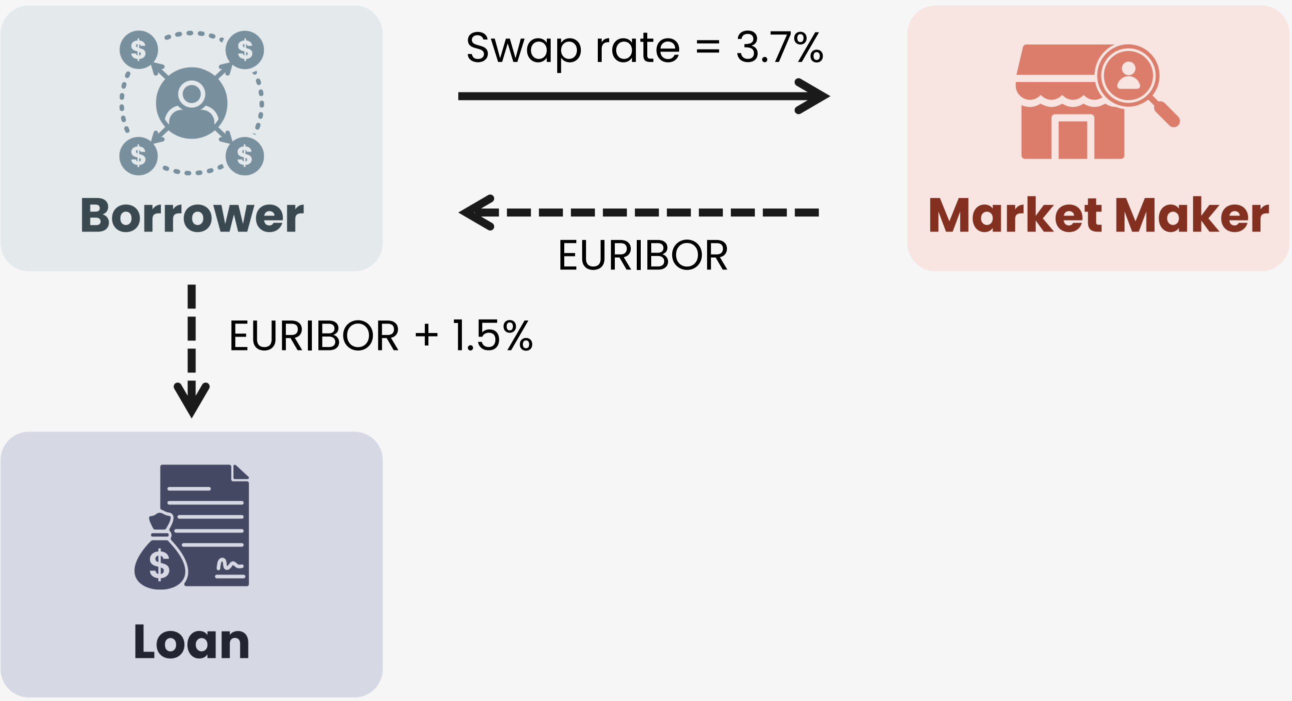
Year	Receiver Swap		Payer Swap		Net
1	3.75%	-(SOFR)	(SOFR)	-3.73%	0.02%
2	3.75%	-(SOFR)	(SOFR)	-3.73%	0.02%

The MTM is given by the discounted net cashflow

Application 1: Hedging Floating-Rate Debt

Corporate borrowers seek to lock in a fixed rate of interest on floating-rate debt

Creates a **synthetic fixed-rate loan**



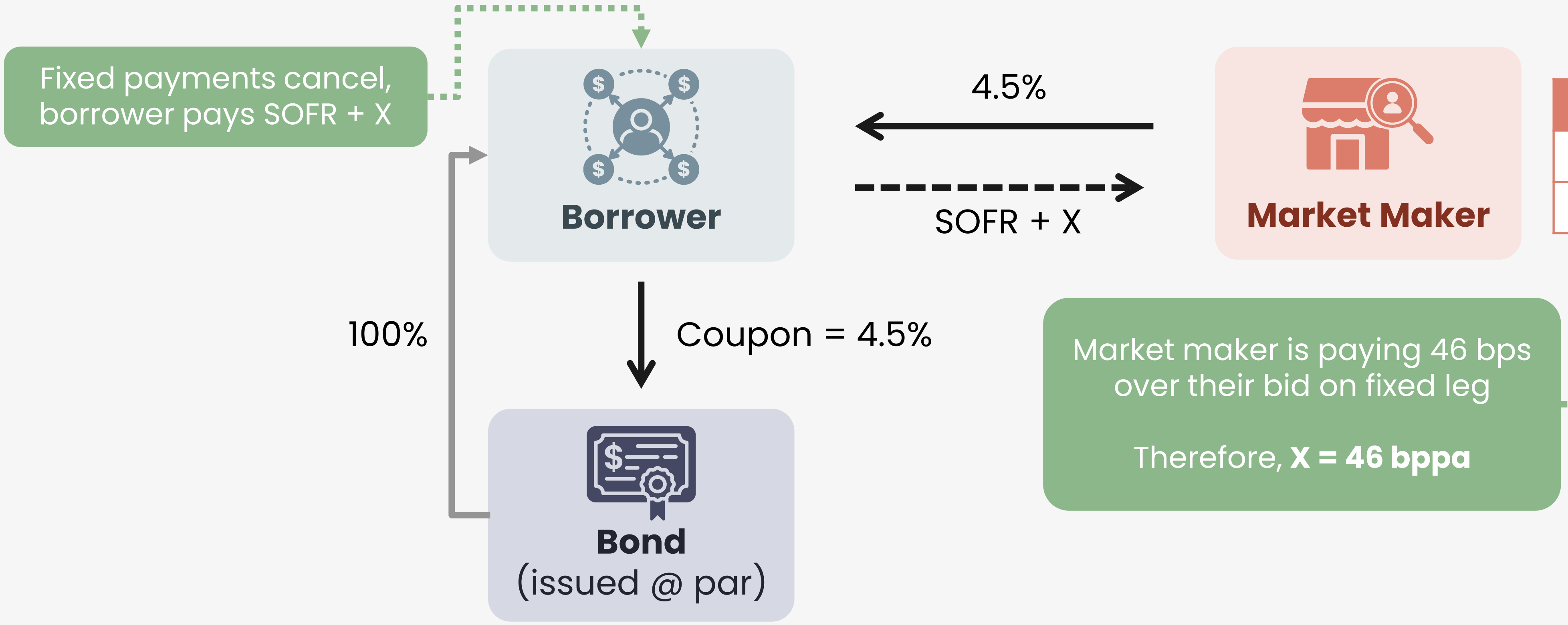
Company pays fixed rate = swap rate + loan margin

EURIBOR	Loan Rate	Swap net payment	All-in Rate
0.00%	1.50%	-3.70%	5.20%
1.00%	2.50%	-2.70%	5.20%
2.00%	3.50%	-1.70%	5.20%
3.00%	4.50%	-0.70%	5.20%
4.00%	5.50%	0.30%	5.20%
5.00%	6.50%	1.30%	5.20%
6.00%	7.50%	2.30%	5.20%
7.00%	8.50%	3.30%	5.20%

Application 2: New Issue Swaps

Bond issuer swaps a fixed coupon to floating

Creates **synthetic floating-rate debt**



Swap market	
Bid	Offer
4.04%	4.06%

Application 3: Trading the Curve

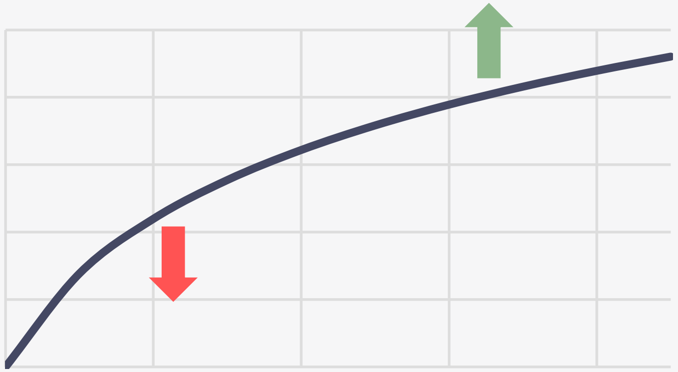
Swaps can be used by **speculate** or **hedge** on movements in the yield curve

Parallel Shift

Rates up → pay fixed

Rates down → rec fixed

Twisting



Steepener → pay long, rec short

Flattener → rec long, pay short

Humping

Butterflies:

More concave → pay body, rec wings

Less concave → rec body, pay wings

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