JPM Asset Management

Fixed Income Academy

Neil Graham

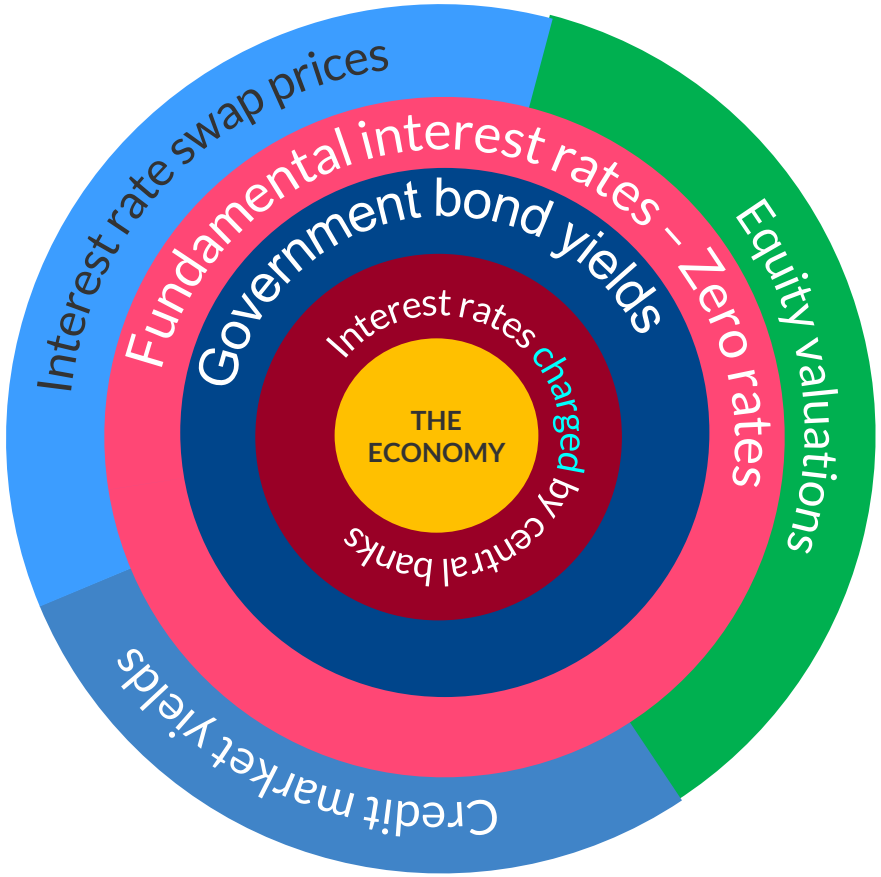
7-9 of April 2025

Prologue

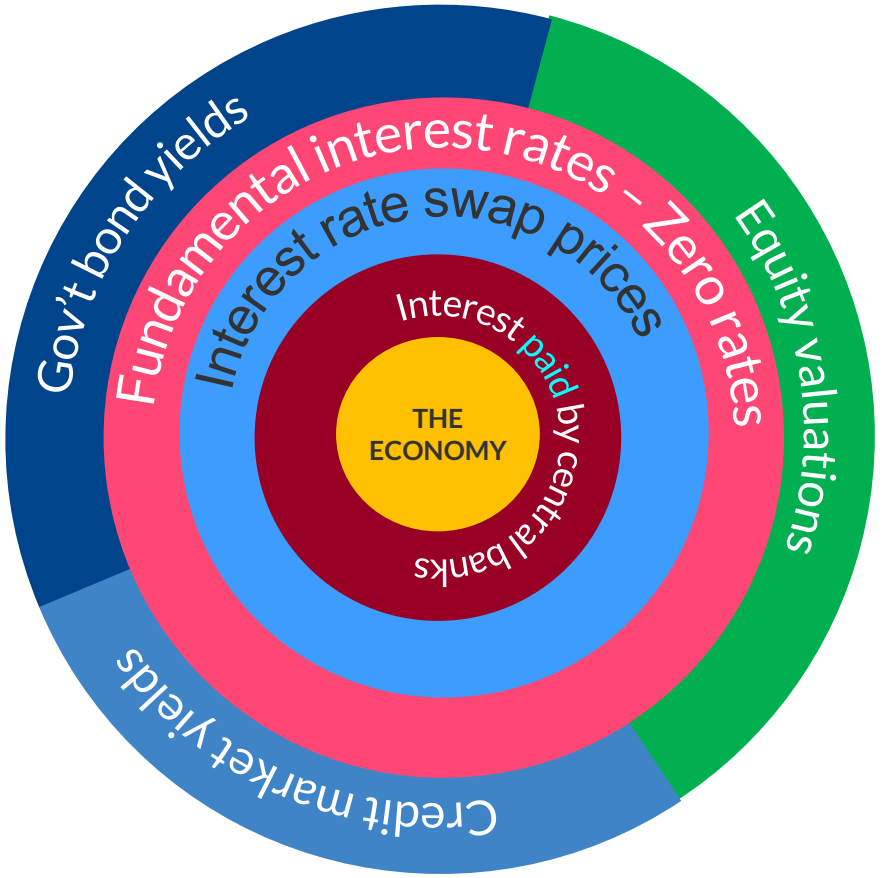
FitchLearning

Prologue; how markets *supposedly* interact with central banks

The past….?

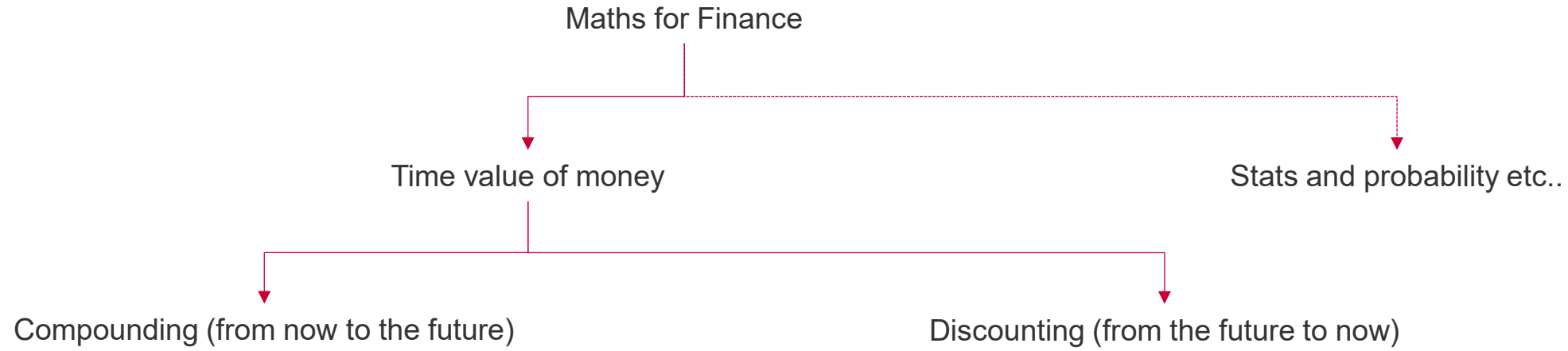


Now….?



Time value of money

Here PV is the present value (amount invested); FV is future value (the amount received from the investment); r is the annual interest rate and f is the frequency per year that the annual interest rate accrues.



- Money market: $FV = PV\left(1 + r\frac{Actual}{Basis}\right)$
- Bonds / notes or > 1y: $FV = PV(1+r)^n$, $FV = PV\left(1+\frac{r}{f}\right)^{n\times f}$

- Money market: $PV = FV \times \frac{1}{\left(1+r\frac{Actual}{Basis}\right)}$
- Bonds / notes or > 1y: $PV = FV \times \frac{1}{(1+r)^n}$, $PV = FV \times \frac{1}{\left(1+\frac{r}{f}\right)^{n\times f}}$
- $\frac{1}{(1+r)^n}$, or $\frac{1}{\left(1+\frac{r}{f}\right)^{n\times f}}$ is the **discount factor** for a period

Time value of money

Use Excel to calculate:

The **future value** of USD 1,000,000 deposited for

- 6 months (182 days) at 5.00% p.a.
- 3 years at 5.00% p.a. paid annually.

The **present value** :

- of USD 1,025,277.78 to be paid in 6 months (182 days) using a required return, or discount rate, of 5.00% p.a.
- USD 1,157,625.00 to be paid in 3 years at 5.00% p.a. paid annually.
- Determine the **discount factors** for the two scenarios above.

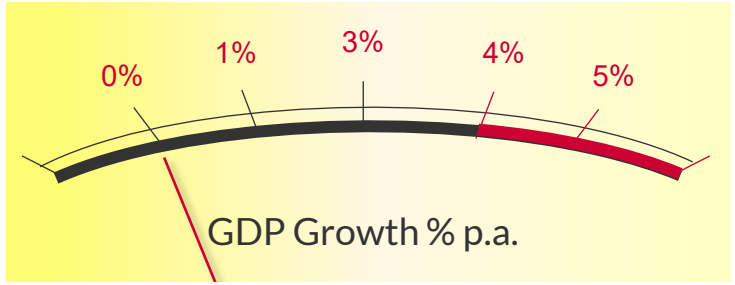
- Discount factors / compound factors are unencumbered by day count conventions

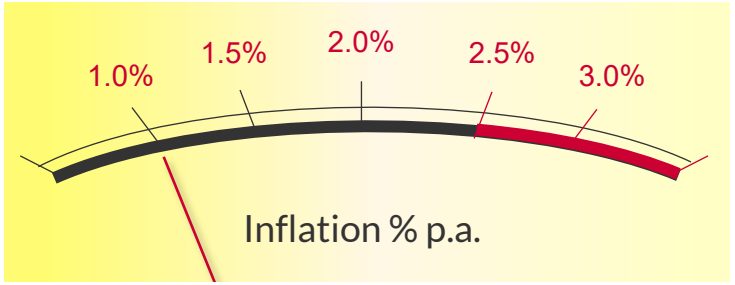
The macro economic outlook

"All economic models are wrong, but some are useful," Huw Pill, chief economist Bank of England

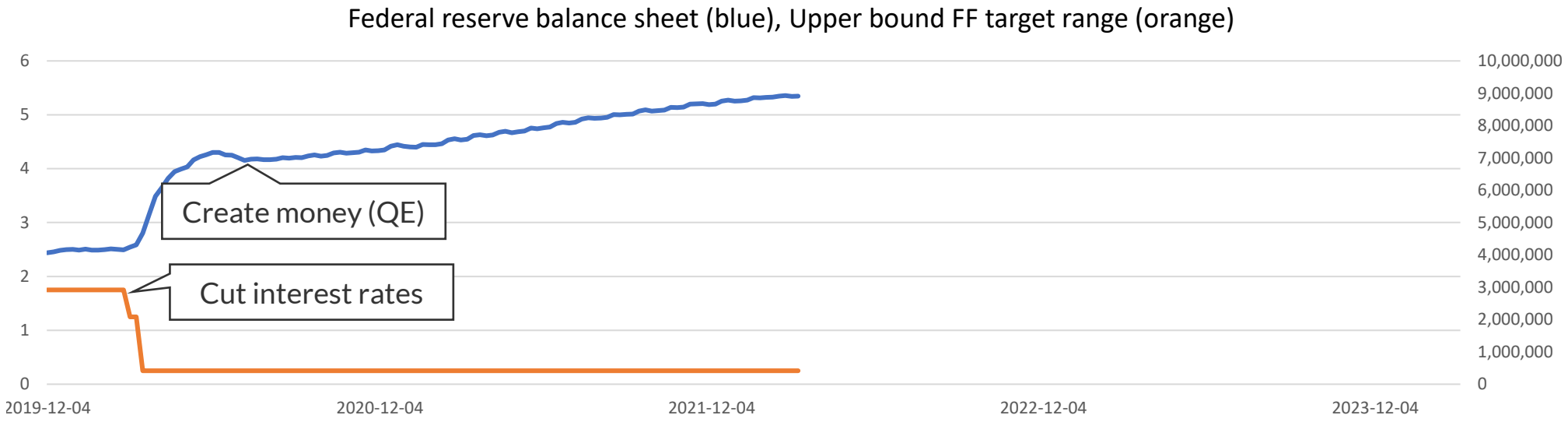
Economic management and expectations

Central banks are trying to keep the economy growing at a stable pace without triggering inflation or unemployment:



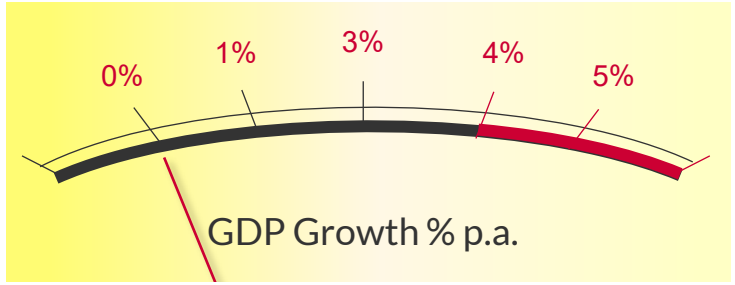


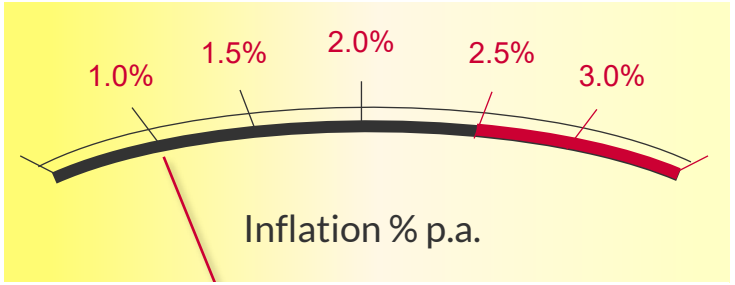
If the economy is, or appears to be, heading for a **recession** the central bank will:



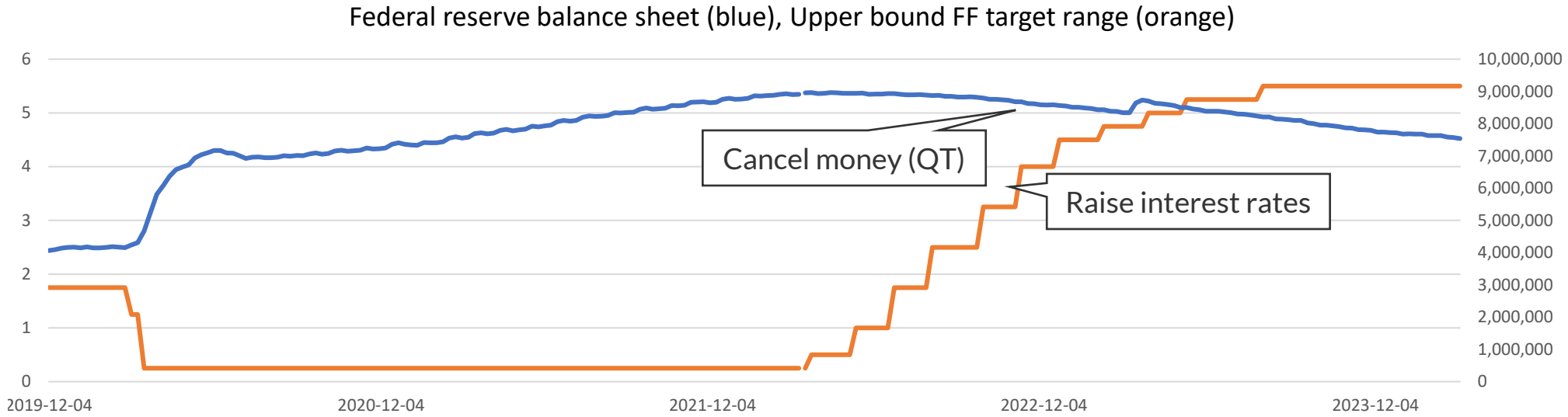
Economic management and expectations

Central banks are trying to keep the economy growing at a stable pace without triggering inflation or unemployment:





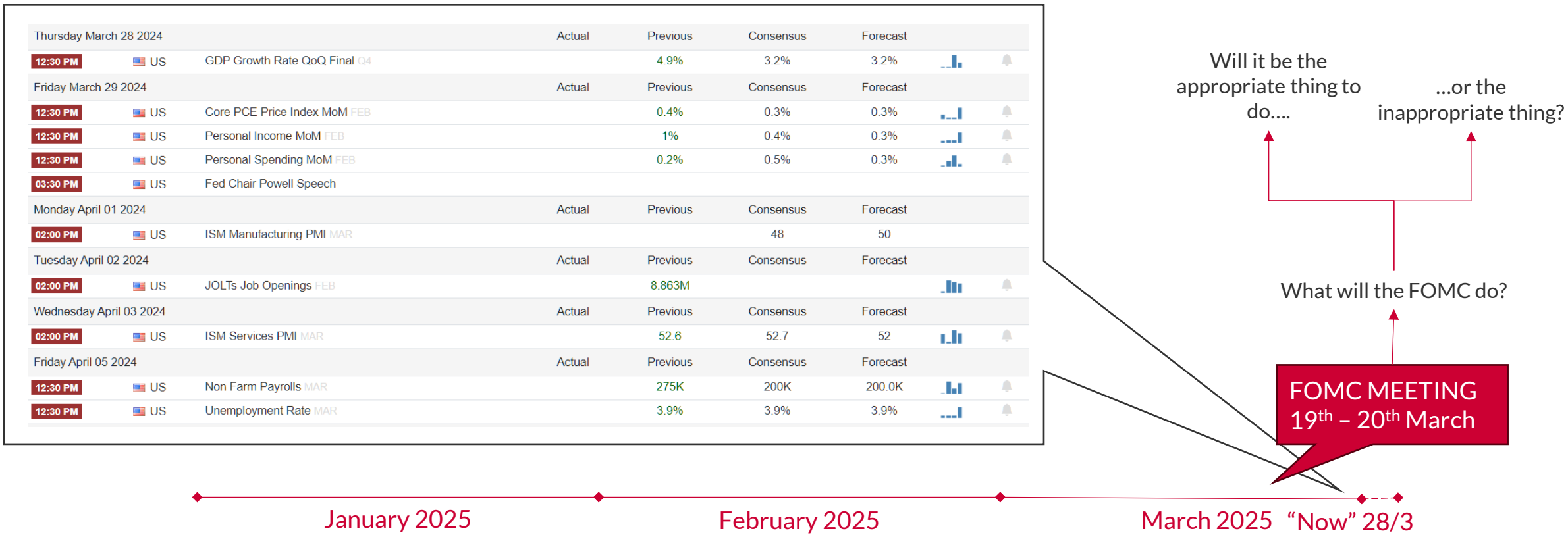
If the economy is, or appears to be, in danger of igniting **inflation** the central bank will:



Economic management and expectations

The fixed income (rates) market's interpretation of the current situation together with its expectations for the future are enormously important for fixed income investors.

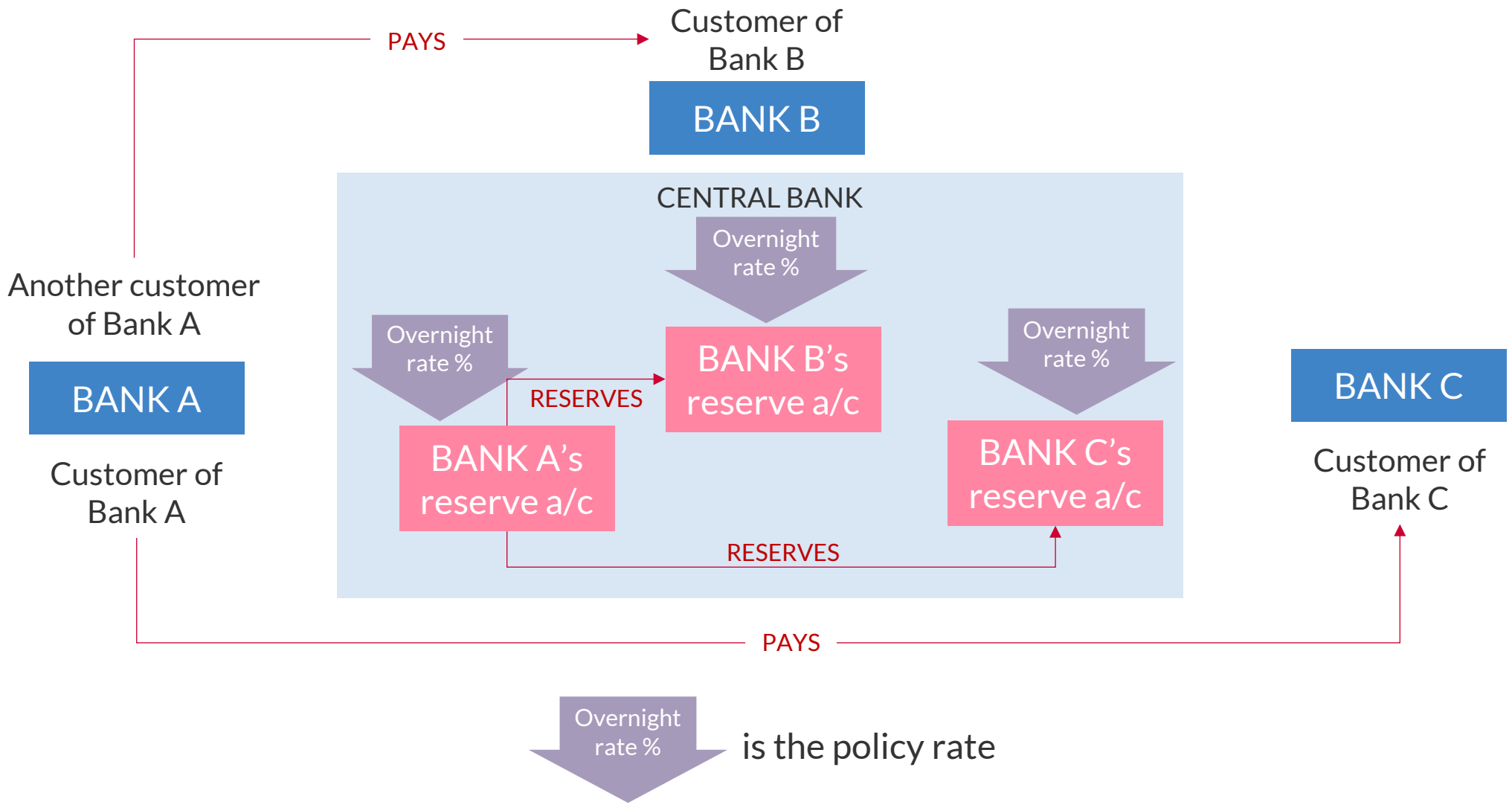
			Actual	Previous	Consensus	Forecast
Thursday March 28 2024						
12:30 PM	US	GDP Growth Rate QoQ Final Q4		4.9%	3.2%	3.2%
Friday March 29 2024			Actual	Previous	Consensus	Forecast
12:30 PM	US	Core PCE Price Index MoM FEB		0.4%	0.3%	0.3%
12:30 PM	US	Personal Income MoM FEB		1%	0.4%	0.3%
12:30 PM	US	Personal Spending MoM FEB		0.2%	0.5%	0.3%
03:30 PM	US	Fed Chair Powell Speech				
Monday April 01 2024			Actual	Previous	Consensus	Forecast
02:00 PM	US	ISM Manufacturing PMI MAR			48	50
Tuesday April 02 2024			Actual	Previous	Consensus	Forecast
02:00 PM	US	JOLTs Job Openings FEB		8.863M		
Wednesday April 03 2024			Actual	Previous	Consensus	Forecast
02:00 PM	US	ISM Services PMI MAR		52.6	52.7	52
Friday April 05 2024			Actual	Previous	Consensus	Forecast
12:30 PM	US	Non Farm Payrolls MAR		275K	200K	200.0K
12:30 PM	US	Unemployment Rate MAR		3.9%	3.9%	3.9%



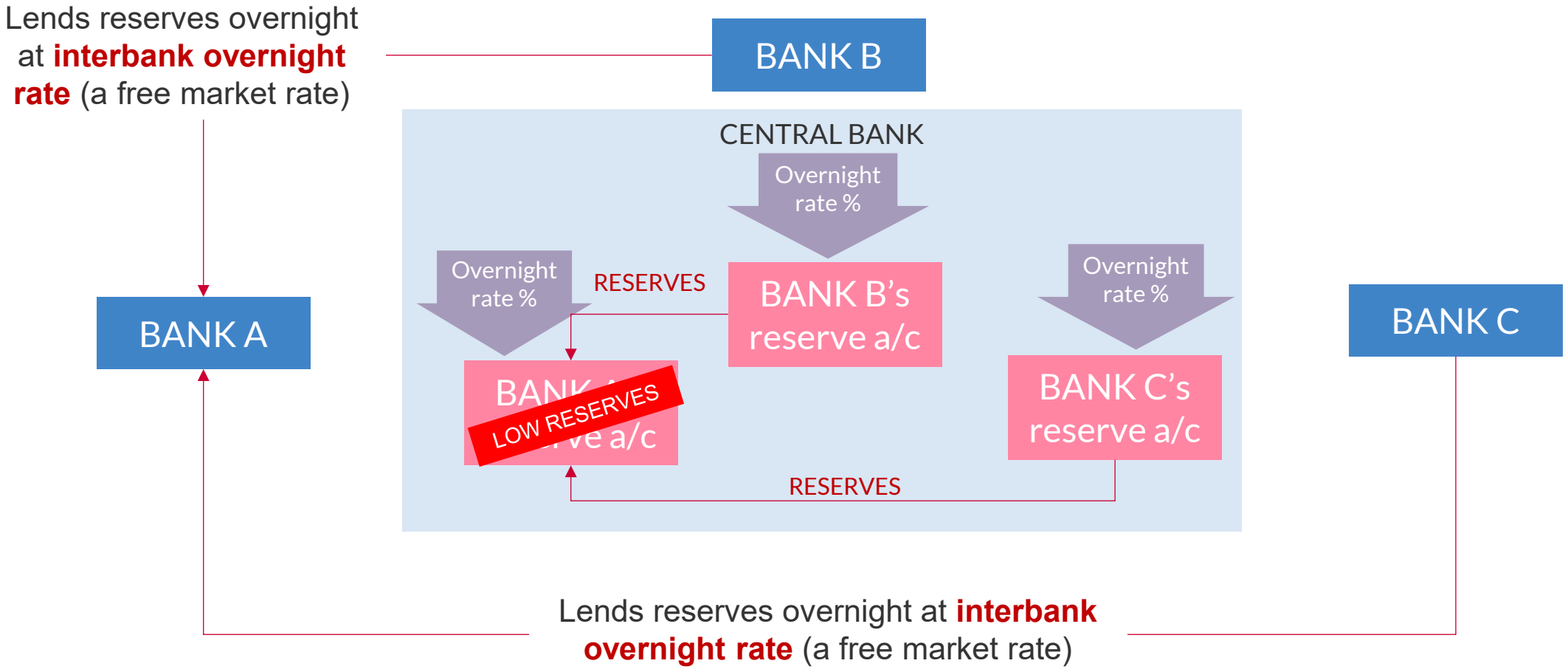
Monetary policy transmission

A case study in monetary policy development and implementation

Central banks, banks and the policy rate



Central banks, banks and the interbank market



The **interbank overnight rate** is influenced by the policy rate
Wider (commercial) lending by the bank is also influenced by the policy rate

Central banks, banks and overnight index rates

CENTRAL BANK

- Monitors all overnight interbank transactions
- Calculates the weighted average rate
- This weighted average is published 8:00am the following day as the overnight index rate (OIR)

Overnight index rate (OIR)	Calculating Agent	Source Market	Currency	Secured or unsecured
Effective Fed Funds Rate **(EFFR)**	Federal Reserve	Fed Funds Market	USD	Unsecured
Secured Overnight Financing Rate **(SOFR)**	Federal Reserve	USD GC repo markets	USD	Secured
Euro Short Term Rate **(ESTR)**	ECB	Wholesale (inter-bank) market. Euro area banks	EUR	Unsecured
Swiss Average Overnight Rate **(SARON)**	SIX Swiss Exchange	SIX Repo Ltd electronic trading platform	CHF	Secured
Tokyo Overnight Average Rate **(TONA)**	Bank of Japan	Japanese yen unsecured overnight money market	JPY	Unsecured
Sterling Overnight Index Average **(SONIA)**	Bank of England	Sterling overnight inter-bank money market	GBP	Unsecured

Central banks, banks and overnight index rates

- These rates are the principle focus of **monetary policy**.
- Central banks use **tools** (such as administered rates) to ensure these rates are kept at the appropriate level.
- They are also **reference rates** – i.e. the starting point for commercial lending by banks.
- They are considered **risk-free** reference rates: the overnight period carries virtually no credit risk.

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Central bank monetary policy tools

The Fed, then, has several tools. **administered rates**, which it sets to control the availability and cost of money.

For release at 2:00 p.m. EST January 29, 2025

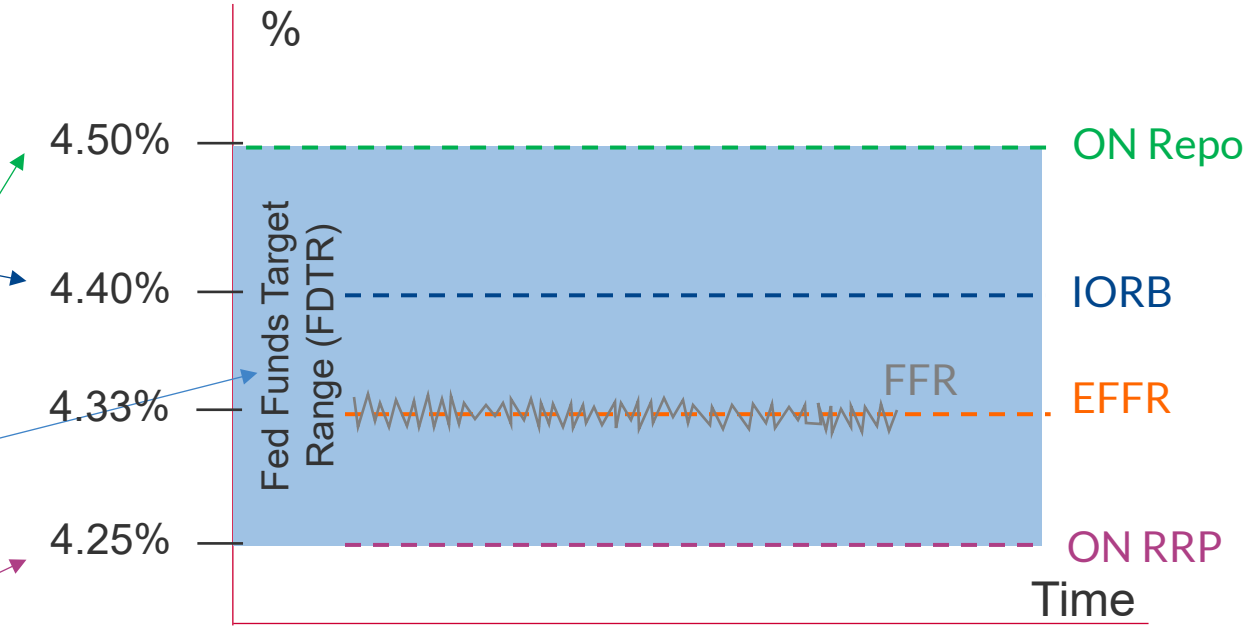
Decisions Regarding Monetary Policy Implementation

The Federal Reserve has made the following decisions to implement the monetary policy stance announced by the Federal Open Market Committee in its statement on January 29, 2025:

- The Board of Governors of the Federal Reserve System voted unanimously to maintain the interest rate paid on reserve balances at 4.4 percent, effective January 30, 2025.
- As part of its policy decision, the Federal Open Market Committee voted to direct the Open Market Desk at the Federal Reserve Bank of New York, until instructed otherwise, to execute transactions in the System Open Market Account in accordance with the following domestic policy directive:

"Effective January 30, 2025, the Federal Open Market Committee directs the Desk to:

- Undertake open market operations as necessary to maintain the federal funds rate in a target range of 4-1/4 to 4-1/2 percent.
- Conduct standing overnight repurchase agreement operations with a minimum bid rate of 4.5 percent and with an aggregate operation limit of $500 billion.
- Conduct standing overnight reverse repurchase agreement operations at an offering rate of 4.25 percent and with a per-counterparty limit of $160 billion per day.

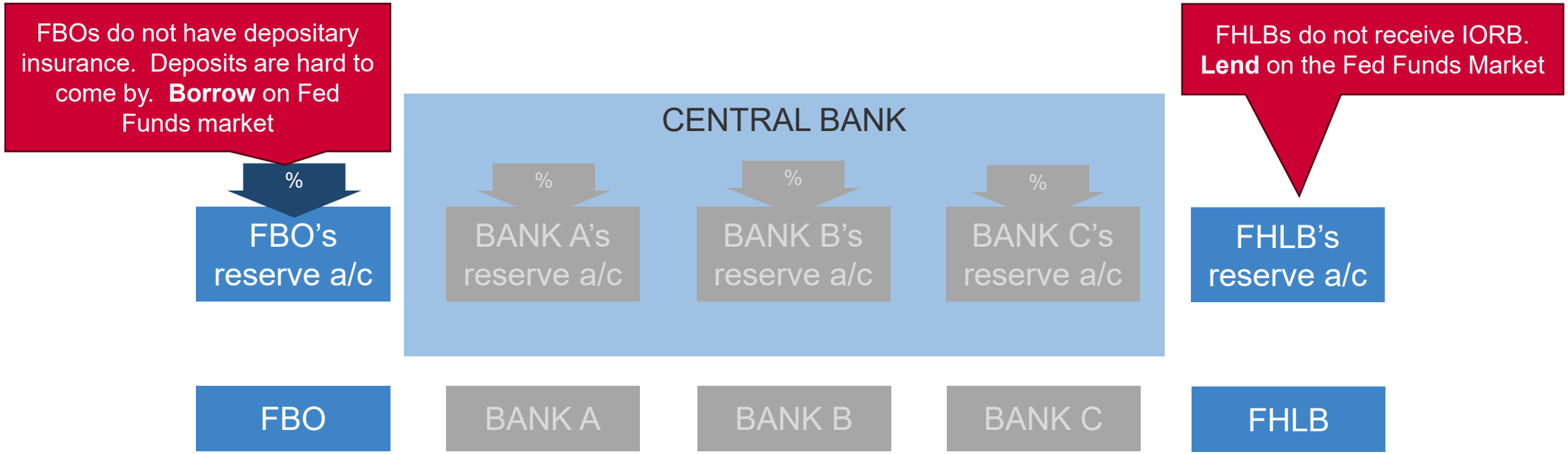


DATE	RATE (%)	1ST PERCENTILE (%)	25TH PERCENTILE (%)	75TH PERCENTILE (%)	99TH PERCENTILE (%)	VOLUME ($Billions)	TARGET RATE/RANGE (%)
02/28	4.33	4.31	4.32	4.34	4.40	95	4.25 - 4.50
02/27	4.33	4.31	4.33	4.34	4.40	110	4.25 - 4.50
02/26	4.33	4.31	4.33	4.34	4.40	108	4.25 - 4.50
02/25	4.33	4.31	4.33	4.34	4.45	108	4.25 - 4.50

Why is EFFR below IORB?

There is a **spread** between FDTR upper and EFFR of about 17bps (0.17% p.a.).

Domestic banks are not the only entities with reserve accounts at the Fed. **Foreign banking organizations** (FBOs) and **Federal Home Loan Banks** also have reserve accounts:



Interest rate expectations

Term structures

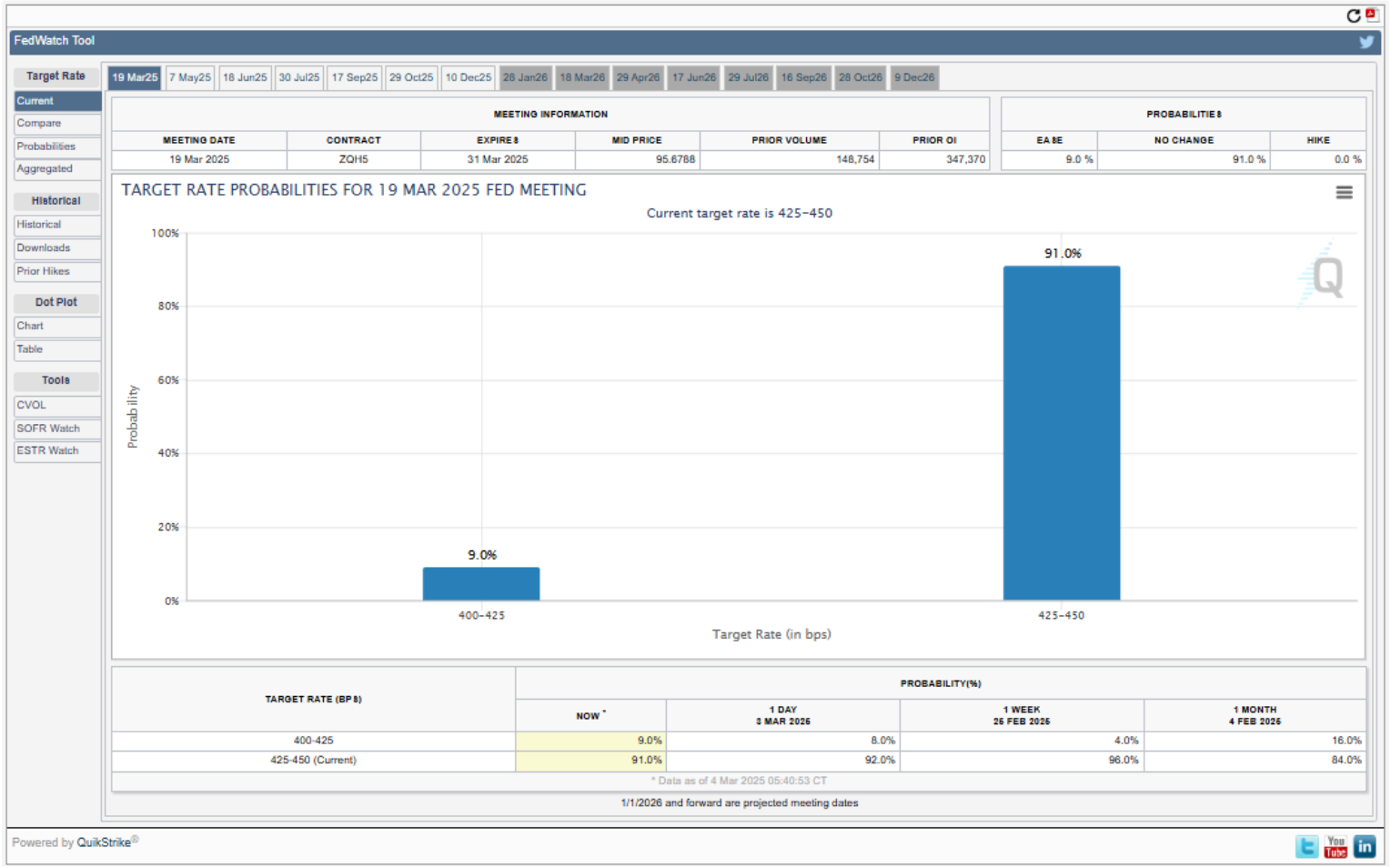
FitchLearning

Interest rate expectations

In groups, use the sources below (and any others you can think of) to forecast the FOMC's decisions over the next two years. Enter any expected / forecast interest rate changes on the spreadsheet [**FOMC exp**].

CME Group MARKETS DATA SERVICES | INSIGHTS EDUCATION LOG IN

CME Fedwatch tool / app



Interest rate expectations

The FOMC's summary of economic projections:

Search for 'FOMC meeting Calanders and information'

November	6-7	**Statement:** PDF | HTML Implementation Note	Press Conference	**Minutes:** PDF | HTML (Released November 26, 2024)
December	17-18*	**Statement:** PDF | HTML Implementation Note	Press Conference **Projection Materials** PDF | HTML	**Minutes:** PDF | HTML (Released January 08, 2025)

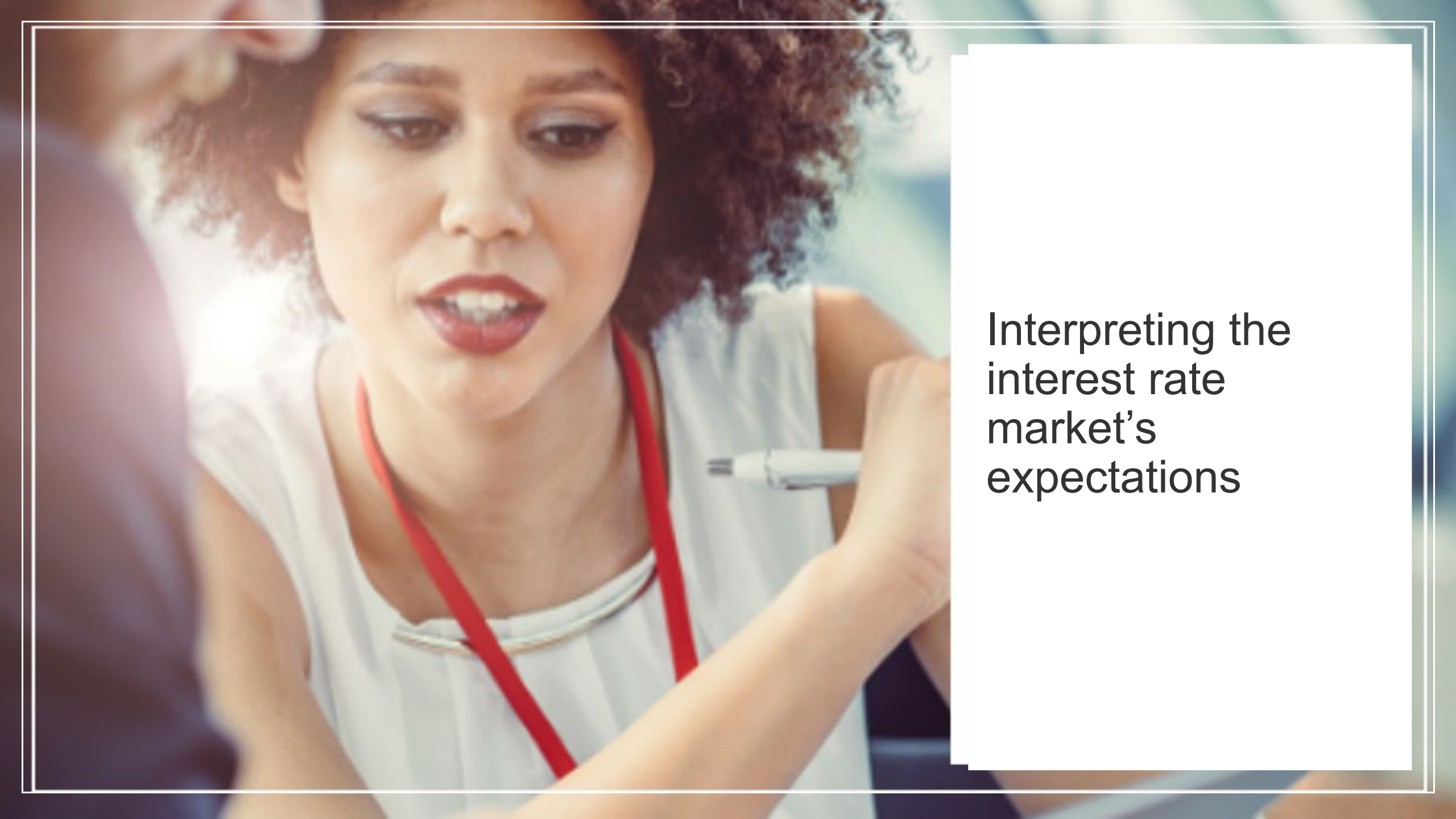
* Meeting associated with a Summary of Economic Projections.

For release at 2:00 p.m., EST, December 16, 2020

Summary of Economic Projections

In conjunction with the Federal Open Market Committee (FOMC) meeting held on December 15–16, 2020, meeting participants submitted their projections of the most likely outcomes for real gross domestic product (GDP) growth, the unemployment rate, and inflation for each year from 2020 to 2023 and over the longer run. Each participant's projections were based on information available at the time of the meeting, together with her or his assessment of appropriate monetary policy—including a path for the federal funds rate and its longer-run value—and assumptions about other factors likely to affect economic outcomes. The longer-run projections represent each participant's assessment of the value to which each variable would be expected to converge, over time, under appropriate monetary policy and in the absence of further shocks to the economy. "Appropriate monetary policy" is defined as the future path of policy that each participant deems most likely to foster outcomes for economic activity and inflation that best satisfy his or her individual interpretation of the statutory mandate to promote maximum employment and price stability.

Beginning with the December 2020 FOMC meeting, all Summary of Economic Projections charts and tables previously released with the minutes of a meeting will be



Interpreting the interest rate market’s expectations

Term rates and expectations

Suppose we are a few weeks away from the next FOMC meeting.
EFFR is printing each day at 5.33% p.a., and *you do not expect it to deviate* away from this.
How would you go about quoting a rate to another bank / client a rate for 1 week?

You could calculate the cumulative compounding of all the overnight periods at your expected rate of 5.33%.
Using an investment of 1 (the red rates represent expectations):

Tue	Wed	Thurs	Fri	Sat	Sun	Mon	Tue
5.33% p.a.	5.33% p.a.	5.33% p.a.	5.33% p.a.			5.33% p.a.	

$$1 * \left(1 + 5.33\% * \frac{1}{360}\right) = 1.00014806$$

$$1.00014806 * \left(1 + 5.33\% * \frac{1}{360}\right) = 1.00029613$$

$$1.00029613 * \left(1 + 5.33\% * \frac{1}{360}\right) = 1.00044423$$

$$1.00044423 * \left(1 + 5.33\% * \frac{3}{360}\right) = 1.00059235$$

$$1.00059235 * \left(1 + 5.33\% * \frac{1}{360}\right) = 1.00073848$$

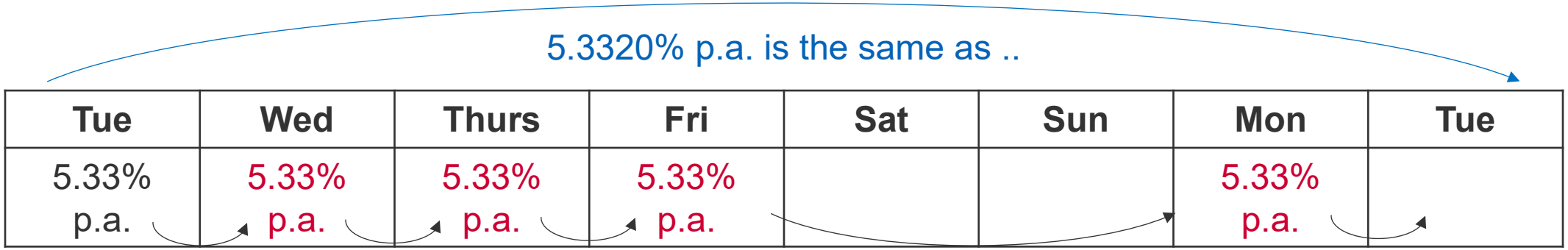
This is a periodic return of 0.1037% which we annualize by multiplying by $\frac{360}{7}$ to get **5.3320% p.a.**

Term rates and expectations

The one-week rate is a composite of the expected overnight rates.

This is known as **expectations theory**: the idea that term rates reflect expectations of the rates for the shorter periods they contain.

The one-week rate in the previous example, would be quoted as 5.3320% p.a. *if* we expect each overnight rate to be 5.3300% p.a.



In theory, if someone quoted a 1-week rate other than 5.3320% p.a. you might be tempted to:

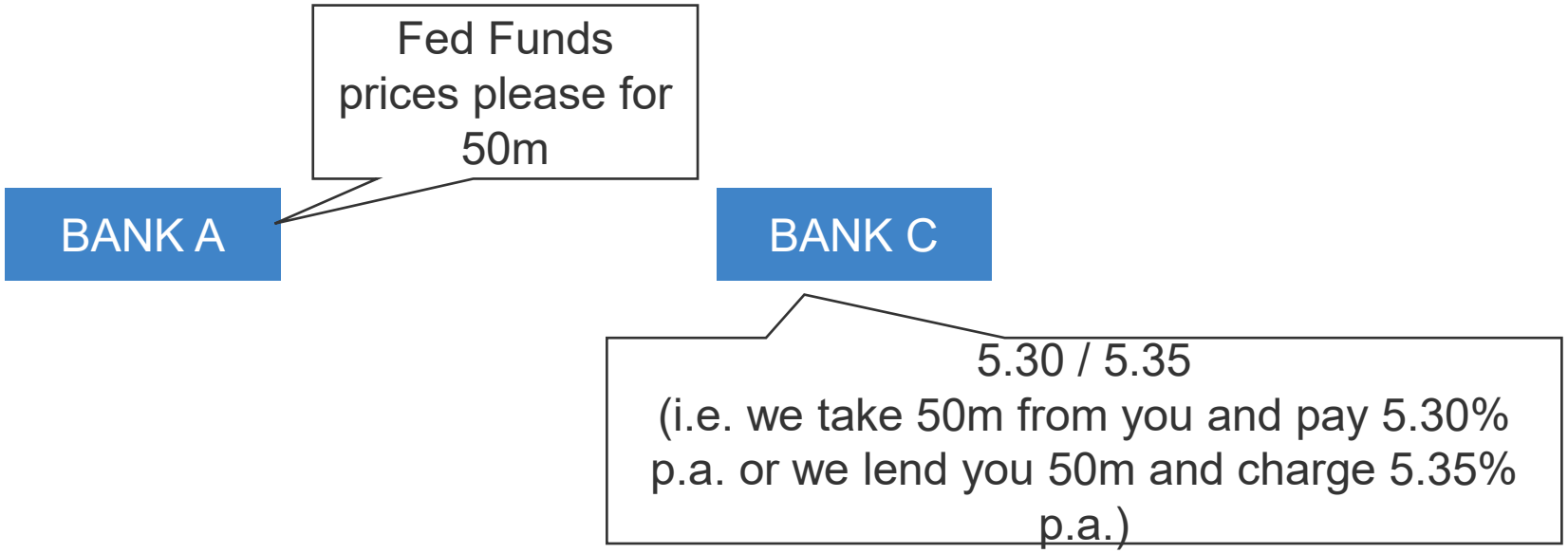
- **Borrow for 1 week** and **repeatedly deposit overnight** at 5.3300% if the quote was **lower**; or
- **Deposit for 1 week** and **repeatedly borrow in the overnight** markets at 5.3300% p.a if it was **higher**.

The reality of interest rate markets

In wholesale markets, such as the fed funds market, depositary institutions quote one another two-way prices.

Bank A asks Bank C for a Fed Funds quote.

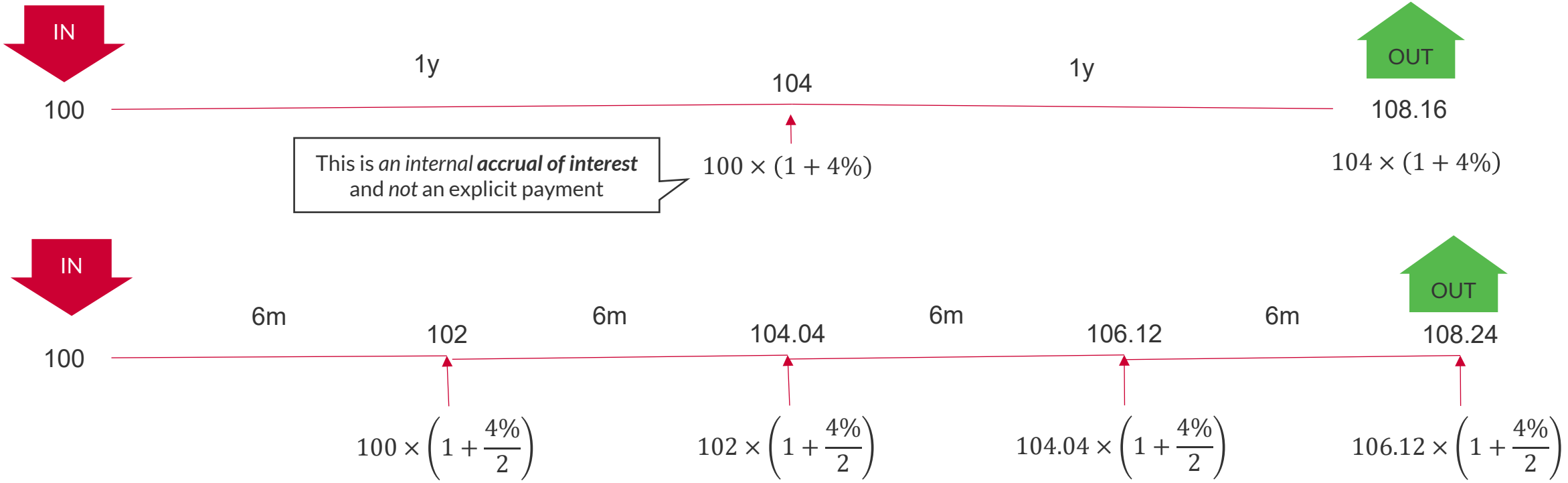
The EFFR is currently printing each day at 5.33% p.a.



Zero [coupon] or spot interest rates

A zero-coupon rate is:

- an **interest rate** for a **period** expressed as a **nominal annual rate**
- qualified with an **accrual frequency**.
- There are only two cash flows one in and one out
- For a 2-year rate at 4% paid annually and semi-annually:



3-month T-bill auction

US Treasury invites bids (yield % p.a.) for USD bn nominal value for 13-week T-bills.

You have clients interested in buying USD 10bn: determine your required yield (using your IR expectations and to 4dp) and submit a bid. Remember that you may be happy with a slightly lower bid as T-bills are very safe and highly sought after.

Fixed income markets– treasury bills

Major governments borrow **short term** (<12m) by issuing T-bills (Bubills in Germany). Bills *only pay face value at redemption.*

- An **auction** is announced, for, say, **27bn face [par] value 1-month (30 day)** T-bills.
- 90%+ is applied for by **broker dealers**, or **markets firms**. These are the **primary dealers** in government securities.
- The markets firm submits a **bid** for a certain nominal value. The bid is determined by the **return** or **yield** the markets firm feels is warranted.
- This **required yield** will consider **interest rate expectations** because the markets firm – a bank – will expect to finance itself from the wholesale markets.
- The amount the firm ought to bid is…

$$99.63 = \frac{100}{\left(1 + 4.40\% \times \frac{30}{360}\right)}$$

The amount 100 nominal T-bill pays out in 1-month's time

The required annual return and the day-count fraction

The firm needs to buy the bills at this price [or less] per 100 nominal to achieve 4.40% p.a. [or more].

Day	Expected CB rate % p.a.	Periodic % p.a. rate incl. exp
Mon	4.50%	
Tue	4.50%	4.50%
Wed	4.50%	4.50%
Thur	4.50%	4.50%
Fri	4.50%	4.50%
Mon	4.50%	4.50%
Tue	4.50%	4.50%
Wed	4.50%	4.50%
Thur	4.50%	4.50%
Fri	4.50%	4.50%
Mon	4.50%	4.50%
Tue	4.50%	4.50%
Wed	4.50%	4.50%
Thur	4.25%	4.50%
Fri	4.25%	
Mon	4.25%	
Tue	4.25%	
Wed	4.25%	
Thur	4.25%	
Fri	4.25%	
Mon	4.25%	4.41%
Tue	4.25%	4.40%
Wed	4.25%	4.40%

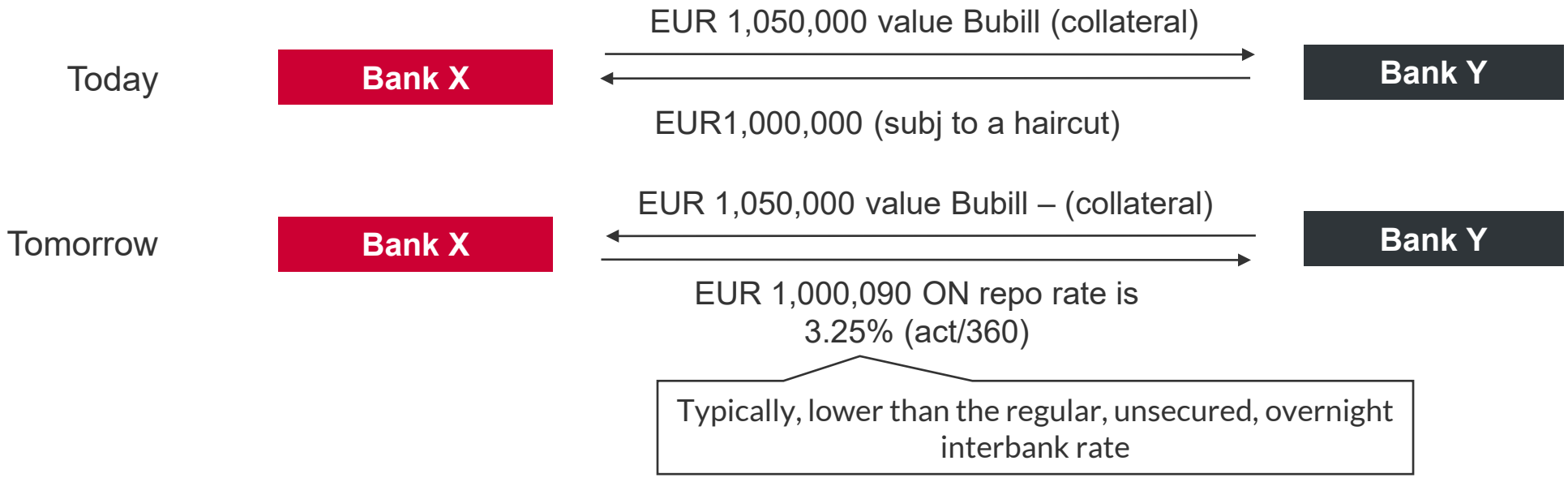
Issue date

CB monetary policy meeting. 25bp cut expected

The 1-month rate equivalent for investing each day at the expected CB rate

Fixed income markets– Repos

You could T-bills / Bubliis to raise (borrow) some cheap money via secured borrowing known as a **sale and repurchase agreement - a repo.**



In the US, the Fed monitors all overnight repos and publishes the overnight index rate **SOFR** (secured overnight financing rate).

Overnight index swaps (OISs)

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Overnight index swaps

An overnight index swap (OIS) is an **agreement** between two parties in which

- the **payer pays a fixed** interest rate (**swap rate**) on a **notional amount** for the **period**, or **tenor**, of the swap, and
- the **receiver pays the floating**, i.e., whatever the compounded interest would be on the notional using each **OIR print** during the swap period.

OIS rates (i.e., the fixed rate) is based on interest rate expectations.

A bank making a 1-week OIS price will apply a **bid-ask spread** around their perceived fair value:

BID
4.25% p.a.
Pays 4.25% p.a.
and receives compounded OIR

ASK
4.75% p.a.
Receives 4.75% p.a.
and pays compounded OIR

Day	Expected CB rate % p.a.	Annualised rate
Mon	4.5000%	
Tue	4.5000%	
Wed	4.5000%	
Thur	4.5000%	
Fri	4.5000%	
Mon	4.5000%	4.5014%
Tue	4.5000%	
Wed	4.5000%	
Thur	4.5000%	
Fri	4.5000%	
Mon	4.5000%	
Tue	4.5000%	
Wed	4.5000%	
Thur	4.2500%	
Fri	4.2500%	
Mon	4.2500%	
Tue	4.2500%	
Wed	4.2500%	
Thur	4.2500%	
Fri	4.2500%	
Mon	4.2500%	
Tue	4.2500%	
Wed	4.2500%	4.3992%

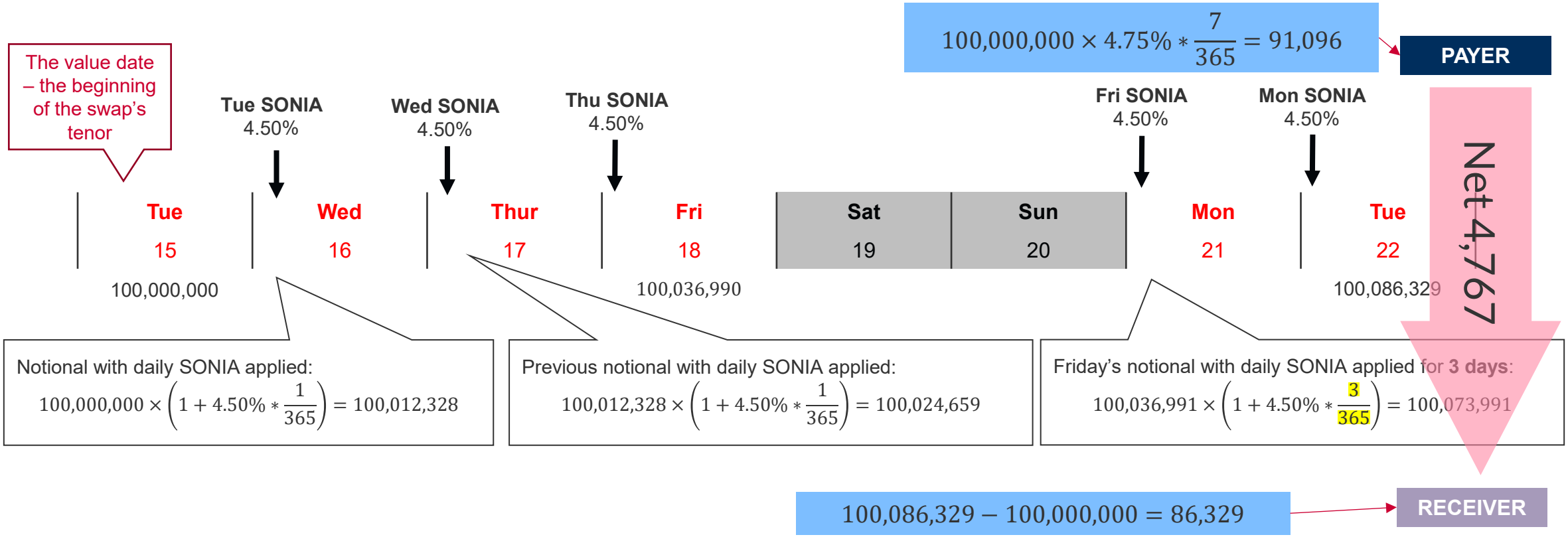
'Fair' 1-week OIS rate

CB monetary policy meeting. 25bp cut expected

'Fair' 1-Month OIS rate

Overnight index swaps

Here's an illustration of how the cash flows might transpire for a 1-week 100m [a notional amount] GBP SONIA OIS if we traded at the banks ask of **4.75%** (i.e., we pay 4.75% p.a.)



Fixed income valuation

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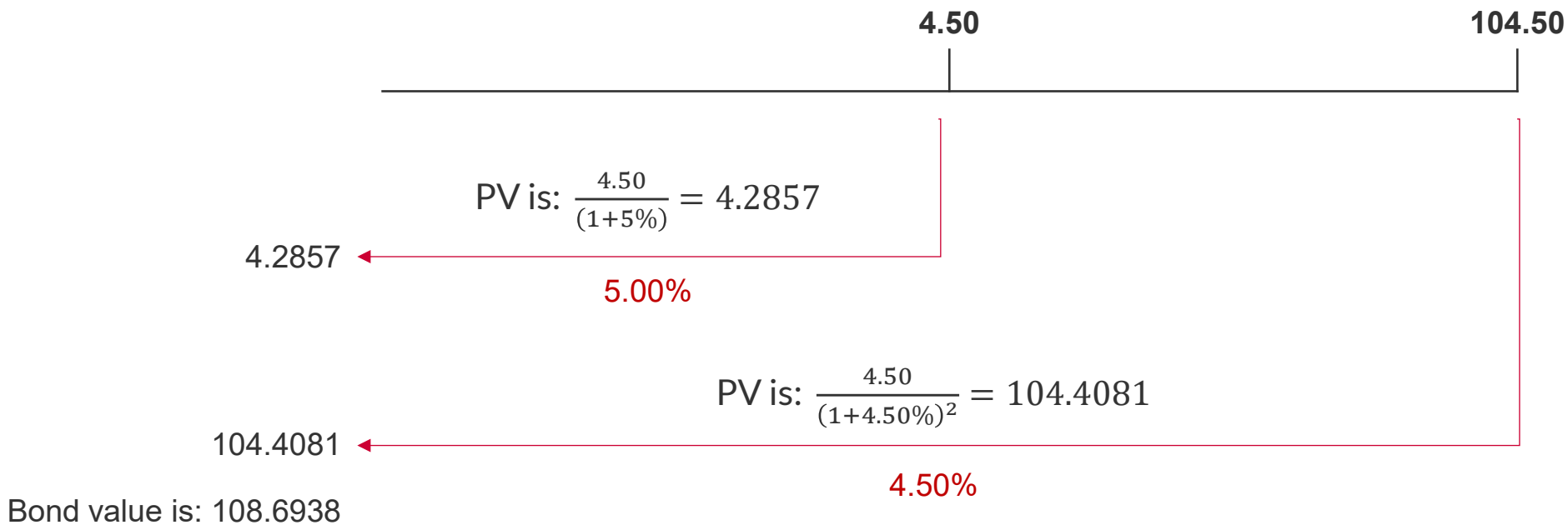
Valuing a bond using a zero term structure

Term / zero rates are used to value a bond. Supposing we have a 2-year 4.50% annual coupon bond and our 1 year zero rate is 5% p.a., and the two year is 4.50% p.a.

We simply discount the cashflows using the zero rates:



Valuing a bond using the yield to maturity

For a bond which pays an **annual coupon** this process may be summarised as:

$$Bond\ value = c \times \left[\frac{1 - \frac{1}{(1+YTM)^n}}{YTM}\right] + \frac{Nom\ Val}{(1+YTM)^n}$$

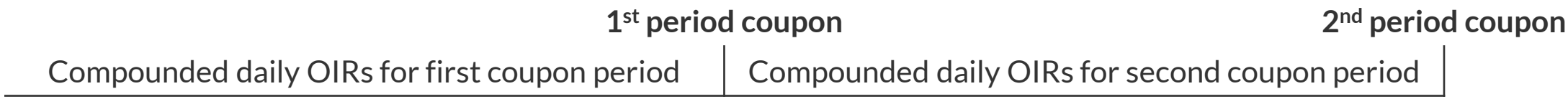
Where:

- c is the bond's coupon paid on the nominal value;
- $Nom\ Val$ is the nominal value of the bond;
- YTM is the bond's **yield to maturity** (a *uniform* required rate of return over the bond's life); and
- n is the number of years.

Valuing a floating-rate note (FRN)

FRNs have coupons which reflect prevailing interest rates.

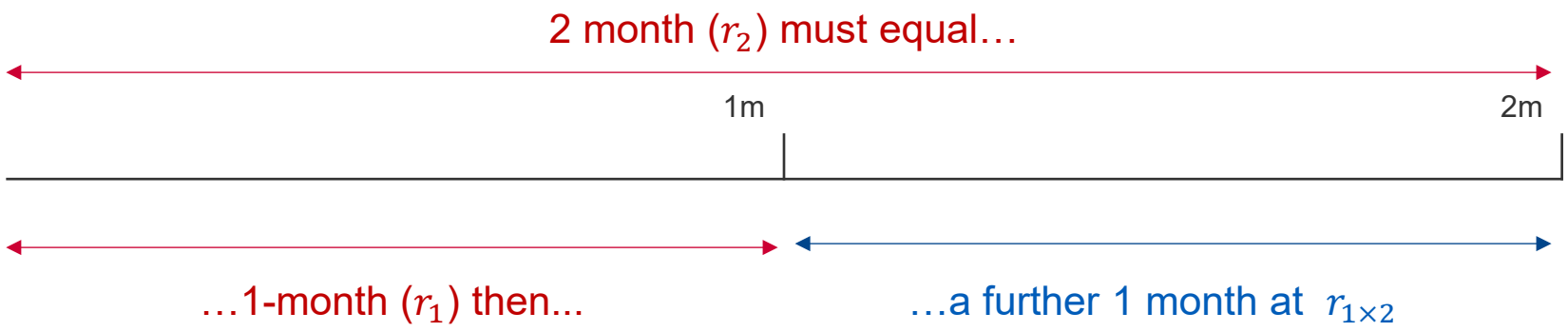
An FRN with an OIR-linked coupon pays the compounded OIRs *at the end of the coupon period*:



Nobody knows for certain what the coupon payments will be.
But we can see what the market *expects* them to be.

Valuing a floating-rate note (FRN)

Interest rates have integrity; depositing for 2 months straight must be the same as depositing for 1-month and then depositing for a further 1 month at the fair 1s2s rate:



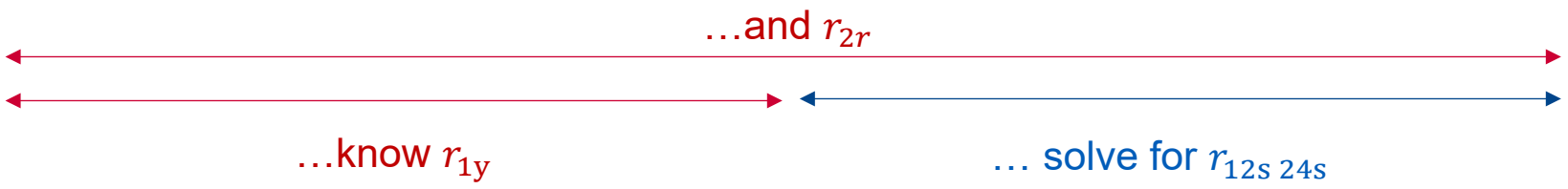
If this wasn't the case, there'd be an arbitrage profit available.

Valuing a floating-rate note (FRN)

This means that:

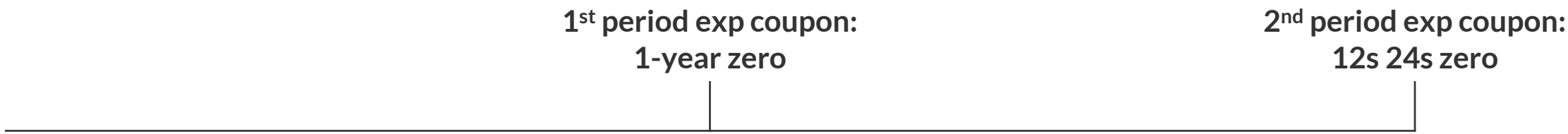
$$(1 + r_{1y}) \times (1 + r_{12s\ 24s}) = (1 + r_{2y})^2$$

And so, if we know any two of r_1, r_2 or $r_{12s\ 24s}$ we can calculate the third:



$$r_{12s\ 24s} = \frac{(1 + r_{2y})^2}{(1 + r_{1y})} - 1$$

For the two-year bond above the expected coupon payments will be the current 1 year zero and the current 12s 24s zero.



The result of discounting the expected coupons / cash flows using the same zero rates used to source the same coupons it a value of **100**, or **par**.

Valuing Treasuries using zero term structure

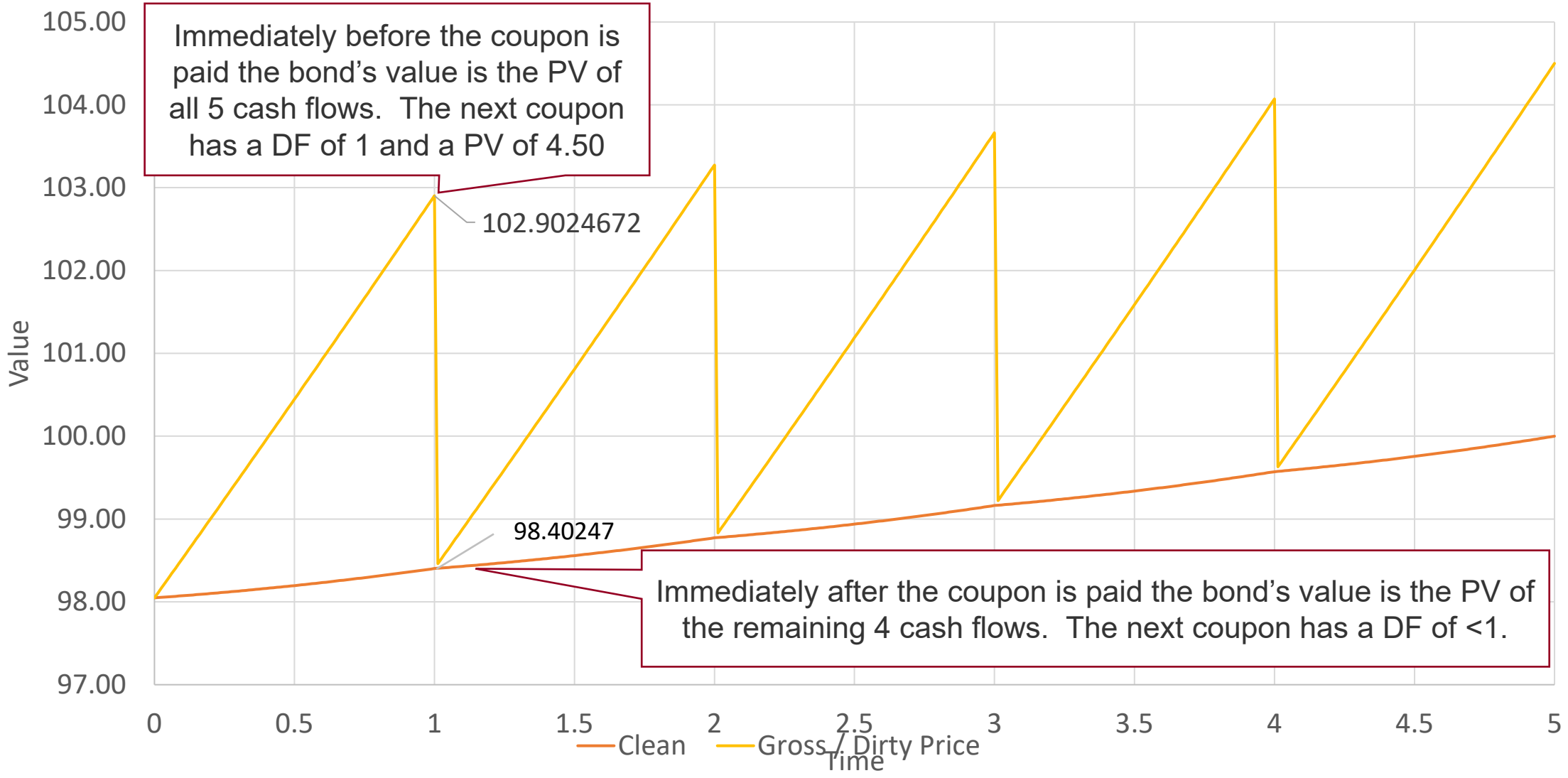
When valuing treasuries, we must apply some sort of adjustment (a **spread**) to the term structure we've been using.

Our term structure is based on expectations of future central bank monetary policy and so future returns.

Treasury securities offer more than just an investment return – they are also used as **collateral** by banks and investors. This means their value may be distorted by collateral markets and their returns too.

Clean and dirty (gross) pricing of bonds

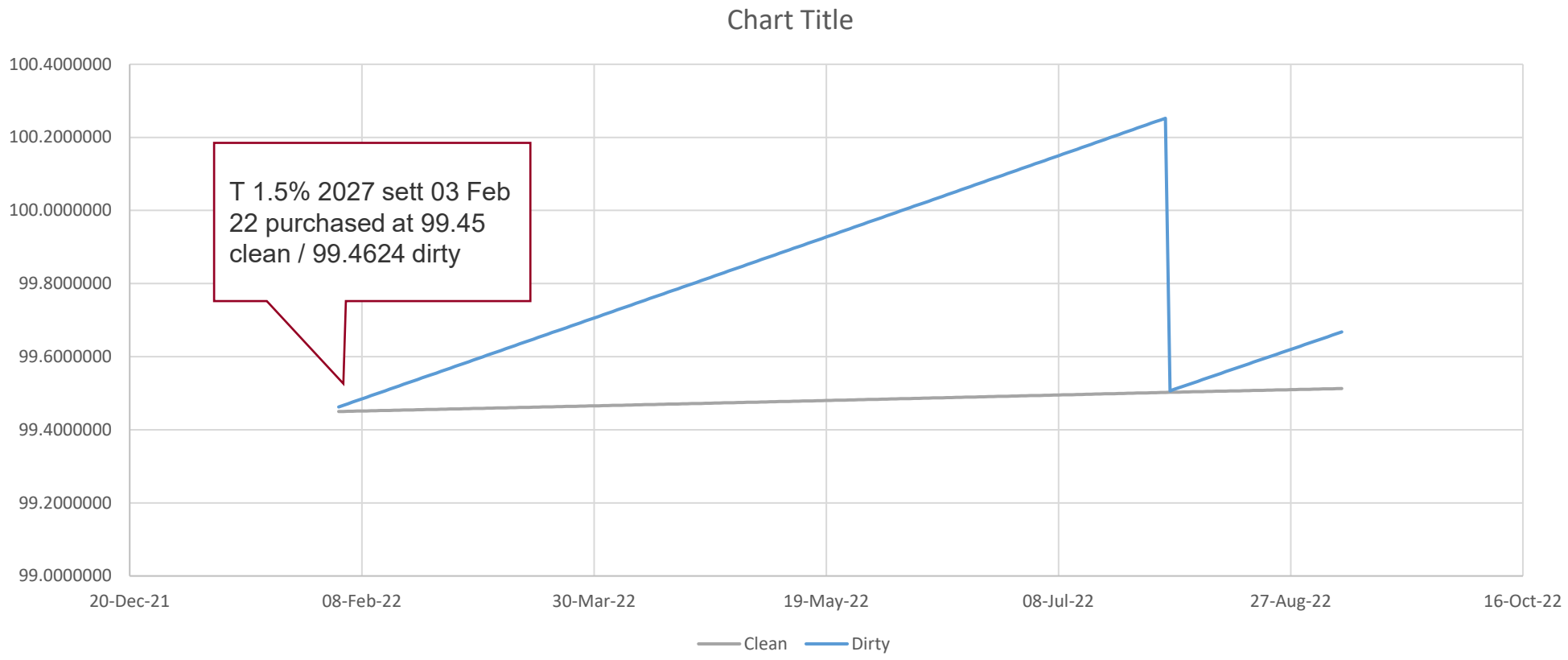
5-year bond with 4.50% annual coupon and 4.80% YTM.



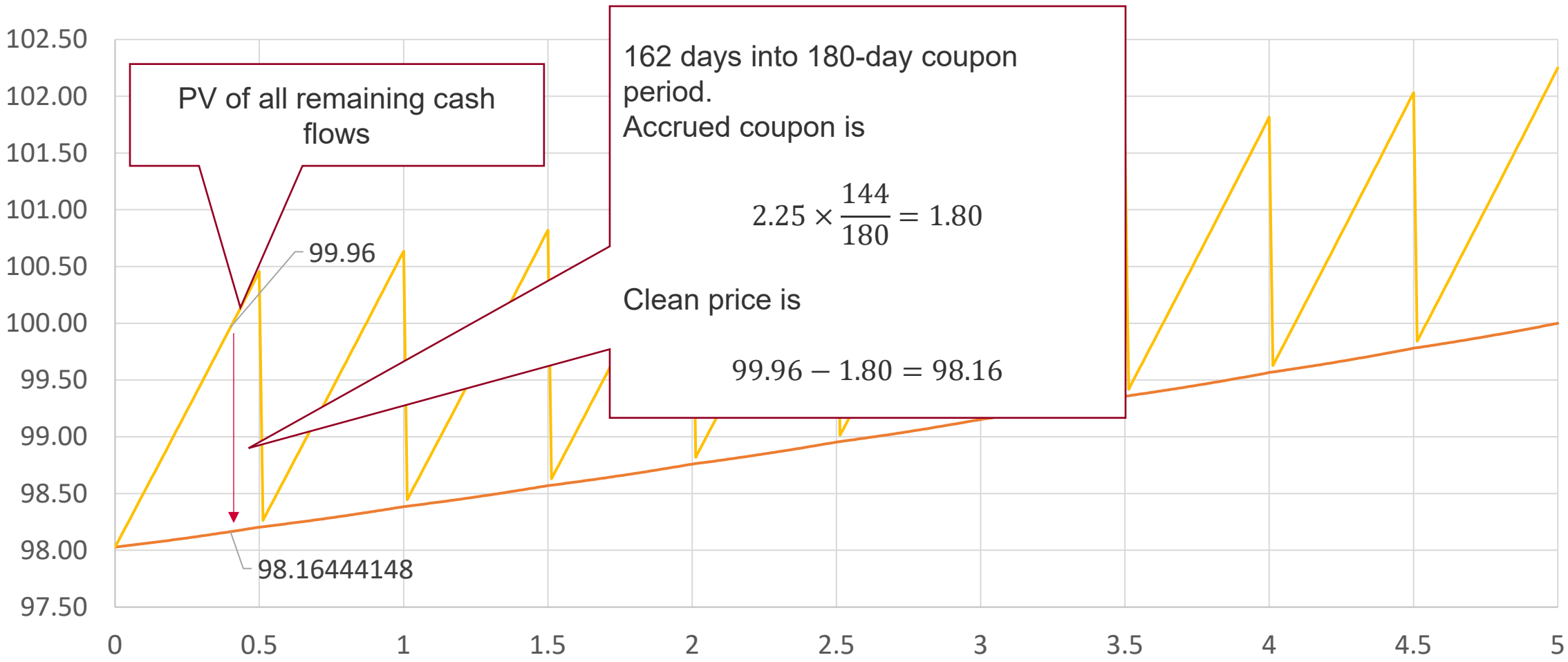
Benefits of trading clean rather than dirty prices

If everything remained constant (YTM) a bond trading above par would experience a pull to par over its remaining life.

The diagram here shows that including accrued (i.e. dirty) the bond's value appears to be more volatile than the clean.



Too avoid the saw-tooth value profile bond markets ignore the accrual of the next coupon



Credit markets and credit curves

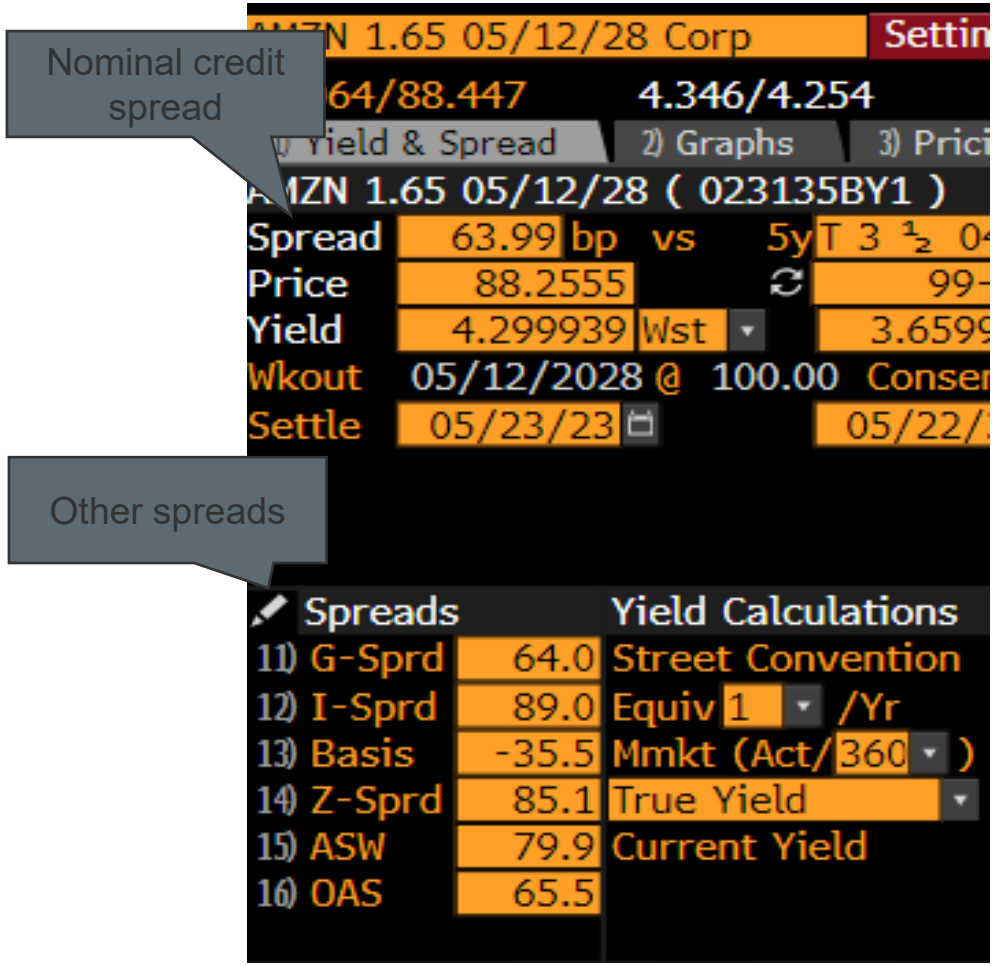
FitchLearning

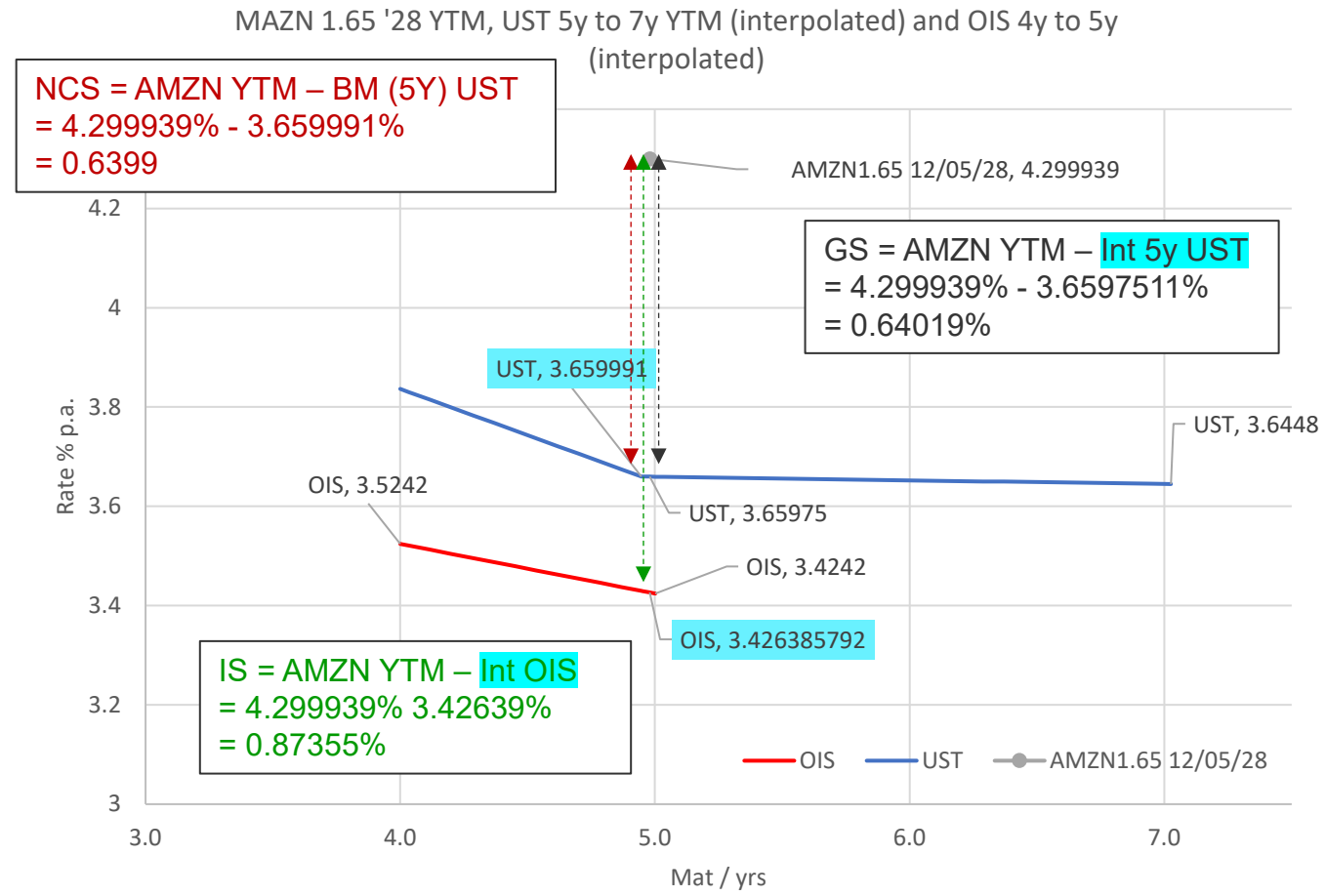
Amazon 1.65% 12/05/2028

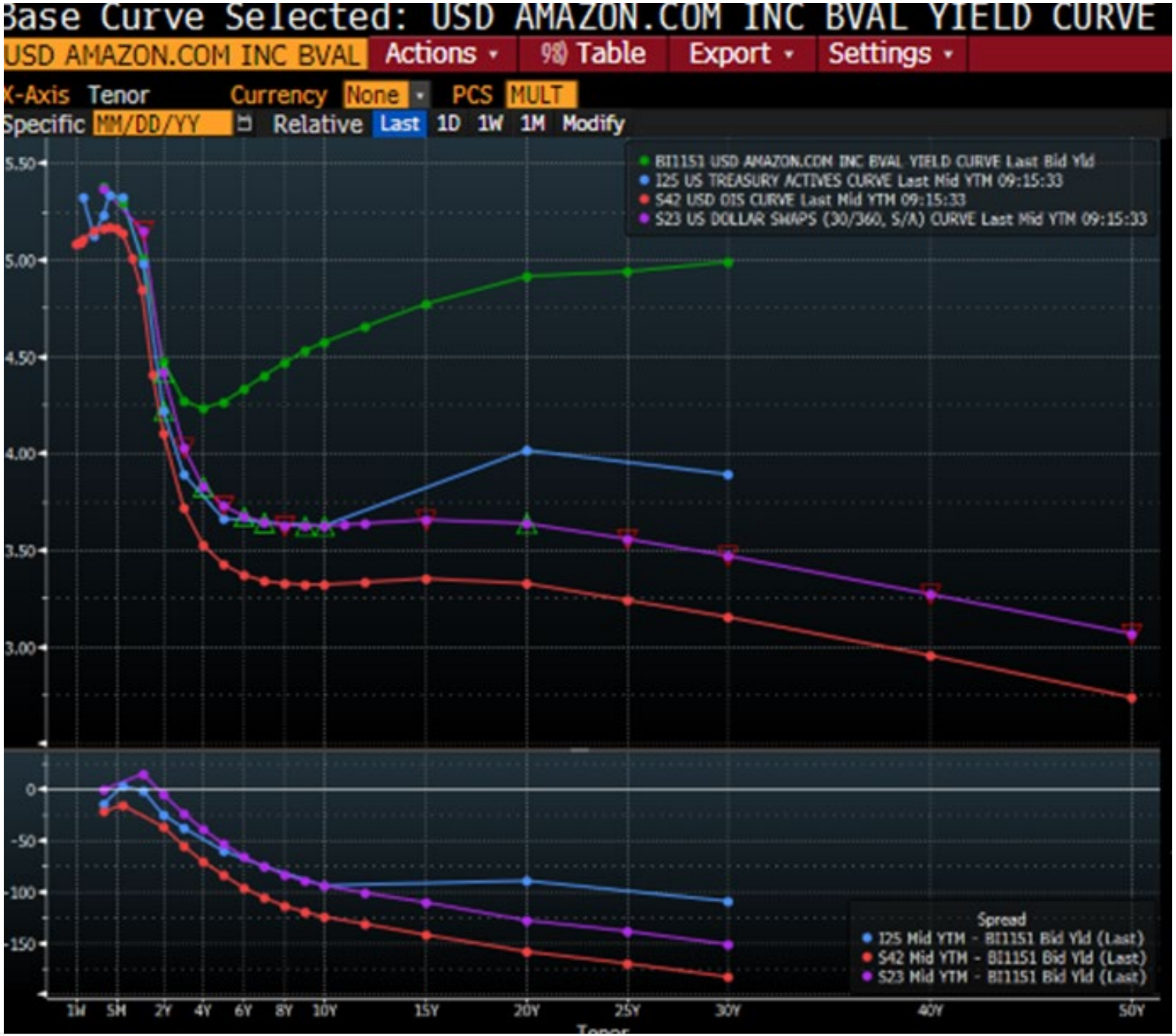
Credit spreads

A credit spread is the difference between the YTM on a risky (corporate) bond and another interest rate (this reference rate is also called the **benchmark rate**).

The most basic is the nominal spread:






Base Curve Selected: USD AMAZON.COM INC BVAL YIELD CURVE
USD AMAZON.COM INC BVAL
Actions
Table
Export
Settings
X-Axis Tenor
Currency None
PCS MULT
Specific MM/DD/YY
Relative Last 1D 1W 1M Modify
BI1151 USD AMAZON.COM INC BVAL YIELD CURVE Last Bid Yld
I25 US TREASURY ACTIVES CURVE Last Mid YTM 09:15:33
S42 USD OIS CURVE Last Mid YTM 09:15:33
S23 US DOLLAR SWAPS (30/360, S/A) CURVE Last Mid YTM 09:15:33
5.50
5.00
4.50
4.00
3.50
3.00
0
-50
-100
-150
Spread
I25 Mid YTM - BI1151 Bid Yld (Last)
S42 Mid YTM - BI1151 Bid Yld (Last)
S23 Mid YTM - BI1151 Bid Yld (Last)
1W 5M 2Y 4Y 6Y 8Y 10Y 15Y 20Y 25Y 30Y 40Y 50Y
Tenor

Zero Volatility (Z-) Spread

The z-spread is the spread added to a zero curve (usually swap-based) which gives the current price of the bond. It reflects the reward the investor (or market) requires for taking on credit, liquidity and option risk.

OIS curve moves from A to B

Ann

				T-bond				AA- Bond		
			Cpn	3.500%			**Cpn**	3.500%		
			Nominal	100			**Nominal**	100		
T	**OIS-based Zero A**	**OIS-based Zero B**	O-spread	CF	PV CF at A - O	PV CF at B - O	Z-spread	CF	PV CF at A + Z	PV CF at B + Z
1.00	4.76%	4.76%	0.080%	3.5000	3.3435	3.3435	0.60%	3.5	3.3219	3.3219
2.00	3.90%	5.11%	0.080%	3.5000	3.2472	3.1728	0.60%	3.5	3.2051	3.1321
3.00	3.50%	5.46%	0.080%	103.5000	93.5679	88.4435	0.60%	103.5	91.7462	86.7532
				Val	100.1586	94.9598		**Val**	98.2732	93.2072
				YTM	3.4435%	5.2013%		**YTM**	4.1237%	5.8564%
								Nom CS	0.6802%	0.6551%
								Change in Nom CS	-0.0251	**basis points**

T-bond priced using underlying OIS based zeros A and B after *subtracting* the O spread

AA-bond priced using underlying OIS based zeros A and B after *Adding* the Z spread. Notic how the NCS changes with the U/L zero curve

Zero Volatility (Z-) Spread

The z-spread is the spread added to a zero curve (usually swap-based) which gives the current price of the bond. It reflects the reward the investor (or market) requires for taking on credit, liquidity and option risk.

OIS curve moves from A to B

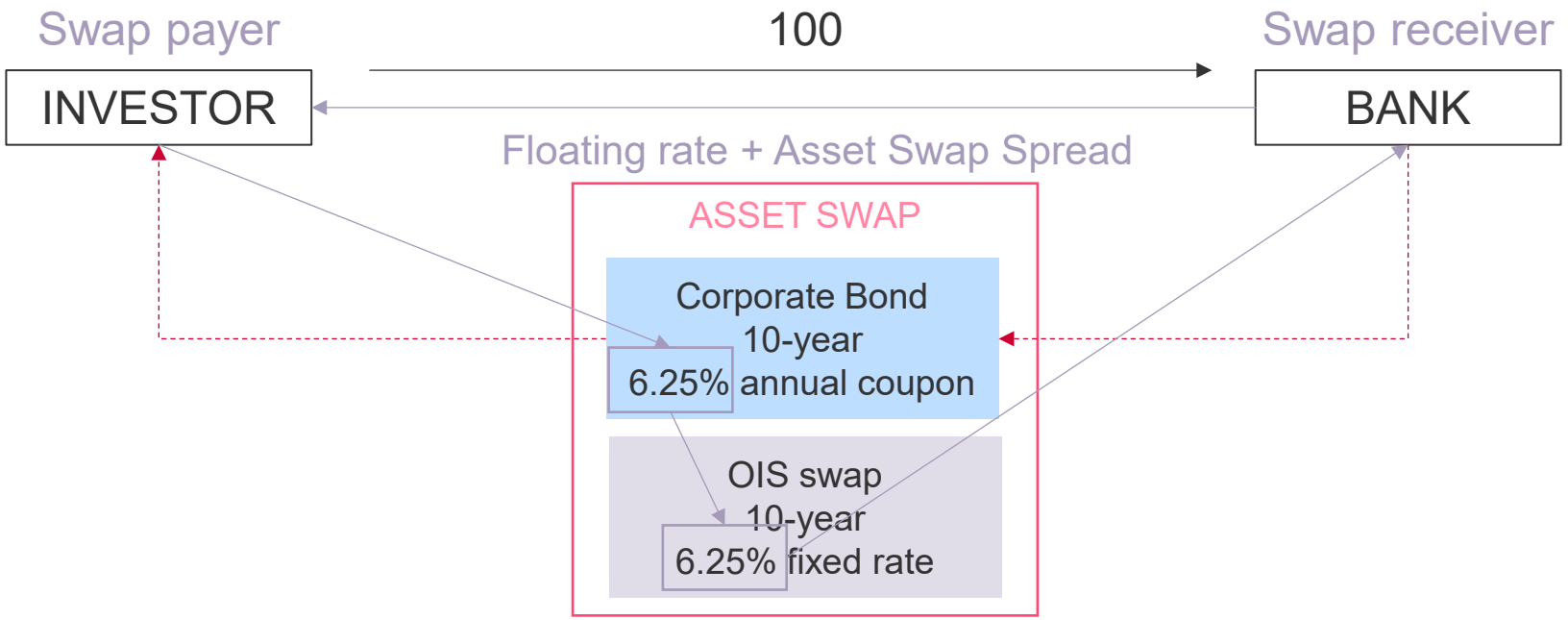
			T-bond				AA- Bond			
			Cpn	3.750%			**Cpn**	5.250%		
			Nominal	100			**Nominal**	100		
Time	**OIS-based Zero A**	**OIS-based Zero B**	O-spread	CF	PV CF at A - O	PV CF at B - O	Z-spread	CF	PV CF at A + Z	PV CF at B + Z
1.00	4.95%	4.25%	0.050%	3.7500	3.5748	3.5988	0.60%	5.25	4.9739	5.0072
2.00	5.25%	5.50%	0.050%	3.7500	3.3884	3.3724	0.60%	5.25	4.6857	4.6637
3.00	5.75%	7.00%	0.050%	103.7500	87.8543	84.8097	0.60%	105.25	87.5003	84.4861
				Val	94.8176	91.7810		**Val**	97.1600	94.1569
				YTM	5.6772%	6.8747%		**YTM**	6.3187%	7.4967%
								Nom CS	0.6415%	0.6220%
								Change in Nom CS	-0.0195	**basis points**

T-bond priced using underlying OIS based zeros A and B after *subtracting* the O spread

AA-bond priced using underlying OIS based zeros A and B after *Adding* the Z spread. Notice how the NCS changes with the U/L zero curve

Asset swaps and ASW

An asset swap is a package comprising a corporate bond and an interest rate swap.
The idea of the package is to convert the nature of the bond's coupons from, say, fixed to floating.

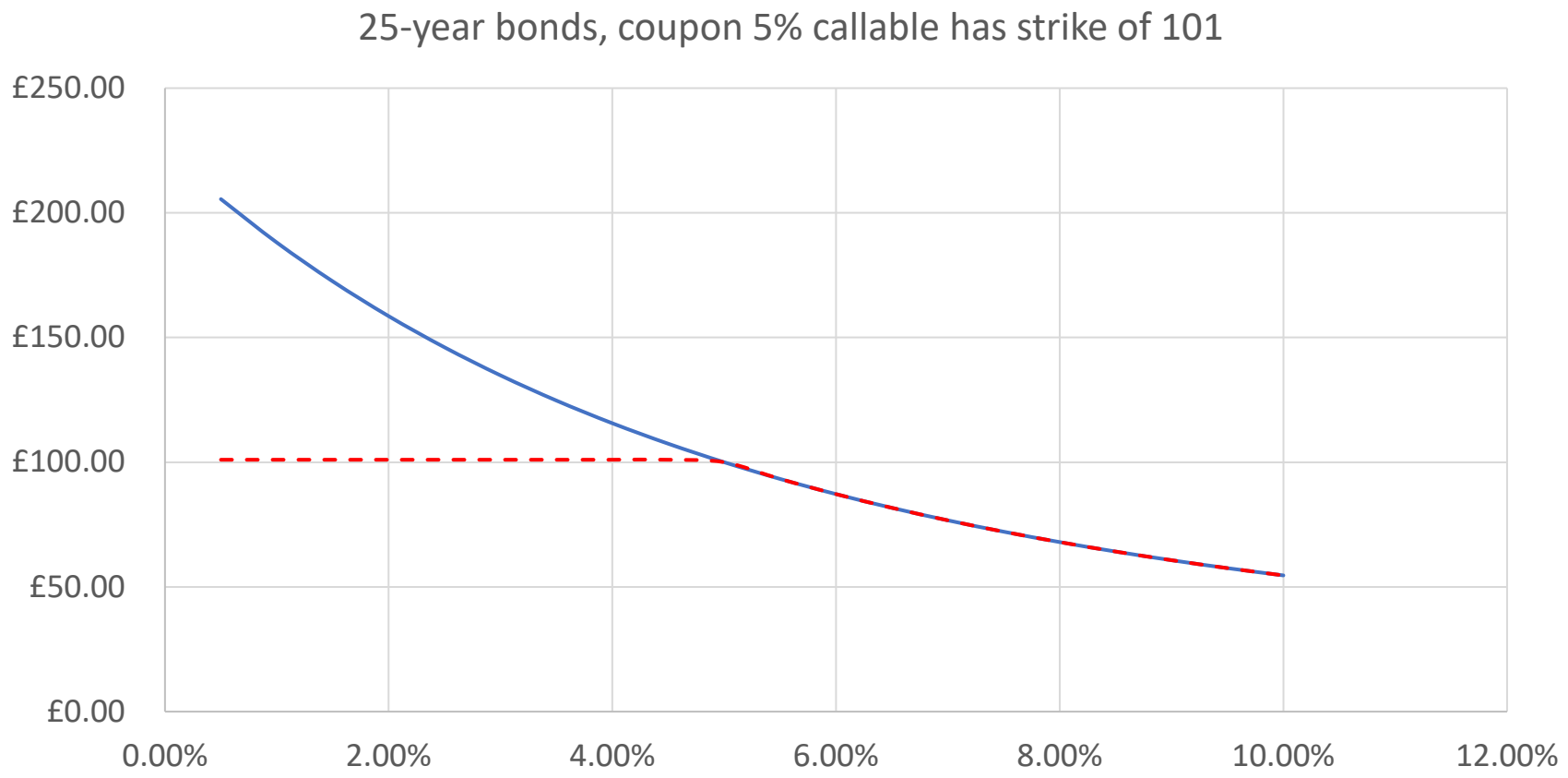


The asset swap spread reflects two things: the off market swap rate and the bond having traded at par

Call-able and Put-able Bonds

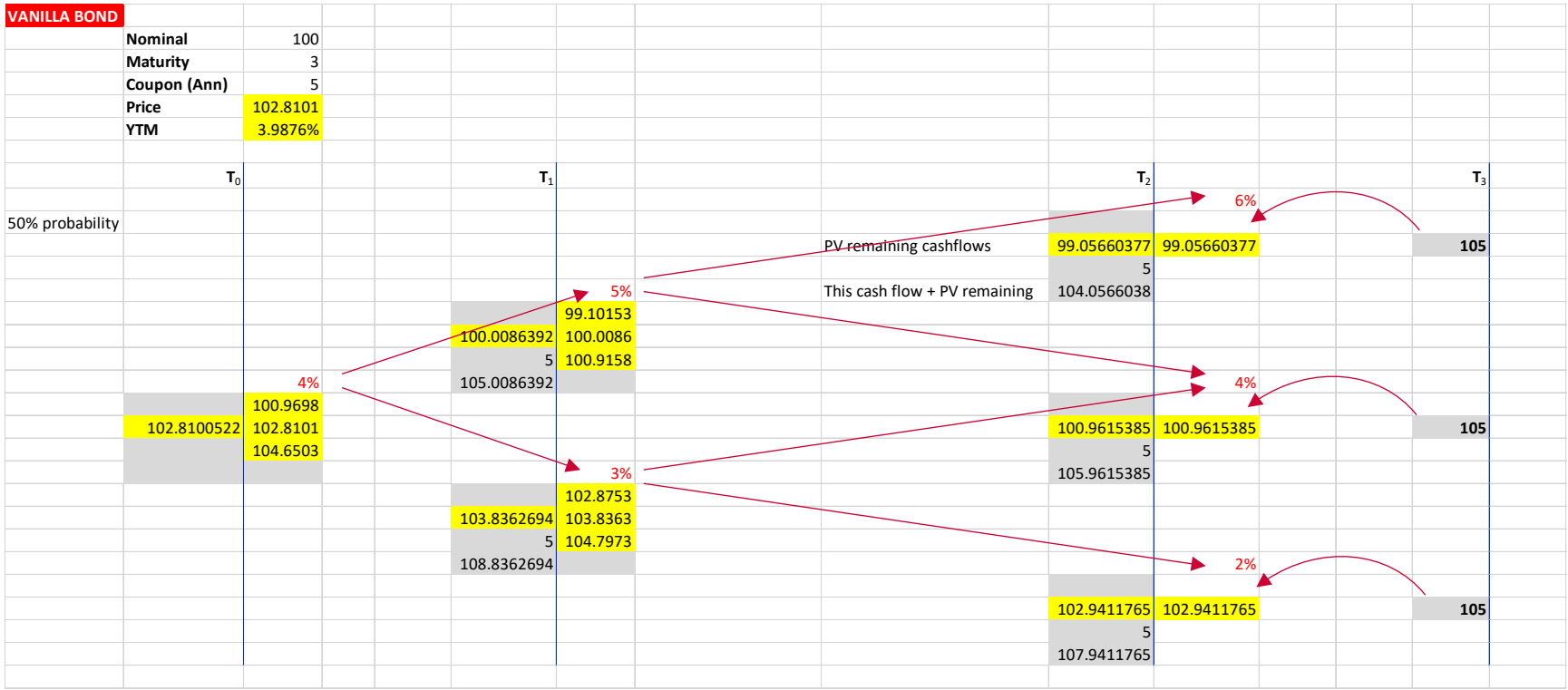
Call-able bonds may be redeemed early by their issuer at a named price (the strike): less attractive than a vanilla, cheaper, higher yield.

Put-able bonds may be redeemed early by the holder: more attractive, more expensive and lower yield.



Call-able and Put-able Bonds

This is a three-year 5% annual coupon bond. We are assuming interest rates will only move up, or down, by 1% in the course of each year. The one year spot rate is currently 4%:



Supposing now we say the bond is **call-able** after one year at a strike of 101. We can see that whenever the bond's price is above 101 it will be **called**. 101 therefore becomes the value of the bond at these points. Why is the bond cheaper?

Call-able Bond														
	Nominal	100			Option value (Price)	-1.36359105								
	Maturity	3			Opion Value (Yield)	0.48643387414877600%								
	Coupon	5												
	Call Strike	101	after 1 year											
	Price	101.4465												
	YTM	4.47%												
	T_0				T_1					T_2			T_3	
												6.00%		
									No Call	99.05660377	99.05660377		**105**	
										5				
						5.00%				104.0566038				
						99.10153								
				No Call	100.0086392	100.0086								
					5	100.9158								
		4%			105.0086392							4.00%		
		100.9698												
	101.4464611	101.4465							No Call	100.9615385	100.9615385		**105**	
		101.9231								5				
						3.00%				105.9615385				
						102.8753								
				CALLED	101	102.894								
					5	102.9126								
					106							2.00%		
									CALLED	101	102.9411765		**105**	
										5				
										106				

Supposing now we say the bond is **put-able** after one year at a strike of 100. We can see that whenever the bond's price is below 100 it will be **put** by the holder. 100 therefore becomes the value of the bond at these points. Why is the bond more expensive?

Put-able Bond													
	Nominal	100			Option value (Price)		0.21597899						
	Maturity	3			Opion Value (Yield)		-0.0762%						
	Coupon	5											
	Put Strike	100	after 1 year										
	Price	103.026											
	YTM	3.91%											
	T_0				T_1				T_2			T_3	
										6%			
								PUT	100	99.05660377		**105**	
									5				
						5%			105				
						100							
				No Put	100.4578755	100.4579							
					5	100.9158							
		4%			105.4578755					4%			
		101.4018											
	103.0260312	103.026						No Put	100.9615385	100.9615385		**105**	
		104.6503							5				
						3%			105.9615385				
						102.8753							
				No Put	103.8362694	103.8363							
					5	104.7973							
					108.8362694					2%			
								No Put	102.9411765	102.9411765		**105**	
									5				
									107.9411765				

Option Adjusted Spread (OAS)

Supposing we have two bonds, both three year and both with 5% coupons.

Bond A has a YTM of 5.00%

Bond B has a YTM of 5.50%

If the risk-free rate is currently 2%, the nominal credit spread would be:

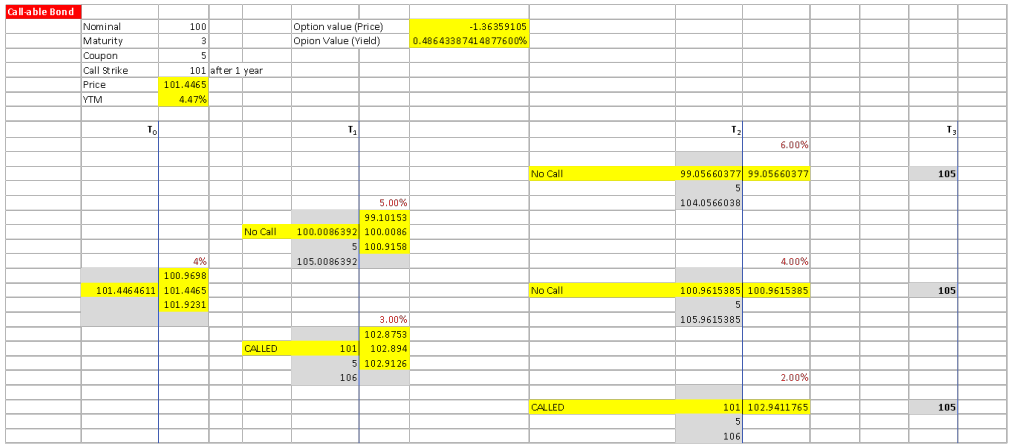
Bond A: 5.00% - 2.00% = 3.00%

Bond B: 5.50% - 2.00% = 3.50%

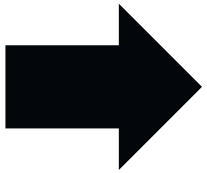
Bond B, it appears, has the higher credit risk.

Supposing that we discover that B is a callable bond…

We run a binomial model and determine that the embedded option is, in yield terms, worth 0.70% p.a.



Callable Bond														
	Nominal	100			Option value (Price)		-1.36359105							
	Maturity	3			Opion Value (Yield)		0.486433074148776 00%							
	Coupon	5												
	Call Strike	101	after 1 year											
	Price	101.4465												
	YTM	4.47%												
	T_0				T_1					T_2			T_3	
											6.00%			
									No Call	99.05660377	99.05660377		105	
										5				
						5.00%				104.0566038				
						99.10153								
				No Call	100.0086392	100.0086								
					5	100.9158								
		4%			105.0086392						4.00%			
		100.9698												
	101.4464611	101.4465							No Call	100.9615385	100.9615385		105	
		101.9231								5				
						3.00%				105.9615385				
						102.8753								
				CALLED	101	102.894								
					5	102.9126								
					106						2.00%			
									CALLED	101	102.9411765		105	
										5				
										106				



Option value in yield terms is 0.70% p.a.

This would mean that the actual credit spread for B is:

$$5.50\% - 0.70\% - 2.00\% = 2.80\%$$

YTM — Option val — RFR — **OAS** Option-adjusted spread

Option Adjusted Spread (OAS)

Supposing we have two bonds, both three year and both with 5% coupons.

Bond A has a YTM of 5.00%

Bond B has a YTM of 5.50%

If the risk-free rate is currently 2%, the nominal credit spread would be:

Bond A: 5.00% - 2.00% = 3.00% no call OAS is 3.00%

Bond B: 5.50% - 2.00% = 3.50%, call 0.70%, OAS is 2.80%

Bond B, it appears, has the higher credit risk.

Supposing that we discover that B is a callable bond…

Private credit

FitchLearning

What is Private Credit?

Private credit refers to **non-bank lending**, where financing is provided by non-traditional lenders.

It encompasses loans and debt financing that are not traded on public markets. The most common types include:

- Direct Lending
- Mezzanine Financing
- Distressed Debt
- Special Situations
- Real Estate Private Debt

Private credit fills the gap for borrowers who may not have access to public bond markets or traditional bank loans, often due to size, credit rating, or the need for bespoke financing solutions.

Characteristics of Private Credit: Overview

Customizable Deals

Direct lending allows for bespoke financing solutions, addressing specific borrower needs (e.g. flexible covenants and repayment schedules).

Higher Returns

Investors in private credit often achieve higher yields, compensating for increased credit risk and illiquidity.

Personalized Lending Relationships

The private setup fosters direct, impactful relationships between lenders and borrowers, enabling detailed due diligence and close monitoring.

Illiquidity

Longer investment horizons and illiquidity are inherent, requiring a long-term perspective for higher yield potential.

Characteristics of Private Credit: Key Players

Borrowers

Startups to multinationals, driving financing demand.

E.g. Tech startups, SMEs

Direct Lenders

Offer flexible, direct financing.

E.g. Ares Management, Apollo Global

Institutional Investors

Supply capital, seek yield and diversification.

E.g. CalPERS, CPPIB

Private Equity Firms

Engage in buyouts, acquisitions; demand for leveraged financing.

E.g. Blackstone, KKR

Intermediaries & Advisors

Connect lenders and borrowers, provide insights.

E.g. Investment banks, Lendio

Regulators

Ensure market stability and transparency.

E.g. SEC (US), FCA (UK)

Inflation-linked bonds

FitchLearning

Nominal and real returns

A nominal return is the return calculated by a change in price.

For example a share rises in value from 100 to 104 over the course of year and pays no dividends. The nominal return is:

$$\frac{(104 - 100)}{100} = 4\%$$

If, over the same period, inflation was calculated at 2.50%, the increase in wealth generated by the share would be diminished because, on average, everything is 2.50% more expensive.

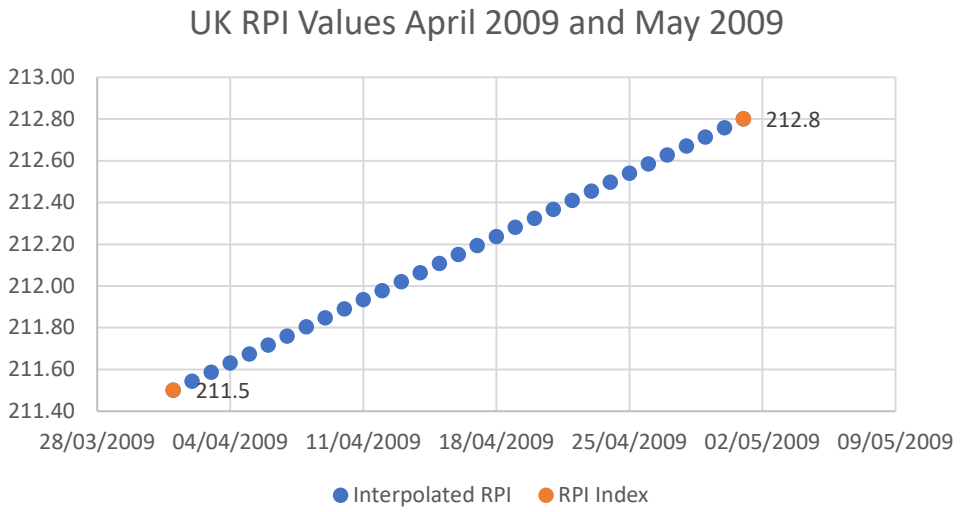
The more realistic view would be that our return was more like 1.50%. In other words:

$$Real\ Return = Nominal\ Return - Inflation\ Rate$$

Index-linking an index-linked bond

UK Index linked Gilts operate on a **3-month lag**. This means the bonds **start, or base, RPI** number is from three months before. When a date falls between two RPI numbers the value is linearly interpolated.

The UK index Linked Gilt **0 5/8% 2042** was issued on 24/07/2009. To calculate its **base RPI** (to 5dp):



Issued 24 July 2009.

$$\textbf{\textit{Base RPI}} = RPI_{m-3} + \frac{(t-1)}{D_m} \times (RPI_{m-2} - RPI_{m-3})$$

$$\mathbf{212.46452} = 211.5 + \frac{(24-1)}{31} \times (22.8 - 211.5)$$

All subsequent cash flows are inflated against the base RPI.

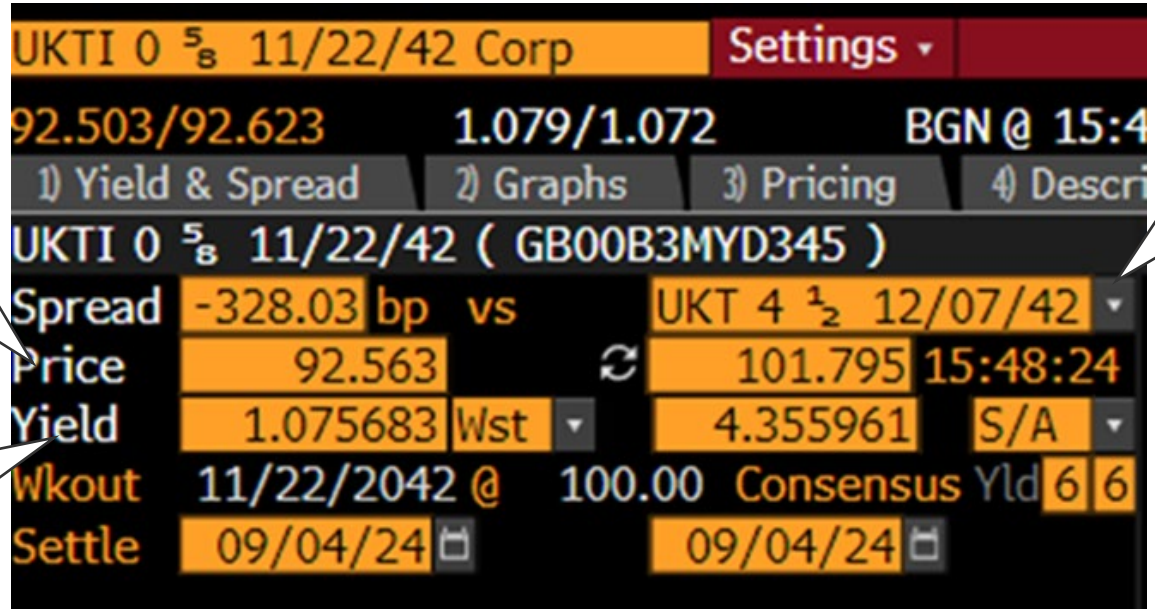
Index-linked gilt illustration

Let's look at a trade in the gilt above settled on 04/09/2024. The previous coupon was paid on 22/05/2024 and the next coupon is to be paid on 22/11/2024.

This gilt will trade in the market at its real price and yield (remember this doesn't include inflation):

…and this is the PV of the remaining cash flows using the **real yield** below (less accrued – this is a **clean price**)

The **real yield** the market wants on the ILG excluding inflation…



A vanilla gilt with similar maturity.
Its yield is nominal and includes inflation expectations

At settlement, the **invoice amount** (the total amount the buyer pays) needs to reflect inflation since the gilt's issue.

Firstly, determine the RPI for the settlement date (**settlement** or **reference RPI**), then use this, along with the base RPI, to determine the **settlement index ratio**:

Settlement date **4 September 2024**

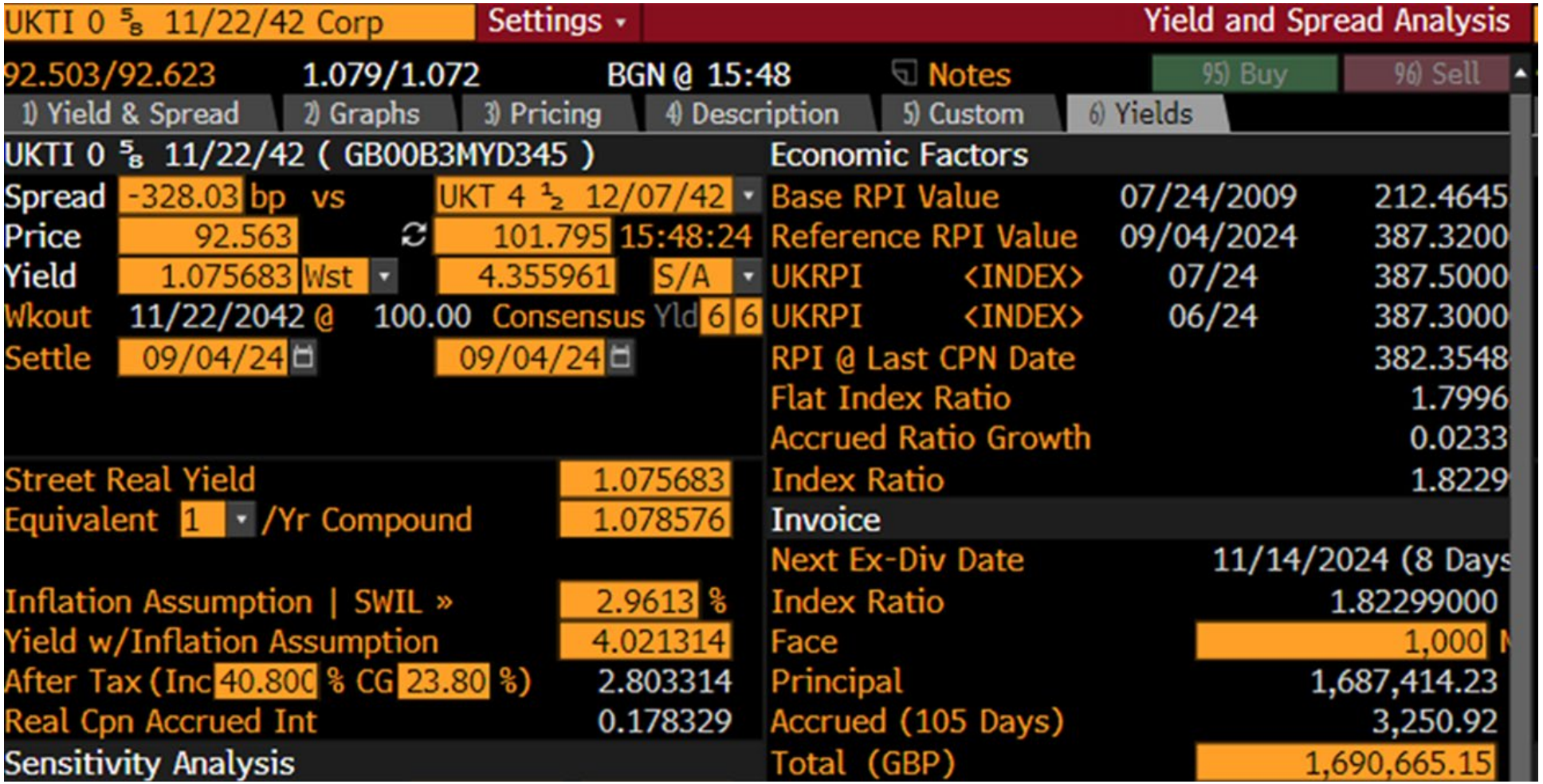
$$\textbf{\textit{Settlement RPI}} = RPI_{JUNE\ 24} + \frac{(t-1)}{Days\ in\ September} \times \left(RPI_{July\ 24} - RPI_{June\ 24}\right)$$

$$\mathbf{387.32143} = 387.30 + \frac{(4-1)}{30} \times (387.50 - 387.30)$$

The **settlement / reference index ratio**:

$$\frac{\mathbf{387.32143}}{\mathbf{212.46452}} = 1.82299$$

We then use the index ratio to calculate the clean, accrued and gross (dirty) amounts [for 1m nominal]:

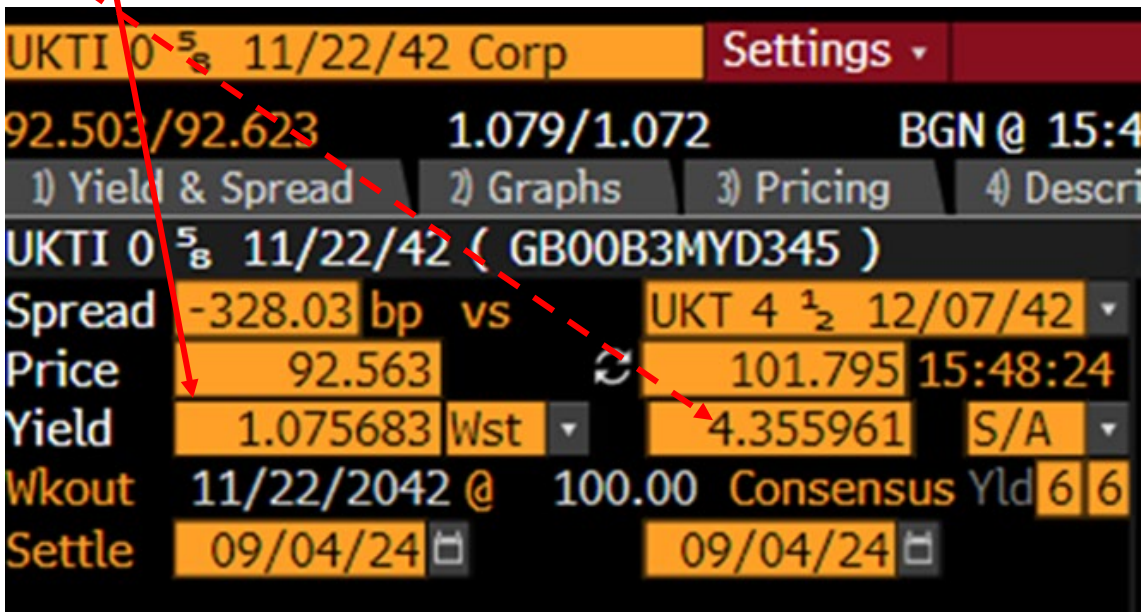


Inflation-linked bonds: Breakeven Inflation

The difference between an inflation linked bond's real yield and a vanilla bond's [nominal] yield is a reflection of inflation expectations and is called breakeven inflation.

Nominal Yields = Real Yields + Expected Inflation + Risk Premium for Unexpected Inflation

BREAKEVEN INFLATION



Yield curves

Construction and trades

FitchLearning

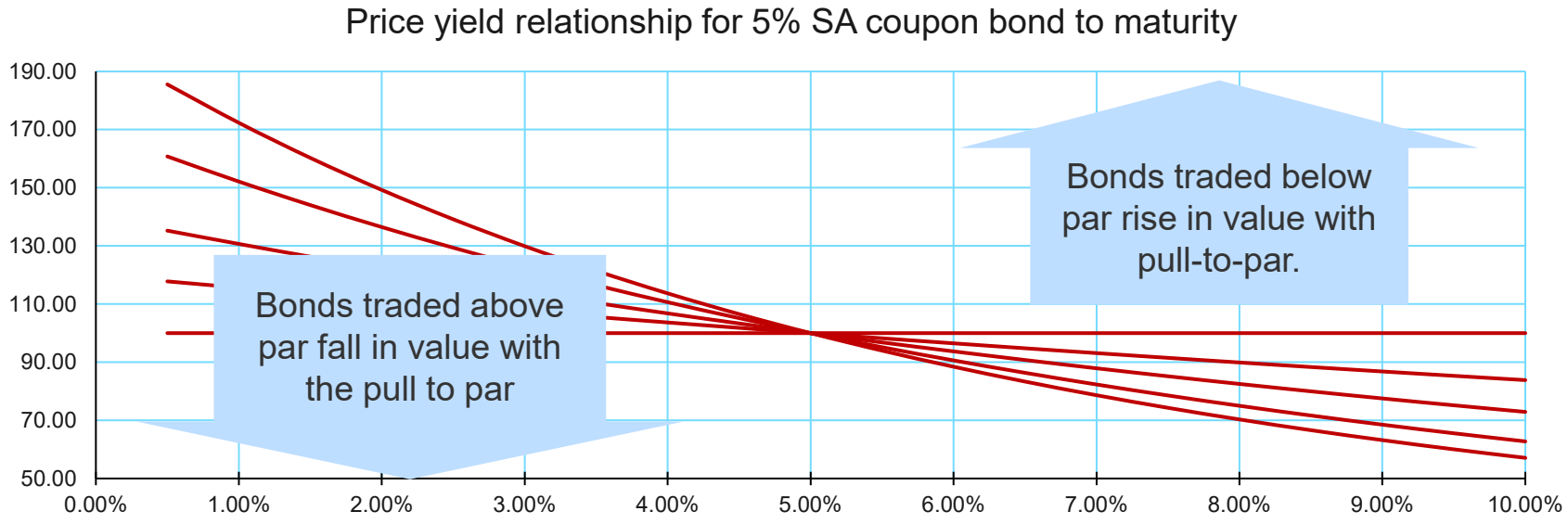
Carry and roll-down

Carry and roll-down are ‘natural’ moves in bond prices which are always going to happen quite apart from any anticipated (speculated) move an investor or trader is looking for.

Because they involve bond price moves they bring an **additional profit and loss** dimension to the position.

Carry comprises **pull-to-par** and **finance**.

Pull-to-par is the [vanilla] bond’s price moving towards par as it approaches maturity. The longer the position is held, the greater the effect of PTP.

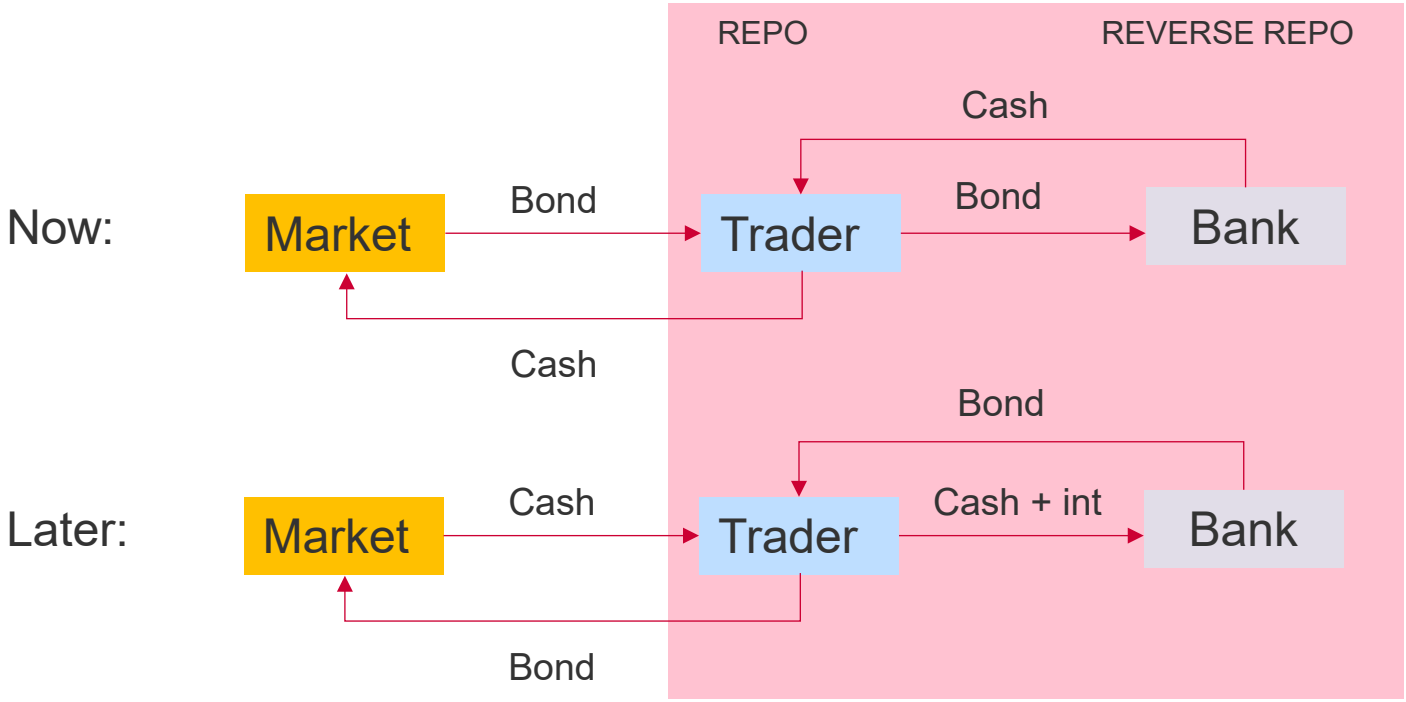


Carry and roll-down

Finance is the net cost of being long or short of the bond.

It is the difference between the coupons received [owed on a short position} and the repo rate paid [received on a short position].

In this example a trader engineers a **long bond position** by simultaneously purchasing a bond in the market and using the bond as collateral for a loan to finance the purchase.

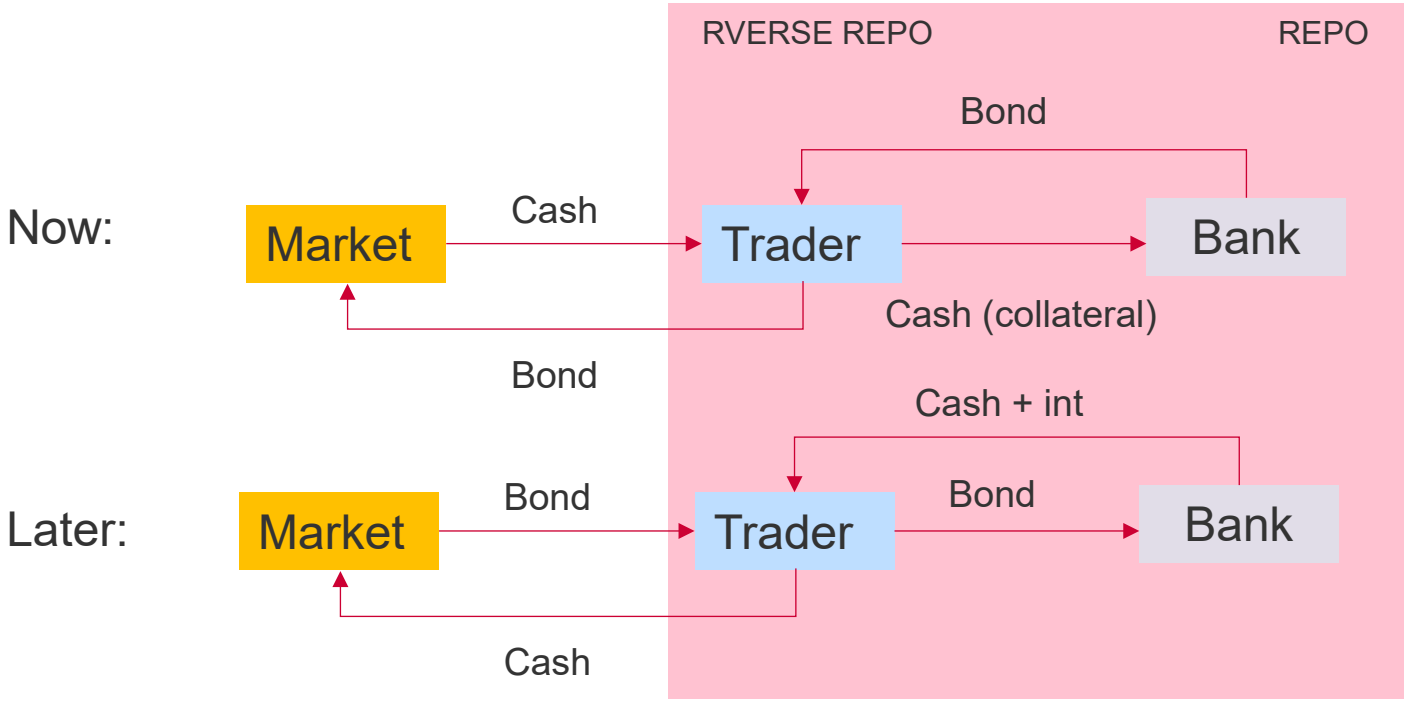


Carry and roll-down

Finance is the net cost of being long or short of the bond.

It is the difference between the coupons received [owed on a short position} and the repo rate paid [received on a short position].

In this example a trader engineers a **short bond position** by simultaneously borrowing a bond from a bank (prime broker) and selling it.



Carry and roll-down

Here is an illustration of pull to par and finance which together are called carry

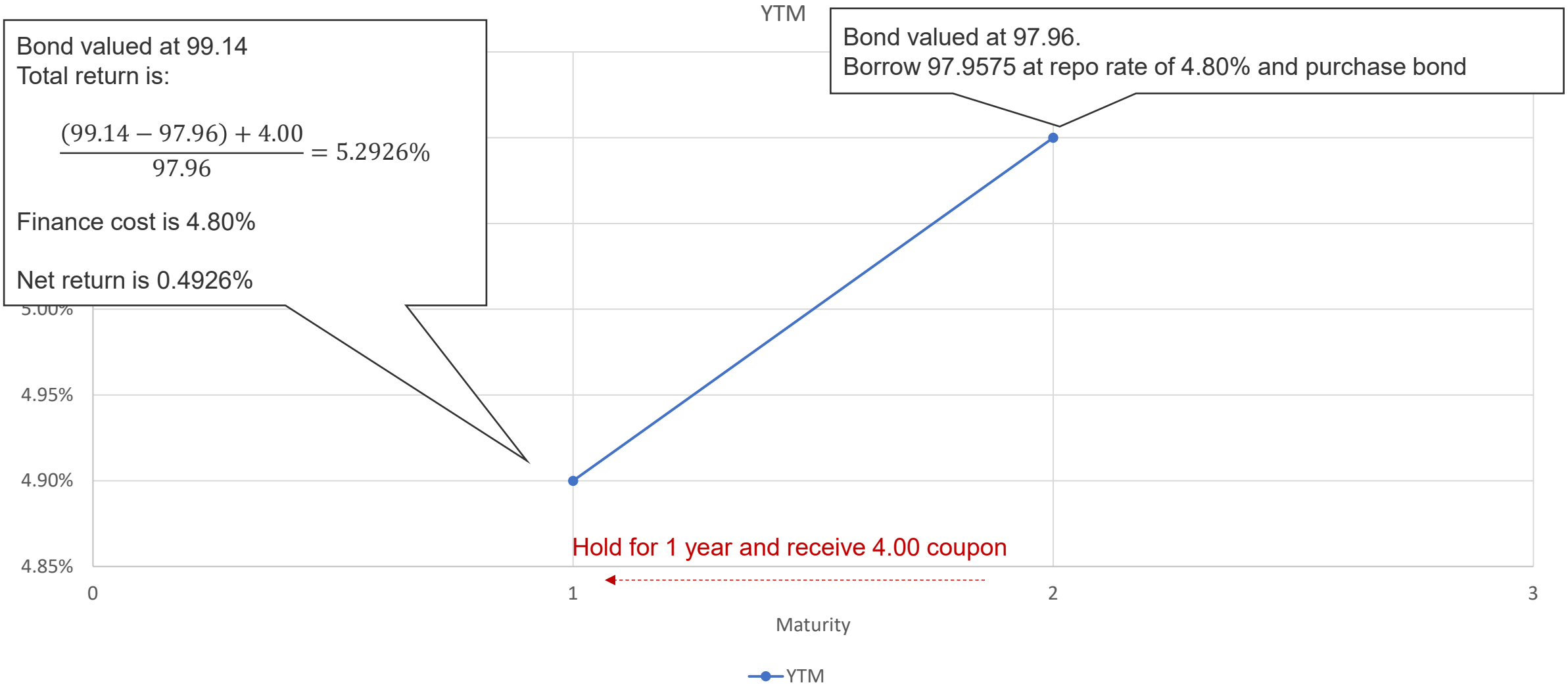
A trader takes a long position of 50m nominal in a 2-year bond and holds it for a year..

	2 year Bond
Maturity (yrs)	2.00
Coupon (ann)	4.00%
Yield	5.10%
Price	97.96

The repo rate is currently 0.25% p.a. and the short end of the yield curve look like this:

Term	YTM
1	4.90%
2	5.10%

Carry and roll down attribution



Carry and roll down attribution

Bond valued at 99.14
Total return is:

$$\frac{(99.14 - 97.96) + 4.00}{97.96} = 5.2926\%$$

Finance cost is 4.80%

Net return is 0.4926%

Net financing costs is coupon received minus financing costs:

$$4.00 - (97.96 \times 4.80\%) = -.7020$$

$$\frac{-0.7020}{97.9595} = -0.7166\%$$

Pull to par is the effect of time passing and pulling the bond closer to its par value:

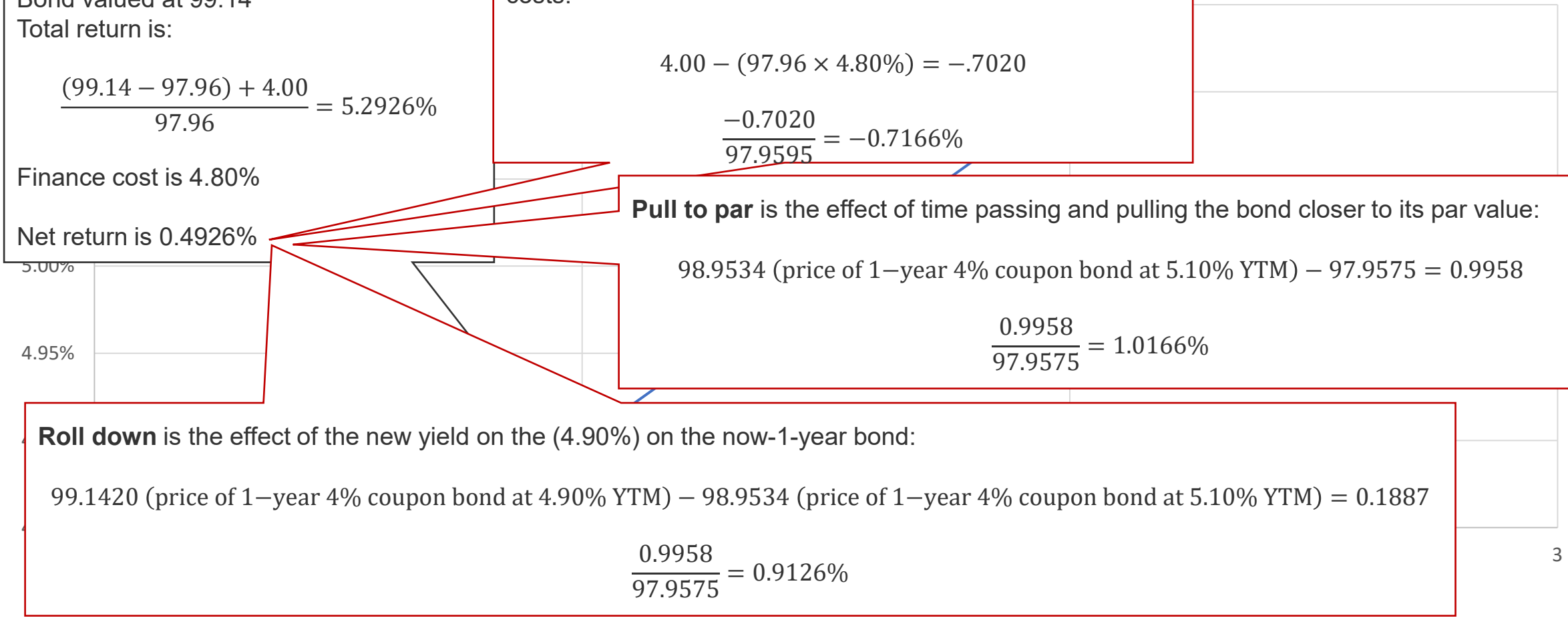
$$98.9534\ (\text{price of } 1\text{−year } 4\%\ \text{coupon bond at } 5.10\%\ \text{YTM}) - 97.9575 = 0.9958$$

$$\frac{0.9958}{97.9575} = 1.0166\%$$

Roll down is the effect of the new yield on the (4.90%) on the now-1-year bond:

$$99.1420\ (\text{price of } 1\text{−year } 4\%\ \text{coupon bond at } 4.90\%\ \text{YTM}) - 98.9534\ (\text{price of } 1\text{−year } 4\%\ \text{coupon bond at } 5.10\%\ \text{YTM}) = 0.1887$$

$$\frac{0.9958}{97.9575} = 0.9126\%$$



Net financing costs (-0.7166%) + P2P (1.0166%) + Roll (0.9126%) = 0.4926%

CARRY

Carry and roll-down

After the year:

- the **coupons received** on the bond would be:

$$50{,}000{,}000 \times 2.00\% = 1{,}000{,}000$$

- the **repo finance** would be (remember the bond's price is 100.98):

$$50{,}488{,}971 \times 0.25\% \times \frac{365}{360} = 127{,}976$$

- the **pull to par** (here we assume all is the same except the maturity, which is now 1 year instead of two):
  - Price of **1 year** 2% annual coupon bond with a YTM of 1.50% is 100.49261
  - 50m nominal at this price is worth 50,245,000
  - A pull to par **loss** of 242,665.

Total carry for the year is:

$$1{,}000{,}000 - 127{,}976 - 242{,}665 = 629{,}359$$

Holding this bond has a **positive carry** – the trader makes a gain simply by holding the bond.

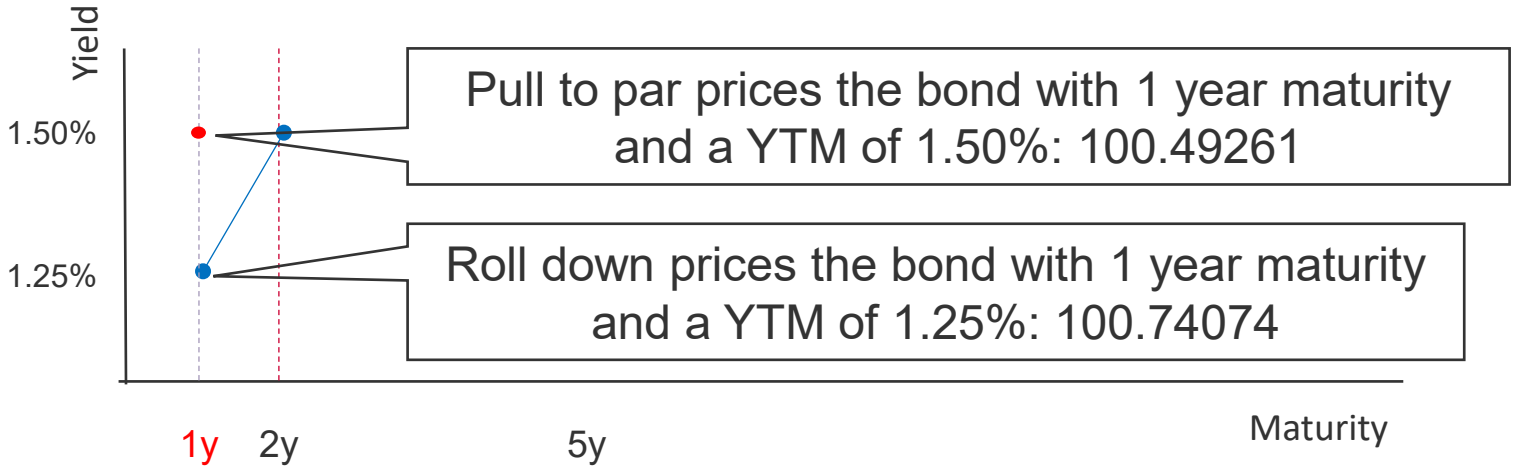
Carry and roll-down

Carry has an element of certainty about it.

Roll down is the effect of the yield changing in line with the shorter maturity *assuming that the yield curve does not change*.

Pull to par took into account the guaranteed fact that the maturity of the bond would be a year shorter in a year's time.

Roll down considers the consequences of the bond's new yield in a years time with nothing changing:



The gain (long bond position, lower yield) on 50m nominal is 124,065

Carry and roll-down

The consequences of finance, pull to par and roll down could be summarised for a 1-year time horizon as:

	2 year Bond
Funding Requirement	(50,488,971)
Pull to Par Price	100.49261
Pull to Par P/L	(242,665)
Repo Finance	(127,976)
Coupon Income	1,000,000
Carry	629,359
Roll Down Yield	1.25%
Yield Change	-0.25%
Roll Down Price	100.74074
Roll Down	124,065
Total Passage of Time (carry + roll down)	753,424

Yield curve trades.

The yield curve is often viewed as a leading indicator, providing an early warning on the likely direction of a country's economy.

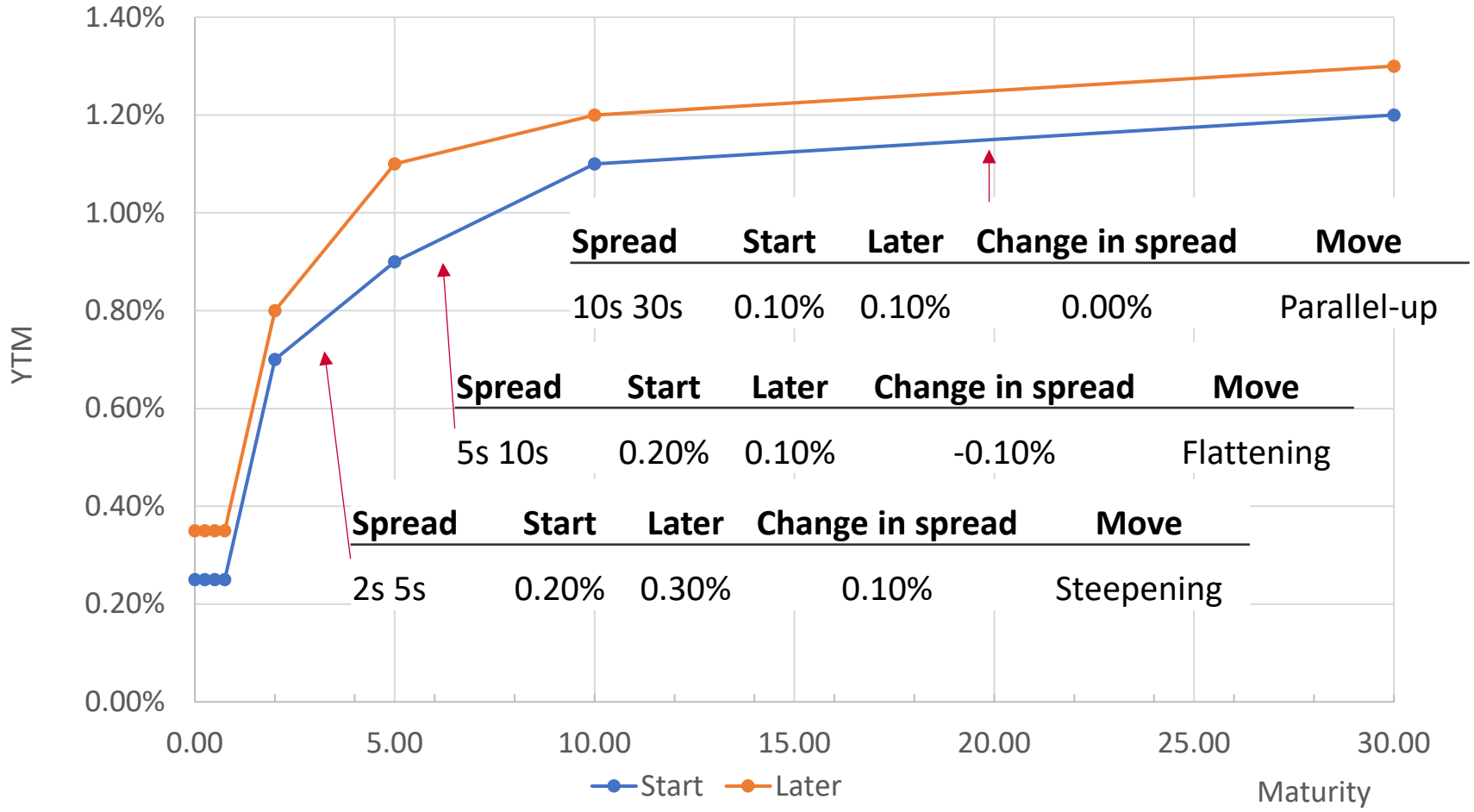
Its success in this sense varies.

Remember that the YC is not a function or mathematical relationship – its empirical; a snapshot of what the market wants as a return from a set of debt instruments over different maturities.

Yield curve movements

Curves (virtually) never move equally across all maturities.

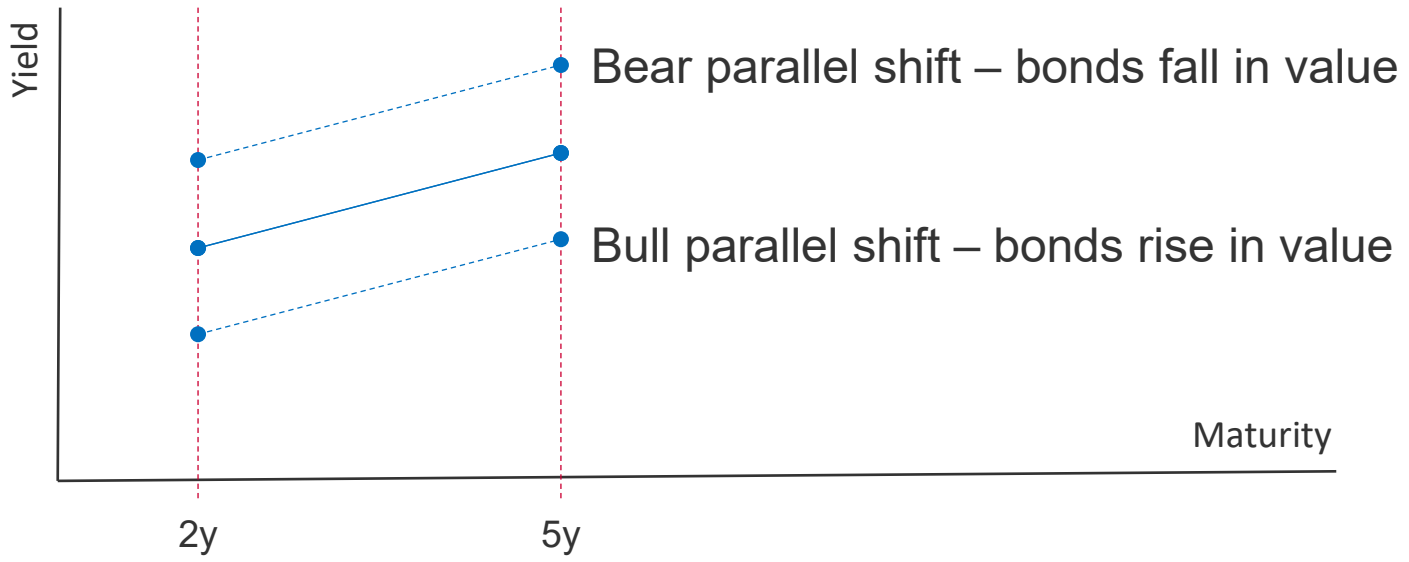
We therefore speak about curve movements between two or three maturities (spreads).



Yield curve movements

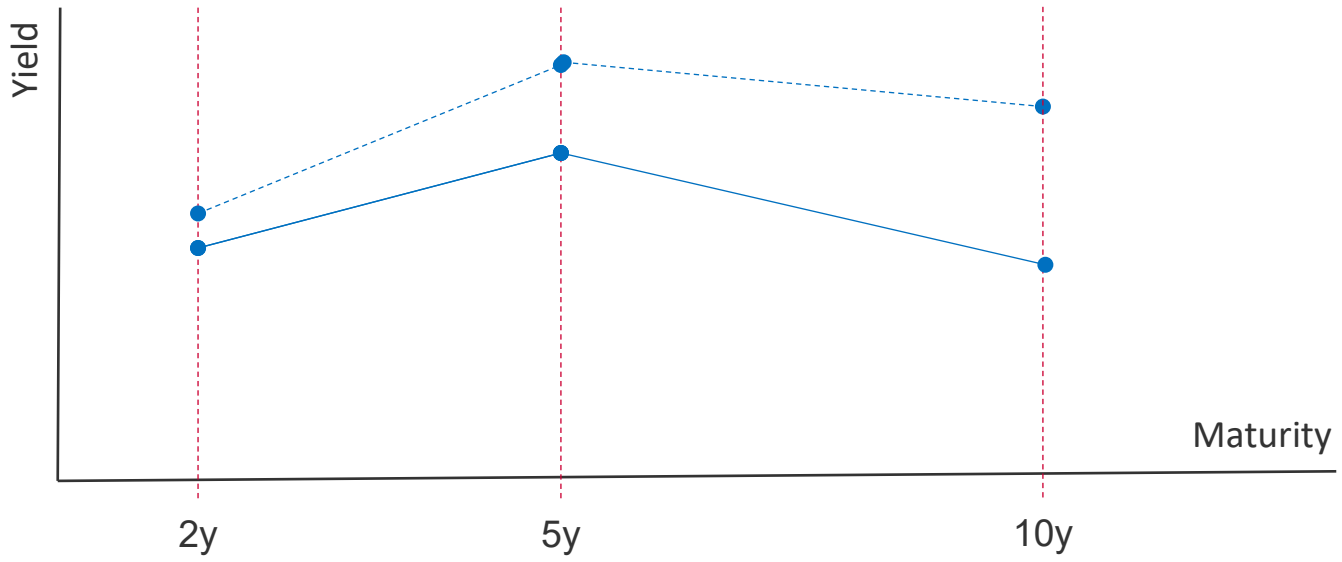
To define these ideas:

A **parallel shift** is where all yields change by the **same amount** (up or down). There is no change in the far-yield minus near-yield spread.



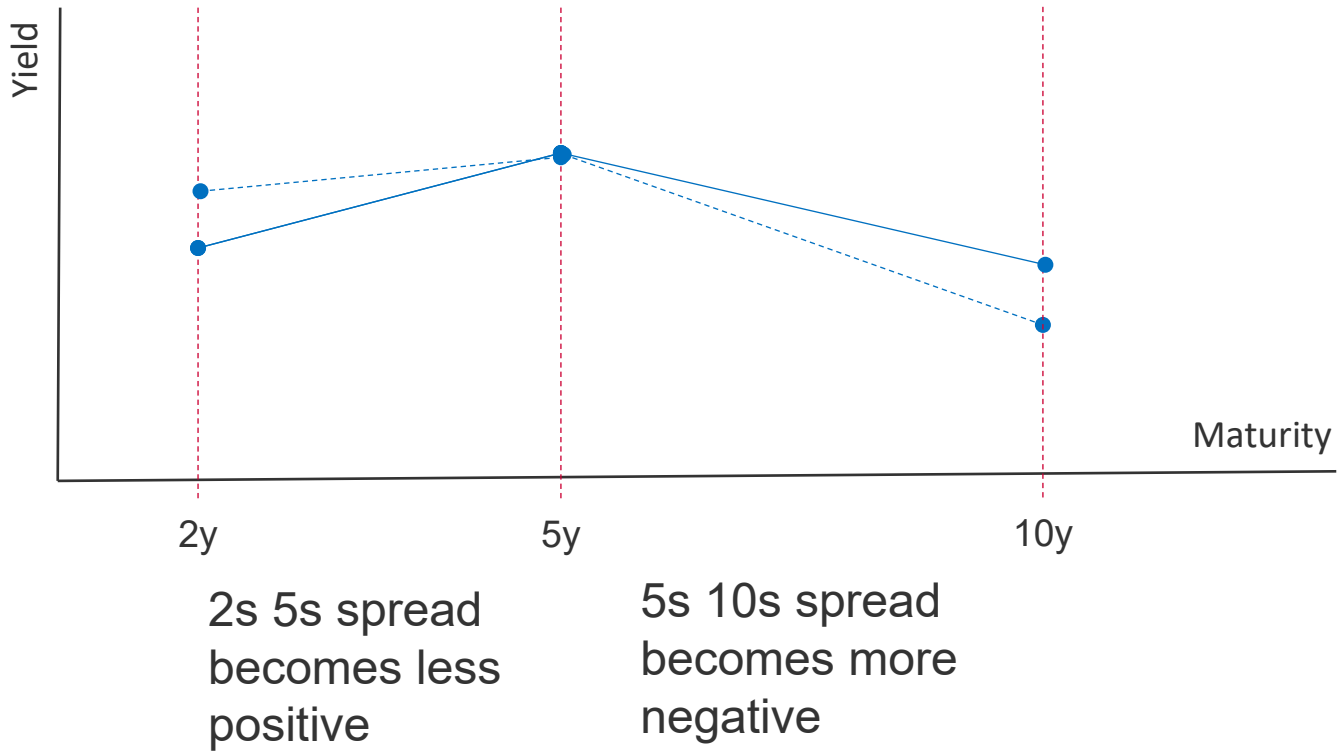
Yield curve movements

A **steepening shift** is where far yield minus near yield becomes **more positive** (or less negative!)



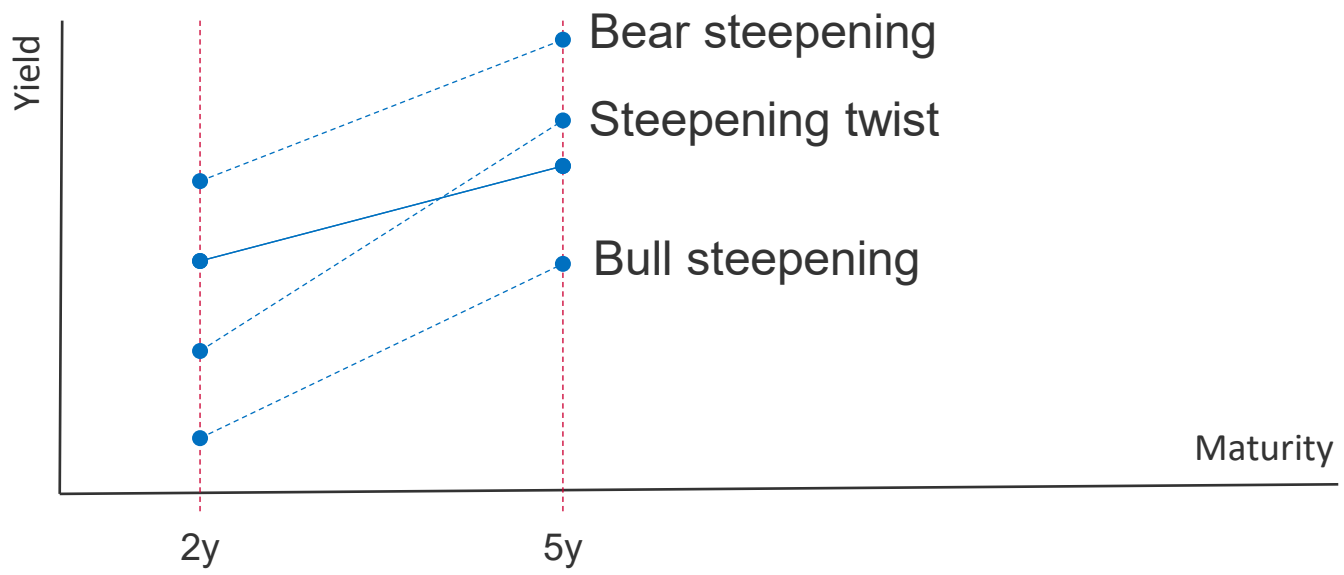
Yield curve movements

A **flattening shift** is where far yield minus near yield becomes **more negative** (or less positive!)



Yield curve movements

Curve moves between two maturities will most likely be a combination of a parallel shift and a steepening or flattening move:



Constructing yield curve trades

If we expect the 2s 5s to **steepen** we are saying we expect the difference (5y YTM – 2y YTM) to **increase**.

In other words we expect the 5-year move to *increase more* than the 2-year move.

We therefore take a negative (short) position in the 5-year and offset it with a positive (long) position in the 2 year.

We must make sure that we have the same DV01 (delta) for both the 2 and 5 year positions.