CHARTA LEARNING · LESSON NOTES

Regulation After the Crisis

FRM Part II

1 A story: the calm-weather VaR

- VaR: a loss exceeded only rarely, from recent data
- Recent past is calm, so VaR is small
- Small VaR, small capital, a bigger trading book
- Markets turn: losses many times the VaR
- Calm-window VaR left banks thinly capitalised

IN THE LESSON

- Imagine Harrowgate Bank just before the crisis.
- Its trading desk measures risk with value at risk, written V a R: the loss that should be exceeded only rarely, on one day in a hundred, say.
- V a R is estimated from the recent past, and the recent past has been calm.
- So the V a R is small, the capital set against it is small, and the bank grows its trading book.
- Then markets turn.
- Losses arrive that are many times the V a R, and the thin capital is soon used up.
- The lesson regulators drew was simple.
- A risk measure fitted to calm times leaves banks thinly capitalised just when they need capital most.

2 Stressed VaR: the same measure, a harder year

- Basel 2.5: trading book rules after the crisis
- Same measure: 10-day, 99% VaR
- Same portfolio: today's positions
- Different data: a continuous 12-month stress period
- It is added to ordinary VaR, not a replacement

IN THE LESSON

- Basel two point five, the set of trading book rules added after the crisis, answered with stressed V a R.
- It is the same ten day, ninety nine per cent V a R.
- It is run on the bank's current portfolio, the positions it holds today.
- The difference is the data.
- Instead of recent market moves, it uses market data from a continuous twelve month period of significant financial stress.
- So the question becomes: if today's positions met a year of significant stress, like two thousand and eight, how much could we lose in ten days?
- Stressed V a R does not replace ordinary V a R.
- The bank computes both, and both feed the capital charge.

3 The market risk capital charge

Charge = max(VaR_{t−1}, mc × VaR_{avg}) + max(sVaR_{t−1}, ms × sVaR_{avg})

VaR term	Yesterday's VaR or mc × average
Stressed VaR term	The same, using stressed VaR
Multipliers mc and ms	At least 3, plus add-on 0 to 1
60-day averages	Mean over the previous 60 days

IN THE LESSON

- Here is the charge.
- Take yesterday's V a R, and the average V a R over the previous sixty days.
- The first term is the larger of yesterday's V a R, and the multiplier m c times the sixty day average.
- The second term does the same for stressed V a R: the larger of yesterday's stressed V a R, and the multiplier m s times its sixty day average.
- The charge is the sum of the two terms.
- The multipliers are at least three, plus an add-on of between zero and one that grows as backtesting finds more exceptions, meaning days when the loss was bigger than the V a R.
- The incremental and comprehensive risk charges, which we meet next, sit on top.

4 Example 1: Harrowgate's charge

Multipliers 3. VaR: yesterday $20m, 60-day average $15m. sVaR: $50m and $40m

VaR: yesterday		**$20m**
VaR term	max(20, 3 × 15)	**$45m**
Stressed VaR: yesterday		**$50m**
Stressed VaR term	max(50, 3 × 40)	**$120m**
Charge	45 + 120	**$165m**

IN THE LESSON

- Let us compute Harrowgate's charge.
- Both multipliers are three.
- Yesterday's V a R was twenty million dollars, and the sixty day average was fifteen million.
- Three times fifteen is forty five, which is larger than twenty, so the V a R term is forty five million.
- Yesterday's stressed V a R was fifty million, and its sixty day average was forty million.
- Three times forty is one hundred and twenty, larger than fifty, so the stressed term is one hundred and twenty million.
- Add the two terms.
- The charge is one hundred and sixty five million dollars.
- Notice that in normal times the multiplied average wins.
- Yesterday's figure wins only after a sudden jump in risk.

5 Example 2: three ways to get it wrong

Same inputs. The correct charge is $165m

Correct	45 + 120	**$165m**
Wrong: multiply latest day	3 × 20 + 3 × 50	**$210m**
Wrong: no max rule	20 + 50	**$70m**
Wrong: stressed replaces VaR	120 only	**$120m**

Two terms, each a max, added together

IN THE LESSON

- The exam likes three mistakes, so let us make each one.
- The right answer is one hundred and sixty five million.
- The first mistake is to apply the multiplier to the latest day instead of the average: three times twenty plus three times fifty gives two hundred and ten million, too high.
- The second is to drop the max rule and just add yesterday's two figures: twenty plus fifty gives seventy million, far too low.
- The third is to replace the V a R term with the stressed term instead of adding both, which leaves only one hundred and twenty million.
- Remember the shape: two terms, each a max, added together.

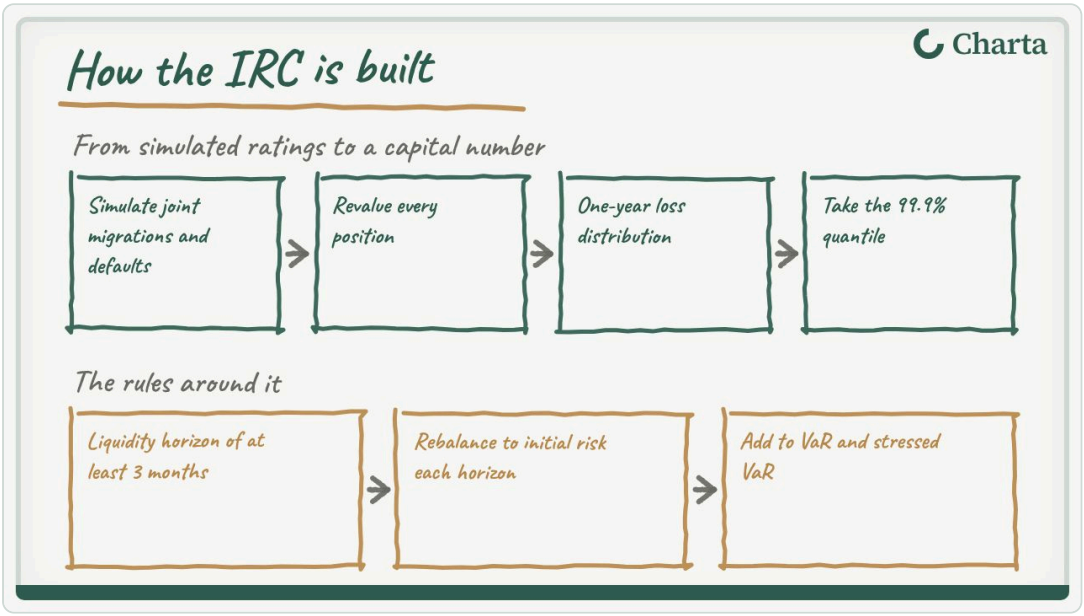
6 What a 10-day VaR cannot see

- Trading book: corporate bonds and credit default swaps
- 10-day VaR misses default and rating migration
- Incremental risk charge (IRC): Basel 2.5
- Covers unsecuritised credit positions
- Securitisations are excluded

IN THE LESSON

- Harrowgate's trading book also holds corporate bonds and credit default swaps, which are contracts that pay out if a named company defaults.
- A ten day V a R mostly sees day to day price moves.
- It misses two slower risks: that an issuer defaults, and that an issuer's rating migrates, meaning it changes, and a downgrade cuts the value of its bonds.
- Before the crisis, banks moved credit positions into the trading book, where these risks attracted little capital.
- The incremental risk charge, I R C for short, was added by Basel two point five to capture default and migration risk on unsecuritised credit positions in the trading book.
- Securitisations are excluded.

7 How the IRC is built



IN THE LESSON

- Look at the boxes, top row first.
- The bank simulates, usually by Monte Carlo, meaning many random draws, the joint rating transitions and defaults of its issuers, using a correlation model so that issuers tend to fall together.
- It revalues every position in every scenario.
- It builds the distribution of losses over one year, and reads off the ninety nine point nine per cent quantile.
- That is the I R C.
- Now the bottom row.
- Each position has a liquidity horizon of at least three months, the time it would take to exit or hedge it.
- The constant level of risk assumption says positions are rebalanced back to their initial risk at the end of each horizon.
- And the I R C is added to V a R and stressed V a R.

8 Example 3: the constant level of risk

$10m bond, loss given default 60%, liquidity horizon 3 months

Horizons in a year	12 months ÷ 3	**4**
Default in quarter 1	10m × 60%	**$6m loss**
End of quarter: rebalance	a new position, same risk	**$10m**
Default again in quarter 3	10m × 60%	**$6m loss**
Year's loss on this path	6 + 6	**$12m**

Held unchanged for the year, it could lose at most $6m

IN THE LESSON

- Here is what constant level of risk means for one position.
- Harrowgate holds ten million dollars of a corporate bond, with a loss given default of sixty per cent, the share lost when the issuer defaults.
- The liquidity horizon is three months, so a year holds four horizons.
- Follow one simulated path.
- The issuer defaults in quarter one, a loss of six million.
- At the end of that quarter the bank is assumed to rebalance back to its initial risk, so it holds a fresh ten million dollar position of the same quality.
- That new position can default too.
- Here it defaults in quarter three, another six million, so the year's loss on this path is twelve million.
- The usual mistake is to treat the position as held unchanged for the whole year.
- Held unchanged, it could lose at most six million.

9 The correlation trading portfolio

- Tranches and nth-to-default credit derivatives
- Value depends on default correlation
- References: single names or indices, liquid both ways
- Hedges included; resecuritisations, tranche options out

IN THE LESSON

- Harrowgate also runs a correlation trading desk.
- Its positions are securitisation tranches, which are slices of a pool of credit that take losses in a set order, and enth to default credit derivatives, which pay when the first, second, or enth name in a basket defaults.
- Their value depends on default correlation, how likely names are to default together.
- Basel two point five gave this portfolio its own charge, the comprehensive risk measure, or C R M.
- To qualify, the reference names must be single name instruments or indices with liquid two way markets, and the portfolio includes the hedges.
- Resecuritisations and options on tranches are excluded.

10 What the CRM model must capture

Modelled at 99.9% over one year

Must capture	Why it matters
Defaults and migrations	The credit events themselves
Credit spread changes	Prices move before any default
Correlation changes	Tranches reprice with no default
Recovery rate variability	Defaults may recover less
Index versus single-name basis	Hedges may not track

IN THE LESSON

- Because these positions depend on default correlation, the bank's model must capture more than defaults.
- It works at ninety nine point nine per cent over one year, like the I R C.
- The table lists what it must capture and why.
- First, defaults and rating migrations, the same credit events as the I R C.
- Second, changes in credit spreads, the extra yield the market demands for credit risk.
- Third, changes in correlation, because a tranche can lose value when correlation moves even with no default at all.
- Fourth, the variability of recovery rates, since a default may recover much less than assumed.
- Fifth, basis risk between an index and the single name hedges set against it.

11 The CRM floor

Capital = max(model CRM, 0.08 × standardised charge)

Bank's own CRM model	Bank's own 99.9% one-year model
Standardised charge	Same positions, standard approach
The 8% floor	Stops the model going too low

IN THE LESSON

- A model this complex could give a very low number, so the rules set a floor.
- The capital charge is the larger of the bank's own C R M model result, and eight per cent of the charge that the standardised securitisation approach would give for the same positions.
- So the floor is eight per cent of the standardised charge.
- A bank without an approved model simply pays the standardised charge in full.
- And other trading book securitisations, those outside the correlation trading portfolio, are outside the C R M altogether and also take the standardised charge.

12 Example 4: does the floor bite?

Standardised charge on the correlation book: $500m

Standardised charge	same positions	**$500m**
Floor	8% × 500	**$40m**
Model CRM	bank's own model	**$30m**
Capital	max(30, 40)	**$40m**
If the model said $55m	max(55, 40)	**$55m**

IN THE LESSON

- Harrowgate's correlation book would attract a standardised charge of five hundred million dollars.
- Eight per cent of that is forty million, which is the floor.
- The bank's own model says thirty million.
- The capital is the larger of thirty and forty, so forty million: the floor bites.
- Now suppose the model had produced fifty five million instead.
- The larger of fifty five and forty is fifty five, so the model result stands.
- The point to take away is that the model can lower the charge a long way below the standardised amount, but never below eight per cent of it.

13 Example 5: Harrowgate's trading book charges

Harrowgate's four Basel 2.5 trading book charges, $m

VaR term	from Example 1	**$45m**
Stressed VaR term	from Example 1	**$120m**
Incremental risk charge	assumed simulation result	**$35m**
Comprehensive risk charge	after the floor	**$40m**
Total	45 + 120 + 35 + 40	**$240m**

IN THE LESSON

- Let us add up Harrowgate's Basel two point five charges for the trading book.
- The V a R term was forty five million dollars.
- The stressed V a R term was one hundred and twenty million.
- Suppose the I R C simulation gives thirty five million for the bond and credit default swap book.
- The comprehensive risk charge is forty million, after the floor.
- The total is two hundred and forty million dollars.
- The stressed term alone is more than two and a half times the V a R term.

14 Basel III: the layers of capital

Tier 1 = CET1 + AT1. Tier 2 absorbs losses in a failure

Layer	Main components
CET1 (going concern)	Shares, retained earnings, reserves
CET1 deductions	Goodwill, deferred tax assets
AT1 (going concern)	Perpetual non-cumulative preferred
Tier 2 (gone concern)	Subordinated debt, 5+ years at issue

IN THE LESSON

- Now from the trading book to the whole bank.
- In the crisis, some of what banks called capital could not absorb losses when it mattered.
- Basel three splits regulatory capital into tier one and tier two.
- Tier one is going concern capital, which absorbs losses while the bank keeps operating.
- Its core is common equity tier one, C E T one: common shares plus retained earnings and reserves, less deductions such as goodwill and deferred tax assets, which would be worth little in a failure.
- Next is additional tier one, A T one, chiefly perpetual non cumulative preferred shares.
- Tier two is gone concern capital, which absorbs losses once the bank fails, mainly subordinated debt with an original maturity of at least five years.

15 Minimum capital ratios

Required capital = ratio × RWA
CET1 ≥ 4.5% Tier 1 ≥ 6% Total ≥ 8%

Minimum ratio	4.5%, 6% or 8%
Risk-weighted assets	Assets scaled by risk weights
Capital required	Each level met separately

IN THE LESSON

- The baseline minimums are set as percentages of risk weighted assets, which is the bank's assets, each scaled by a weight that reflects its risk.
- C E T one must be at least four point five per cent.
- Total tier one must be at least six per cent, so tier one needs one and a half points on top of C E T one, normally supplied by A T one.
- Total capital, tier one plus tier two, must be at least eight per cent, so tier two can fill the last two points.
- The capital required at each level is its ratio times risk weighted assets.
- These come before any buffers, and the requirement a bank actually faces varies by jurisdiction.

16 Example 6: Harrowgate's minimum capital

Harrowgate: risk-weighted assets $80bn

CET1 required	4.5% × 80	**$3.6bn**
Tier 1 required	6% × 80	**$4.8bn**
Total capital required	8% × 80	**$6.4bn**
Room for AT1	1.5% × 80	**$1.2bn**
Room for Tier 2	2% × 80	**$1.6bn**

IN THE LESSON

- Harrowgate has risk weighted assets of eighty billion dollars.
- It needs C E T one of four point five per cent of eighty, which is three point six billion.
- It needs tier one of six per cent of eighty, four point eight billion.
- And it needs total capital of eight per cent of eighty, six point four billion.
- Read the gaps.
- Between C E T one and tier one, one point two billion can come from A T one.
- Between tier one and total capital, one point six billion can come from tier two.
- These are minimums before any buffers, which we add shortly.

17 Example 7: each level is met separately

Dunmore Bank: RWA $40bn. Amounts in $bn

CET1	2.1 − 0.3 − 0.1 = 1.7	**4.25%**
Tier 1	1.7 + 0.8 = 2.5	**6.25%**
Total capital	2.5 + 0.9 = 3.4	**8.50%**
CET1 needed	4.5% × 40	**$1.8bn**
CET1 shortfall	1.8 − 1.7	**$0.1bn**

Surplus AT1 or Tier 2 cannot cover a CET1 shortfall

IN THE LESSON

- Now a rival, Dunmore Bank, with risk weighted assets of forty billion dollars.
- Its common shares, retained earnings and reserves total two point one billion.
- Deduct goodwill of point three and deferred tax assets of point one, and C E T one is one point seven billion, a ratio of four point two five per cent.
- Add A T one of point eight, and tier one is two point five billion, six point two five per cent.
- Add tier two of point nine, and total capital is three point four billion, eight point five per cent.
- Tier one and total capital pass.
- But C E T one fails.
- It needs four point five per cent of forty, one point eight billion, so it is short by one hundred million dollars, and surplus A T one or tier two cannot cover a C E T one shortfall.
- Each level must be met separately.

18 Why Basel III added buffers

- Banks kept paying dividends and bonuses as losses grew
- Rules made lending more cyclical
- Two buffers, both held in CET1
- On top of the 4.5% baseline minimum
- Build capital in good times, use it in bad times

IN THE LESSON

- Two more failures shaped Basel three.
- First, as losses ate into their capital during the crisis, many banks kept paying dividends and bonuses, so capital walked out of the door when it was most needed.
- Second, the rules made lending more cyclical: in a boom, capital looked plentiful and credit grew fast, and in a bust, banks cut lending just when the economy needed it.
- Basel three therefore added two buffers, both held in C E T one, on top of the four point five per cent baseline minimum.
- The idea is to build capital in good times that can be used in bad times.

19 Two buffers and a surcharge

All held in CET1, on top of the 4.5% minimum, as % of RWA

Piece	Size	How it works
Conservation buffer	2.5% fixed	Dip in: payout limits tighten
Countercyclical buffer	0 to 2.5%	Set nationally; released in downturns
Bank's own rate	Weighted average	By private-sector credit exposure
G-SIB surcharge	1% to 3.5%	By bucket; top 3.5% kept empty

IN THE LESSON

- The table shows the pieces.
- The capital conservation buffer is a fixed two point five per cent of risk weighted assets.
- A bank may dip into it, but as it does, limits on dividends, share buybacks and bonuses tighten.
- The countercyclical buffer runs from zero to two point five per cent, and it is set by national authorities when credit growth is excessive, then released in a downturn.
- A bank's own rate is the average of the rates in the jurisdictions where it lends, weighted by its private sector credit exposures in each.
- Global systemically important banks, G S I Bs, are treated differently.
- They must also hold a surcharge of one to three point five per cent in C E T one, according to their bucket.
- The top bucket of three point five per cent is kept empty, so in practice it is one to two point five per cent.

20 Example 8: Harrowgate's countercyclical rate

Share of private-sector credit exposure, and each country's rate

Home country	60% × 1.0%	**0.6%**
Second country	30% × 2.0%	**0.6%**
Third country	10% × 0%	**0.0%**
Harrowgate's rate	0.6 + 0.6 + 0	**1.2%**

IN THE LESSON

- Harrowgate lends in three countries.
- Sixty per cent of its private sector credit exposure is at home, where the authority has set a countercyclical rate of one per cent.
- Thirty per cent is in a second country running a credit boom, with a rate of two per cent.
- Ten per cent is in a third country with a rate of zero.
- The bank's rate is the weighted average.
- Sixty per cent times one per cent is point six of a point.
- Thirty per cent times two per cent is another point six.
- Ten per cent times zero adds nothing.
- Harrowgate's countercyclical buffer is one point two per cent of risk weighted assets.

21 The full CET1 requirement

CET1 required = 4.5% + 2.5% + countercyclical + G-SIB

Baseline CET1 minimum	4.5% of RWA
Conservation buffer	2.5%, fixed
Countercyclical buffer	0 to 2.5%, weighted average
G-SIB surcharge	1% to 3.5%, G-SIBs only

IN THE LESSON

- Adding the pieces gives the full C E T one requirement.
- It is the four point five per cent baseline minimum, plus the two point five per cent conservation buffer, plus the bank's countercyclical rate, plus any G S I B surcharge.
- For a bank that is not a G S I B and lends only where the countercyclical rate is zero, the total is seven per cent.
- Keep in mind that national rules, phase in arrangements and add-ons specific to one institution can make the requirement actually applied different from this sum.

22 Example 9: is Harrowgate in its buffer?

Harrowgate: RWA $80bn, CET1 $7.2bn, G-SIB surcharge 1.5% (assumed)

Full CET1 requirement	4.5 + 2.5 + 1.2 + 1.5	**9.7%**
In dollars	9.7% × 80	**$7.76bn**
Harrowgate's CET1	7.2 ÷ 80	**9.0%**
Short of the requirement	7.76 − 7.2	**$0.56bn**
Above the 4.5% minimum?	9.0% versus 4.5%	**Yes**

Inside the buffers: payout limits apply until it rebuilds

IN THE LESSON

- Suppose Harrowgate is a G S I B in a bucket with a surcharge of one point five per cent.
- Its full C E T one requirement is four point five, plus two point five, plus one point two, plus one point five, which is nine point seven per cent.
- On risk weighted assets of eighty billion, that is seven point seven six billion dollars.
- Harrowgate holds C E T one of seven point two billion, a ratio of nine per cent.
- It is five hundred and sixty million dollars short of the full requirement, though still well above the four point five per cent minimum.
- It is inside its buffers, so limits on its dividends, buybacks and bonuses apply until it rebuilds.

23 The leverage ratio

Leverage ratio = Tier 1 capital ÷ total exposure ≥ 3%

Tier 1 capital	CET1 plus AT1
Total exposure	All exposures, no risk weights
Leverage ratio	Backstop to risk weights

IN THE LESSON

- Basel three also added three measures that ignore risk weights altogether.
- The first is the leverage ratio.
- It is tier one capital divided by total exposure, where total exposure counts on balance sheet assets and off balance sheet items, such as undrawn commitments, without any risk weighting.
- The minimum is three per cent.
- Why have it?
- A bank can make its risk weighted ratios look strong by holding assets with low risk weights, and the crisis showed that some of those assets were riskier than their weights said.
- The leverage ratio is a backstop that limits leverage hidden by low risk weights.

24 Example 10: Harrowgate's leverage ratio

Harrowgate: CET1 $7.2bn, AT1 $1.0bn. Amounts in $bn

Tier 1 capital	7.2 + 1.0	**$8.2bn**
Total exposure	230 on + 20 off	**$250bn**
Leverage ratio	8.2 ÷ 250	**3.28%**
Risk-weighted Tier 1 ratio	8.2 ÷ 80	**10.25%**
G-SIB: plus half of 1.5%	3% + 0.75%	**3.75%: short**

Low risk weights can hide a lot of leverage

IN THE LESSON

- Harrowgate's tier one capital is its C E T one of seven point two billion dollars plus one billion of A T one, which is eight point two billion.
- Its on balance sheet assets are two hundred and thirty billion and its off balance sheet items add twenty billion, so total exposure is two hundred and fifty billion.
- The leverage ratio is eight point two over two hundred and fifty, which is three point two eight per cent.
- That passes the three per cent baseline minimum, but only just.
- Compare the risk weighted tier one ratio, eight point two over eighty, which is ten point two five per cent and looks comfortable.
- But under the final Basel three standard, a G S I B also holds a leverage buffer of half its surcharge, so Harrowgate would need three point seven five per cent, and would fall short.
- Low risk weights can hide a lot of leverage.

25 Two liquidity ratios

LCR = HQLA ÷ net cash outflows over 30 days ≥ 100%
NSFR = available ÷ required stable funding ≥ 100%

High-quality liquid assets	After haircuts
Net cash outflows	Inflows capped at 75% of outflows
Available stable funding	Weighted liabilities and equity
Required stable funding	Weighted assets, over one year

IN THE LESSON

- The other two measures are about liquidity, the ability to meet cash needs.
- The liquidity coverage ratio, L C R, compares high quality liquid assets, H Q L A, with net cash outflows over a thirty day stress period.
- Those liquid assets are counted after haircuts, and inflows count only up to seventy five per cent of outflows, so net outflows are at least a quarter of gross outflows.
- The L C R must be at least one hundred per cent.
- The net stable funding ratio, N S F R, looks out one year.
- It compares available stable funding with required stable funding, using a weight on each liability and on each asset, and it too must be at least one hundred per cent.
- Do not mix up the horizons: thirty days for the L C R, one year for the N S F R.

26 Example 11: Harrowgate's LCR

Stress outflows $40bn, inflows $35bn. Haircut on other bonds 25% (assumed)

HQLA after haircuts	12 + 4 × 75%	**$15bn**
Inflows allowed	min(35, 75% × 40)	**$30bn**
Net cash outflows	40 − 30	**$10bn**
LCR	15 ÷ 10	**150%**
Wrong: no inflow cap	15 ÷ (40 − 35)	**300%**

IN THE LESSON

- Harrowgate holds twelve billion dollars of the highest quality liquid assets, which count in full, and four billion of other eligible bonds, which take a haircut assumed here to be twenty five per cent.
- So high quality liquid assets are twelve plus three, fifteen billion.
- In the thirty day stress, outflows are forty billion and contractual inflows are thirty five billion.
- But inflows count only up to seventy five per cent of outflows, which is thirty billion.
- Net outflows are forty minus thirty, ten billion, and the L C R is fifteen over ten, one hundred and fifty per cent.
- Forget the cap, and net outflows look like five billion, giving a flattering three hundred per cent.

27 Example 12: Harrowgate's NSFR

Weights assumed for the example. Amounts in $bn

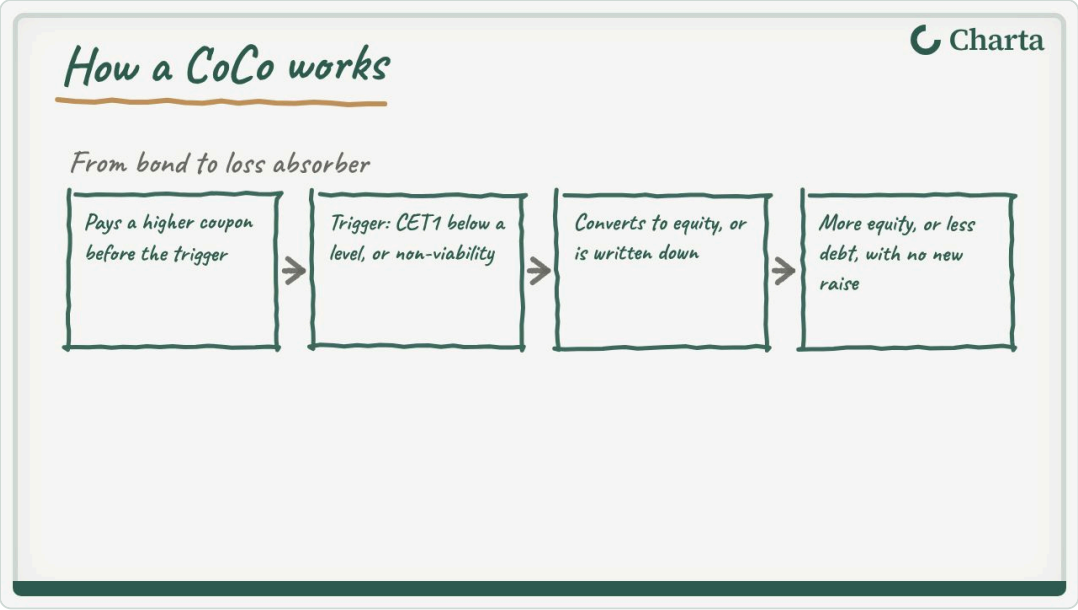
Available stable funding	30×100% + 130×90% + 70×50%	**$182.0bn**
Required stable funding	16×5% + 194×85% + 20×100%	**$185.7bn**
NSFR: fails	182.0 ÷ 185.7, below 100%	**98.0%**
Wrong: inverted	185.7 ÷ 182.0	**102.0%**

Fix: swap $10bn wholesale for long-term debt: 187.0 ÷ 185.7 = 100.7%

IN THE LESSON

- Now the one year view, with weights assumed for the example.
- On the funding side, thirty billion of equity and long term debt counts in full, one hundred and thirty billion of retail deposits counts at ninety per cent, and seventy billion of short term wholesale funding counts at fifty per cent.
- Available stable funding is one hundred and eighty two billion.
- On the asset side, sixteen billion of liquid assets need five per cent, one hundred and ninety four billion of loans need eighty five per cent, and twenty billion of other assets need one hundred per cent.
- Required stable funding is one hundred and eighty five point seven billion.
- The N S F R is ninety eight per cent, a fail.
- Invert it, and you get a false pass of one hundred and two per cent.
- One fix: swap ten billion of wholesale funding for long term debt.
- Available stable funding rises to one hundred and eighty seven billion, and the N S F R to one hundred point seven per cent.

28 How a CoCo works



IN THE LESSON

- Harrowgate's one billion dollars of A T one is a contingent convertible bond, a coco.
- Follow the boxes.
- Before the trigger, it is a bond that pays a coupon higher than ordinary debt, because the holder carries extra risk.
- The trigger is usually a C E T one ratio falling below a stated level, or a supervisor's judgment that the bank is no longer viable.
- When the trigger is hit, one of two things happens, depending on the contract.
- Either the bond converts into common equity, or its principal is written down.
- Either way, the bank ends up with new equity, or a smaller liability, without having to raise capital in a stressed market.

29 Example 13: Harrowgate's CoCo is triggered

CoCo $1bn; converts if CET1 ratio < 7% (assumed). Amounts in $bn

CET1 after a bad year		**$5.4bn**
Risk-weighted assets		**$85bn**
CET1 ratio: triggered	5.4 ÷ 85, below 7%	**6.35%**
CET1 after conversion	5.4 + 1.0	**$6.4bn**
New CET1 ratio	6.4 ÷ 85	**7.53%**

IN THE LESSON

- Suppose Harrowgate's coco converts into shares if its C E T one ratio falls below seven per cent, a trigger assumed for this example.
- A very bad year cuts C E T one to five point four billion dollars, while risk weighted assets rise to eighty five billion.
- The ratio is five point four over eighty five, about six point three five per cent, below the trigger.
- The coco converts, so one billion dollars of debt becomes common equity.
- C E T one rises to six point four billion, and the ratio to about seven point five three per cent, back above the trigger.
- No new share sale was needed in the middle of a crisis.

30 Example 14: the conversion price matters

1,000m existing shares. $1bn converts. Share price at the trigger: $2

At market price: new shares	$1,000m ÷ $2	**500m**
CoCo holders then own	500 ÷ 1,500	**33.3%**
At fixed $5: new shares	$1,000m ÷ $5	**200m**
CoCo holders then own	200 ÷ 1,200	**16.7%**

A low market price means heavy dilution and invites short selling

IN THE LESSON

- Who pays for that rescue?
- The existing shareholders, through dilution, which means their share of the bank shrinks.
- Harrowgate has one billion shares.
- If the one billion dollars converts at the market price at the trigger, and the share price has crashed to two dollars, the coco holders receive five hundred million new shares, a third of the enlarged bank.
- The alternative is a fixed conversion price, set in the contract.
- At five dollars a share, holders receive two hundred million shares, about sixteen point seven per cent.
- So a low market price means heavy dilution, and it invites short selling, since pushing the price down means more shares are issued.

31 Why banks issue CoCos

- Counts as AT1 or Tier 2 capital
- Coupon usually tax deductible; dividends are not
- Shareholders diluted only if the bank is in trouble
- Conversion: bond holders become shareholders
- Write-down: principal cut, holders lose part or all

IN THE LESSON

- Why would Harrowgate issue cocos instead of ordinary shares?
- There are three reasons.
- First, well designed cocos count as regulatory capital, either additional tier one or tier two.
- Second, the coupon is usually tax deductible as interest, while dividends on shares are not, so the capital is cheaper after tax.
- Third, shareholders are diluted only if the bank gets into trouble, whereas issuing shares today dilutes them at once.
- The distinction to keep for the exam is conversion versus write-down.
- A conversion turns the bond into shares, so the holders become owners.
- A write-down cuts the principal, and the holders simply lose part or all of their claim.

32 Reform in the United States

Dodd-Frank Act, 2010: match each reform to its failure

Reform	Failure it targets
Financial Stability Oversight Council	Nobody watched system-wide risk
Orderly liquidation authority	Bail out or disorderly collapse
Consumer protection bureau	Harmful products sold to households
Stress testing requirements	Unknown capital in a downturn
Volcker Rule: no prop trading, fund limits	Deposit banks speculating

IN THE LESSON

- Reform also went beyond Basel.
- For the exam, match each reform to the failure it was aimed at.
- In the United States, the Dodd Frank Act of two thousand and ten created the Financial Stability Oversight Council, to watch for risks to the whole system, which no single regulator had owned.
- It created an orderly liquidation authority, so a failing large firm can be closed in an orderly way rather than bailed out or left to collapse in disorder.
- It created a consumer protection bureau, aimed at harmful products sold to households.
- It required stress testing, so supervisors could see whether big banks would survive a downturn.
- And its Volcker Rule bars deposit taking banks from proprietary trading, meaning trading for their own profit, and limits their investments in hedge funds and private equity funds, while still allowing market making and hedging.

33 Derivatives, ring-fencing and Basel III

Match each reform to the failure it was aimed at

Reform	Failure it targets
Central clearing, trade reporting	Opaque web of bilateral exposures
Margin on uncleared trades	Exposures without collateral
UK ring-fencing	Deposits exposed to trading losses
Basel III capital and ratios	Thin capital and liquidity

IN THE LESSON

- Reform also reached derivatives markets and bank structure.
- Following commitments by the G twenty, standardised over the counter, or O T C, derivatives must be cleared through central counterparties, and all O T C derivatives must be reported to trade repositories.
- That targets the opaque web of bilateral exposures that nobody could see during the crisis.
- Trades that are not cleared face margin requirements, so that exposures are backed by collateral.
- The United Kingdom adopted ring-fencing, which separates retail banking from investment banking within a banking group, protecting ordinary deposits from trading losses.
- And Basel three added higher capital, buffers, and the leverage and liquidity ratios, aimed at too little capital, of poor quality, and too little liquidity.

34 Try three quick questions

1. VaR: yesterday $12m, average $10m. sVaR: $30m, $25m. Multipliers 3. Charge?
   Answer: max(12, 30) + max(30, 75) = $105m.
2. G-SIB: RWA $50bn, countercyclical 1%, surcharge 1%. Full CET1 needed?
   Answer: 4.5 + 2.5 + 1 + 1 = 9%; 9% × 50 = $4.5bn.
3. HQLA $20bn; 30-day outflows $50bn, inflows $45bn. LCR?
   Answer: Inflows capped at 37.5. 20 ÷ 12.5 = 160%.

IN THE LESSON

- Now try three quick questions.
- Pause the video, think, then listen to the answers.
- Question one.
- Yesterday's V a R is twelve million dollars, with a sixty day average of ten million.
- Yesterday's stressed V a R is thirty million, with an average of twenty five million.
- Both multipliers are three.
- What is the charge?
- Thirty plus seventy five, which is one hundred and five million dollars.
- Question two.
- A G S I B has risk weighted assets of fifty billion, a countercyclical rate of one per cent and a surcharge of one per cent.
- What C E T one does it need in full?
- Nine per cent, which is four point five billion dollars.
- Question three.
- A bank has twenty billion of liquid assets after haircuts, thirty day outflows of fifty billion and inflows of forty five billion.
- What is its L C R?
- Inflows are capped at thirty seven point five, so net outflows are twelve point five, and the L C R is one hundred and sixty per cent.