CHARTA LEARNING · LESSON NOTES

Central Clearing

FRM Part II

1 A story: the hub in the middle

- CCP: buyer to every seller, seller to every buyer
- It guarantees performance to its clearing members
- Only members face it; others clear through a member
- Daily: variation margin, initial margin, default fund
- Risk is concentrated, not removed: credit risk on members

IN THE LESSON

- Imagine a market fair where every trader makes promises to many others.
- If one trader fails, the traders it owed are hurt, and may then fail on their own promises.
- Now suppose the fair appoints one strong organiser, and every promise is made to the organiser instead.
- That organiser is a central counterparty, or C C P.
- It becomes the buyer to every seller and the seller to every buyer, and it guarantees performance to its clearing members.
- Only members face it directly.
- Other firms clear through a member that stands behind their trades.
- But notice the exam point: the risk has not disappeared.
- It has moved, and it is credit risk on the members.

2 Example 1: one day at Meridian

Illustration: price moves; amounts in $ millions

Birch's position loses	pays Meridian in cash	**−4m**
Alder's position gains	paid by Meridian	**+4m**
Meridian's net cash	+4m − 4m	**0**
If Birch cannot pay	Meridian still owes Alder	**4m at risk**

IN THE LESSON

- Follow one day, in millions of dollars.
- Alder is on one side of a contract and Birch is on the other, and both have been taken on by Meridian.
- The price moves, so Alder's position gains four million and Birch's loses four million.
- This is variation margin.
- Birch pays four million in cash to Meridian, and Meridian passes four million to Alder.
- Look at Meridian's own cash: four million in, four million out, so its book is matched and it carries no directional market risk.
- That is true only while members pay.
- If Birch fails to pay, Meridian still owes Alder the four million, and that is the credit risk the rest of this lesson is about.

3 Novation: the old contract disappears

- Happens when the CCP accepts the trade, not at the price
- Old contract extinguished, two new ones, same terms
- Seller delivers to the CCP; buyer receives from it
- Original parties: no claim on each other
- Not netting, not a guarantee: the old contract disappears

IN THE LESSON

- The legal tool that puts the C C P in the middle is called novation.
- Suppose Alder and Birch agree a price for a trade.
- Novation happens when the C C P accepts the trade for clearing.
- The original contract between Alder and Birch is then extinguished, and replaced by two new contracts on the same economic terms: one between Alder and the C C P, the other between the C C P and Birch.
- The seller now delivers to the C C P and the buyer receives from the C C P.
- The original parties have no claim on each other any more.
- Novation is not netting, and it is not a guarantee laid over the old contract.
- The old contract is gone.

4 Example 2: novation of one trade

Illustration: Alder sells a 50m notional contract to Birch

Price agreed	Alder ↔ Birch, 1 contract	**Not yet novated**
Meridian accepts	old contract extinguished	**Novation**
After: new contracts	Alder ↔ CCP, CCP ↔ Birch	**2 × 50m**
Alder's claim on Birch	released	**None**

IN THE LESSON

- In the morning Alder and Birch agree a price for a contract with a notional of fifty million dollars.
- Alder still has a claim on Birch.
- Later Meridian accepts the trade for clearing.
- That is the moment of novation.
- The single contract becomes two, each for fifty million, one between Alder and Meridian, the other between Meridian and Birch, on the same terms.
- Alder's claim on Birch is released.
- If Birch now fails, Alder's counterparty is Meridian, not Birch.
- So the C C P becomes the counterparty and the original bilateral link is released.

5 Netting, offset and compression

- Netting: offsets positive and negative values
- Multilateral offset: all trades face one CCP
- Compression: tears up redundant or offsetting trades
- Netting and offset cut exposure and margin
- Compression cuts gross notional, not net risk

IN THE LESSON

- Three tools reduce exposures in a cleared market.
- Netting offsets positive and negative values into one amount.
- Multilateral offset comes from novation: because all trades now face one counterparty, a member who bought a contract from one firm and sold the same contract to another ends with a net position of zero, or the small difference.
- Compression tears up redundant or offsetting trades, such as a ring of identical swaps.
- It cuts the number of trades and the gross notional, but each member's net position and net market risk stay unchanged.
- Netting and offset reduce exposure and margin.
- Compression mainly reduces gross notional, operational burden and gross-based capital or leverage measures.

6 Example 3: multilateral offset

Contract worth 3% of notional to the buyer. $ millions

Birch long 100m from Alder	3% × 100m	**+3.0m**
Birch short 90m to Cedar	3% × 90m	**−2.7m**
Bilateral: gross, no offset	3.0 + 2.7	**5.7m**
Via Meridian: net long 10m	3% × 10m	**0.3m**

IN THE LESSON

- A contract is worth three per cent of its notional to the buyer.
- Birch bought one hundred million of it from Alder, so the position is worth plus three million.
- Birch also sold ninety million of the same contract to Cedar, worth minus two point seven million.
- Bilaterally, nothing offsets.
- Birch is owed three million by Alder, and Birch owes two point seven million to Cedar, so the gross amounts across the two pairs total five point seven million.
- Through Meridian, Birch holds one position: long a hundred million and short ninety million, a net of ten million long.
- At three per cent that is worth point three million.
- Offsetting cut the exposure from five point seven to point three million.

7 Example 4: compression of a ring

Ring: Alder pays Birch 100, Birch pays Cedar 80, Cedar pays Alder 60

Gross notional before	100 + 80 + 60	**240m**
Gross notional after	40 + 20 + 0	**60m**
Trades	3 → 2	**fewer**
Net: Alder, Birch, Cedar	same before and after	**−40, +20, +20**
Net market risk	unchanged	**same**

IN THE LESSON

- Now compression.
- Three members have a ring of identical swaps in the same contract.
- Alder owes one hundred million of notional to Birch, Birch owes eighty million to Cedar, and Cedar owes sixty million to Alder.
- Gross notional is two hundred and forty million across three trades.
- The smallest link is sixty, so tear up sixty of each trade.
- Alder to Birch becomes forty, Birch to Cedar becomes twenty, and the third trade vanishes.
- Gross notional falls to sixty million and there are two trades, not three.
- Now check each member's net position, received minus paid.
- Alder is minus forty both before and after, and Birch and Cedar are each plus twenty both before and after.
- Net positions are unchanged, so market risk is untouched.

8 Example 5: split across two CCPs

Initial margin assumed at 4% of notional. $ millions

One CCP: net 10m	4% × 10m	**0.40m**
Two CCPs: long 100m	4% × 100m	**4.00m**
Two CCPs: short 90m	4% × 90m	**3.60m**
Total, two CCPs	4.00 + 3.60 = 19 × 0.40	**7.60m**
Margin lost to the split	7.60 − 0.40	**7.20m**

IN THE LESSON

- The benefits exist only inside one C C P.
- Suppose Birch's two trades from Example three are cleared at different clearing houses: the long hundred million at Meridian, and the short ninety million at a rival, Northgate.
- Neither offsets the other's trade.
- Assume each charges initial margin of four per cent of notional.
- At one C C P, the net ten million costs point four million of margin.
- Split across two, Meridian charges four million on the long and Northgate three point six million on the short, a total of seven point six million.
- Splitting the trades forfeits the offset and adds seven point two million of margin, so the total is nineteen times as much.

9 Margin and the default fund

- Variation margin: daily gains and losses, no build-up
- Initial margin: future loss over the MPOR
- MPOR: days needed to close out after a default
- Default fund: pool of members' contributions
- Sized by stress tests: cover-2 absorbs two largest

IN THE LESSON

- Variation margin passes the daily gains and losses between members, through the C C P, so exposure does not build up.
- Initial margin is different.
- Each member posts it against a potential future loss on its own portfolio over the margin period of risk, written M P O R, which is the time needed to close out after a default.
- Finally there is the default fund, a pool contributed by members and used when a defaulter's own resources are not enough.
- It is sized from stress tests, commonly so that the default of the two members with the largest stressed losses can be absorbed.
- That standard is called cover two.

10 Estimating initial margin

IM = z × σ × √MPOR × Position

z	From a high confidence level
sigma	Daily volatility
MPOR	Days to close out
Position	Size of the exposure
IM	Margin held against future loss

IN THE LESSON

- A typical estimate of initial margin has four inputs.
- The multiplier, called zee, comes from a high confidence level such as ninety nine per cent.
- Sigma is the daily volatility of the portfolio's value.
- The margin period of risk, M P O R, is the number of days to close out.
- The position is the size of the exposure.
- Initial margin, written I M, equals zee, times sigma, times the square root of M P O R, times the position.
- For a portfolio, sigma uses correlations between the positions, so offsetting positions need less margin than the sum of the separate positions.
- And here is the common error.
- The margin period is scaled with its square root, not linearly.
- Ten days of risk is not twice five days of risk.

11 Example 6: margin and the linear trap

Dunmore: position 80m, daily volatility 1.2%, z = 2.33

Daily move in money	1.2% × 80m	**0.96m**
Margin, 5 days	2.33 × 0.96m × √5	**5.00m**
Margin, 10 days	2.33 × 0.96m × √10	**7.07m**
Wrong: double 5 days	2 × 5.00m	**10.00m**
Overstatement	10.00m − 7.07m	**2.93m**

IN THE LESSON

- Size a margin for Dunmore.
- Its position is eighty million dollars, the daily volatility is one point two per cent, and zee is two point three three.
- The daily move in money is one point two per cent of eighty million, which is point nine six million.
- With a five day period, multiply two point three three by point nine six by the square root of five, which is two point two three six, and the margin is five point oh oh million.
- With a ten day period, use the square root of ten, three point one six two, and the margin is seven point oh seven million.
- The trap is to scale linearly and double five to ten point oh oh million.
- That overstates the margin by two point nine three million.

12 Example 7: offsetting positions need less margin

Long 80m and short 70m, volatility 1.2% each, ρ = 0.9, 5 days

Separate: long 80m	2.33 × 0.96m × √5	**5.00m**
Separate: short 70m	2.33 × 0.84m × √5	**4.38m**
Sum of separate margins	5.00 + 4.38	**9.38m**
Portfolio volatility	0.9216 + 0.7056 − 1.4515	**√0.1757 = 0.419m**
Portfolio margin	2.33 × 0.419m × √5	**2.18m**

IN THE LESSON

- Now a portfolio.
- Suppose Dunmore is long eighty million of one contract and short seventy million of a closely related contract, each with daily volatility of one point two per cent, and the correlation is point nine.
- The daily moves in money are point nine six million and point eight four million.
- Taken separately, the five day margins are five million and four point three eight million, a total of nine point three eight million.
- But the two positions mostly offset.
- The portfolio volatility is the square root of point nine six squared plus point eight four squared minus two times point nine times point nine six times point eight four, point one seven five seven, whose square root is about point four one nine million.
- Portfolio margin is only two point one eight million.

13 Example 8: sizing the default fund

Stressed loss left after each member's own margin. $ millions

Largest: Dunmore	stress test	**70m**
Second: Alder	stress test	**50m**
Cover-2 fund size	70 + 50	**120m**
Cover-1 would be	largest only	**70m**
Contributions	20 + 50 + 30 + 20	**120m**

IN THE LESSON

- Next, the default fund.
- Meridian runs stress tests and finds, for each member, the stressed loss that would be left after that member's own margin.
- Dunmore would leave seventy million, Alder fifty, Birch twenty and Cedar fifteen.
- Under cover two, the fund must absorb the default of the two members with the largest stressed losses.
- That is Dunmore at seventy plus Alder at fifty, so the fund is sized at one hundred and twenty million.
- Cover one would need only the largest, seventy million.
- Members contribute to reach the total: Dunmore twenty, Alder fifty, Birch thirty and Cedar twenty, which adds to one hundred and twenty.
- We keep these contributions for the waterfall.

14 What a CCP is exposed to

- Credit risk on members: left with unmatched positions
- Price move from last margin to completed hedge or auction
- Liquidity risk: must keep paying gainers if defaulter doesn't
- Collateral: investment risk and concentration
- Wrong-way risk, operational risk, legal risk

IN THE LESSON

- A C C P's main exposure is credit risk on its members.
- Its book is matched, so as long as everyone pays it carries no market risk.
- When a member defaults, though, the C C P is left holding the defaulter's side of every trade, now unmatched.
- It bears the price move between the last variation margin it received and the completion of hedging or auction.
- It also faces liquidity risk, because it must keep paying variation margin to members who gained, even when the defaulter does not pay in.
- Investment risk and concentration arise on the collateral it holds.
- Wrong-way risk arises when a member's default is correlated with its positions.
- And there are operational and legal risks, such as a failed system or an unenforceable rule.

15 How a CCP controls its exposures

Each exposure has a control, and every control has a limit

Exposure	Control
Member default	Standards, margin, limits, add-ons
Extreme default	Stress-tested default fund
Liquidity strain	Committed liquidity lines
Collateral risk	Conservative investment
Model error	Backtesting of margin models

IN THE LESSON

- Membership standards limit who can default in the first place.
- Daily variation margin stops losses building up, and initial margin covers the move while the portfolio is closed out.
- Position limits and add-ons for concentrated or wrong-way positions raise the margin where the risk is higher.
- The default fund is stress-tested, and committed liquidity lines give the C C P cash to keep paying gainers on the day a member fails.
- Collateral is invested conservatively, and margin models are backtested.
- But remember the central exam point.
- Margin and fund resources are finite.
- A big enough loss can still exhaust them, which is why the layers beyond them exist.

16 Example 9: the gap after a default

Cedar misses a call. $ millions

Unpaid call, cash to gainers	liquidity need	**25m**
Further move before auction	1.5% × 300m	**4.5m**
Loss since last margin	25 + 4.5	**29.5m**
Cedar's initial margin	held by Meridian	**24m**
Shortfall	29.5 − 24	**5.5m**

IN THE LESSON

- Cedar fails to pay a variation margin call of twenty five million.
- Meridian must still pay the members who gained, so it needs twenty five million of cash that day, which is the liquidity risk.
- Meridian then hedges and auctions Cedar's three hundred million position, and the market moves a further one point five per cent against it before the process is complete.
- That is a further four point five million.
- The total loss since the last variation margin received is twenty nine point five million.
- Cedar's initial margin is twenty four million, so there is a shortfall of five point five million.
- The rest must come from the next resources.

17 The loss waterfall

- 1. Defaulter's variation and initial margin
- 2. Defaulter's default fund contribution
- 3. CCP's own capital: skin in the game
- 4. Surviving members' default fund contributions
- 5. Recovery tools: assessments, gains haircutting

IN THE LESSON

- The loss waterfall is the order in which resources absorb the loss from a member's default.
- First comes the defaulter's own margin, variation and initial.
- Second is the defaulter's contribution to the default fund.
- Third is the C C P's own capital, called skin in the game.
- Fourth are the non-defaulting members' default fund contributions.
- Last are the recovery tools, such as further assessments on members or haircuts to variation margin gains.
- To work it, take each resource in turn, subtract it from the remaining loss, and stop when the loss reaches zero.
- Each layer is limited by its own size.
- The usual mistakes are skipping a layer, or using survivors' money before the C C P's own capital.

18 Example 10: Dunmore defaults

Loss 150m. Dunmore's IM 80m, fund share 20m, CCP capital 10m

Defaulter's initial margin	150 − 80	**70 left**
Defaulter's fund share	70 − 20	**50 left**
CCP's own capital	50 − 10	**40 left**
Survivors' fund shares	40 − 40	**0 left**

IN THE LESSON

- Now watch a waterfall at work.
- Dunmore defaults and the loss on closing out its portfolio is one hundred and fifty million.
- Its initial margin is eighty million, so after the first layer seventy million remains.
- Next is its fund contribution of twenty million, leaving fifty.
- Then comes Meridian's own capital of ten million, leaving forty.
- Only now are the survivors' contributions touched, and the mutualised fund bears forty million, bringing the loss to zero.
- A smaller loss would stop higher up, and survivors would lose nothing.

19 Example 11: sharing the survivors' layer

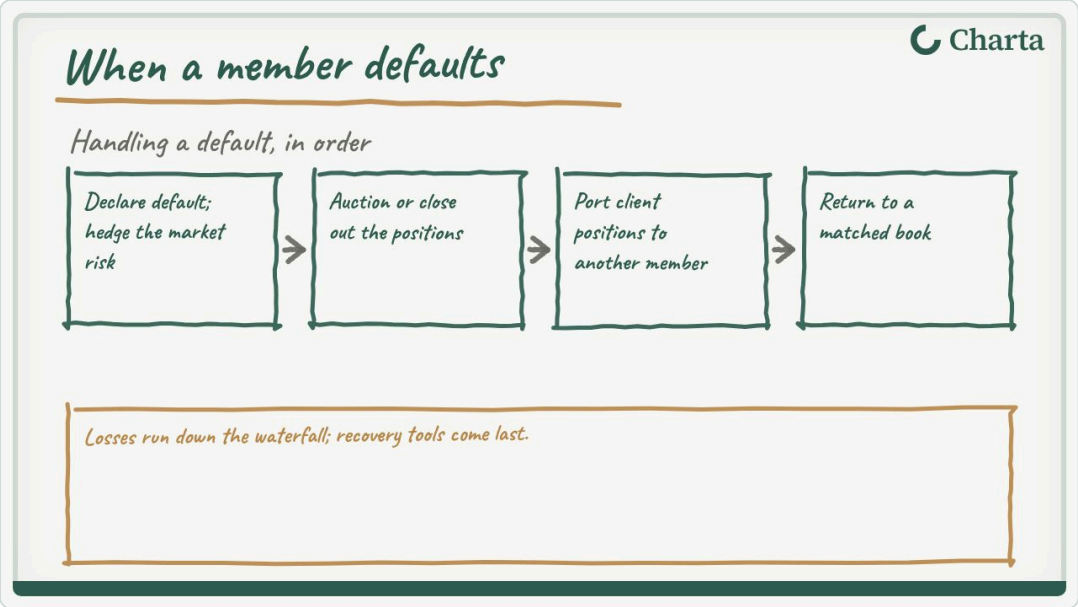
Mutualised loss 40m shared pro rata to contributions

Alder: 50 of 100	40 × 50%	**20m**
Birch: 30 of 100	40 × 30%	**12m**
Cedar: 20 of 100	40 × 20%	**8m**
Wrong: equal split	40 ÷ 3	**13.33m each**

IN THE LESSON

- The last layer is shared among surviving members, and the sharing rule matters.
- The forty million is split pro rata to contributions, not equally.
- Alder contributed fifty million, Birch thirty and Cedar twenty, a total of one hundred.
- So Alder bears fifty per cent of the forty million, which is twenty million, Birch bears thirty per cent, which is twelve million, and Cedar bears twenty per cent, which is eight million.
- The common mistake is to split the loss equally.
- Dividing forty by three gives thirteen point three three million each, which is too much for Cedar and too little for Alder.

20 When a member defaults



IN THE LESSON

- When a member fails to meet a call, the C C P declares it in default.
- It first hedges the market risk of the defaulter's portfolio, so that prices stop hurting it.
- It then auctions or closes out the positions, often to surviving members, to get back to a matched book.
- If the defaulter has clients, their positions may be ported to another member, so they are not caught in the failure.
- Losses are absorbed through the waterfall we just met: the defaulter's margin and fund contribution, then the C C P's capital, then the surviving members' contributions.
- Only if all of these are exhausted do the recovery tools come into play.

21 The recovery tools

All of them come after pre-funded resources

Tool	What it does
Assessment	More cash from members, capped, pro rata
Gains haircutting	Cuts gainers' payouts; positions stay
Partial tear-up	Ends contracts at last price
After tear-up	Members must rehedge
Order	Last, after pre-funded layers

IN THE LESSON

- If pre-funded resources run out, the rulebook has recovery tools.
- Assessments call for more cash from surviving members, usually capped as a multiple of their contribution, and shared pro rata.
- Variation margin gains haircutting cuts the payouts to members that have gains, pro rata to the shortfall.
- Partial tear-up terminates contracts at the last price instead of paying cash.
- There is an important difference between the last two.
- Haircutting leaves positions in place, while tear-up removes them, and leaves members to rehedge.
- Rulebooks differ between C C P s.
- The exam point is that recovery tools sit after the pre-funded resources, and the order matters.

22 Example 12: a loss beyond the fund

Loss 260m; assessment capped at 1× contribution

After defaulter and CCP capital	260 − 80 − 20 − 10	**150 left**
Survivors' fund, all used	150 − 100	**50 left**
Assessment call, pro rata	50 shared 50 : 30 : 20	**25, 15, 10**
Left to cover	50 − 50	**0**

IN THE LESSON

- Take a bigger default.
- The loss is two hundred and sixty million.
- Dunmore's margin, fund share and Meridian's capital remove eighty, twenty and ten, leaving one hundred and fifty.
- The survivors' fund of one hundred million is used in full, leaving fifty.
- Pre-funded resources are exhausted, so recovery tools apply.
- The rules allow an assessment capped at one times each member's contribution, so up to one hundred million is available.
- Meridian calls fifty million, pro rata to contributions: Alder pays twenty five, Birch fifteen and Cedar ten.
- The shortfall is now zero.
- The assessment came after the survivors' fund, and each call is inside its cap.

23 Example 13: haircutting gains

Shortfall 30m. Gains owed today: Alder 90m, Birch 30m

Shortfall to cover	after pre-funded layers	**30m**
Gains owed	90 + 30	**120m**
Haircut rate	30 ÷ 120	**25%**
Cut: Alder, Birch	25% × 90, 25% × 30	**22.5m, 7.5m**

IN THE LESSON

- Now suppose instead the loss ends with a thirty million shortfall after all pre-funded resources, and Meridian uses variation margin gains haircutting.
- On that day Alder is owed ninety million of variation margin gains and Birch thirty million, a total of one hundred and twenty.
- The haircut is the shortfall over the gains: thirty over one hundred and twenty, which is twenty five per cent.
- Alder's payout is cut by twenty five per cent of ninety, which is twenty two point five million.
- Birch's is cut by twenty five per cent of thirty, which is seven point five million.
- The cuts total thirty, so the shortfall is covered.
- Their positions remain in place.
- Under tear-up their contracts would instead end at the last price.

24 Bilateral clearing and central clearing

- Bilateral: each pair, own terms, own close-out
- Netting only within each pair, plus agreed collateral
- CCP: standardised, novated, netted across everyone
- Mandatory risk-based margin; one default process
- Cuts exposure, concentrates risk, nets within one CCP

IN THE LESSON

- Let us now compare the two ways of clearing.
- In bilateral clearing each party faces its counterparty directly.
- Credit risk is spread across many relationships, and it is reduced only by netting within each pair under a master agreement, plus whatever collateral the two agree.
- Terms can be customised.
- On a default, each survivor closes out and replaces its own trades separately, which can cause fire sales.
- With a C C P, trades are standardised, novated and netted across all counterparties.
- Margin is mandatory and risk-based, and one coordinated default process runs.
- The trade-offs run both ways.
- Central clearing cuts total exposures through multilateral netting, but it concentrates risk in the C C P and nets only within one C C P.
- And it can raise collateral demand.

25 Bilateral against central

Netting scope, concentration, standardisation

	Bilateral	Central
Risk	Spread, many pairs	Concentrated
Netting	Per pair	All, one CCP
Margin	As agreed, maybe none	Mandatory
Default	Each alone	One process
Products	Bespoke	Standardised

IN THE LESSON

- Here is the comparison.
- On exposures, bilateral risk is spread over many pairs, while central clearing concentrates it in one C C P.
- On netting, bilateral is pair by pair, while central is across all counterparties, but only within that one C C P.
- On margin, bilateral margin is whatever the two parties agree, and may be none, while central margin is mandatory and risk-based.
- On default, bilateral survivors each close out alone, while a C C P runs one process.
- And on products, bilateral handles bespoke contracts, while central clearing needs standardised ones.
- Do not say that clearing always reduces collateral.
- If many bilateral trades were uncollateralised, moving them to a C C P increases margin.
- The exam points are netting scope, concentration and standardisation.

26 Example 14: exposure down, margin up

Alder's trades with three firms. $ millions

Bilateral exposure	30 + 20, the −10 stays	**50m**
Through one CCP	30 − 10 + 20	**40m**
Bilateral margin, none posted	uncollateralised	**0**
CCP initial margin	assumed	**6m**

IN THE LESSON

- Alder has three trades, each with a different counterparty.
- It is owed thirty million by Birch, owes ten million to Cedar, and is owed twenty million by Dunmore.
- Bilaterally, netting works only within each pair, so Alder's exposure is thirty plus twenty, fifty million.
- The ten it owes Cedar does not reduce it.
- Through one C C P, everything is netted: thirty minus ten plus twenty is forty million.
- Exposure falls by ten million.
- But suppose the bilateral trades were uncollateralised, so no margin was posted.
- The C C P demands initial margin, which we assume is six million.
- So exposure fell, but collateral demand rose from zero to six million.
- That is why clearing does not always reduce collateral.

27 Initial margin against the default fund

Defaulter pays against mutualised

	Initial margin	**Default fund**
Who pays	The defaulter	Shared
Sized from	Own portfolio	Aggregate stress
Covers	Own default	Beyond defaulter's means
Cost	Funding cost	Funding cost, capital
Incentives	Aligned	Moral hazard

IN THE LESSON

- Both initial margin and default fund contributions come from clearing members, but they work very differently.
- Initial margin is defaulter-pays.
- It is calibrated to the member's own portfolio and held against its own default, so it keeps the member's incentives aligned with its risk.
- The default fund is mutualised.
- It is sized from aggregate stress, covers losses beyond the defaulter's resources, and spreads them across surviving members.
- On cost, both tie up collateral that has an opportunity or funding cost, and members' contributions can attract capital charges.
- On moral hazard, mutualisation means that prudent members subsidise risk-takers.
- A member bears less of the cost of its own risk-taking, and has less reason to monitor the others.
- The exam point is defaulter pays versus mutualised.

28 Example 15: shifting from margin to the fund

Loss 150m, CCP capital 10m. Funding cost 4%

Design X: IM 100, fund 10	150 − 100 − 10 − 10	**Survivors 30m**
Design Y: IM 60, fund 30	150 − 60 − 30 − 10	**Survivors 50m**
Posted by Dunmore	X: 110m, Y: 90m	**Y posts 20m less**
Annual funding cost	X: 4.4m, Y: 3.6m	**Y saves 0.8m**

IN THE LESSON

- Here is the moral hazard in numbers.
- Meridian considers two designs for a one hundred and fifty million loss with ten million of its own capital.
- In design X, Dunmore's initial margin is one hundred million and its fund share is ten million.
- The survivors bear one hundred and fifty minus one hundred minus ten minus ten, which is thirty million.
- In design Y, the initial margin is sixty million and the fund share is thirty million, so the survivors bear fifty million.
- Dunmore posts less in design Y, ninety million against one hundred and ten, and at a four per cent funding cost pays three point six million a year instead of four point four.
- It is cheaper for Dunmore, while the survivors pay twenty million more.
- Shifting resources from initial margin to the fund weakens incentives.

29 The strengths of central clearing

- Netting and compression cut exposure and gross notional
- Daily variation margin stops losses accumulating
- Standard rules and one default process limit contagion
- Mutualised resources can absorb a large member's failure

IN THE LESSON

- Central clearing has four main strengths.
- First, multilateral netting and compression reduce exposures and gross notional, as we saw with Birch and with the ring of swaps.
- Second, daily variation margin stops losses from accumulating, because gains and losses are settled in cash every day.
- Third, standardised rules, transparency and a coordinated default management process limit contagion, so one failure is less likely to spread along a web of private contracts.
- Fourth, mutualised resources can absorb a large member's failure, because the default fund is shared and so can be far larger than any one member could hold alone.
- But each strength has a matching weakness.

30 The weaknesses, matched to their source

Match the scenario to the source

Scenario	Source
Too big to fail	Concentration
Margin jumps in a crisis	Procyclicality
Prudent pay for risk-takers	Moral hazard
Offset lost across CCPs	Fragmentation
Bespoke trades stay out	Standardised only

IN THE LESSON

- Now the weaknesses.
- Risk concentrates in a few C C P s that become too big to fail, so recovery and resolution planning is needed.
- Margin models can be procyclical, calling more collateral in a stress, just when liquidity is scarcest.
- Mutualisation creates moral hazard, as we saw in the last example.
- Netting is lost when trades are split across C C P s, which is fragmentation.
- In addition, only standardised products can be cleared, and competition between C C P s can pressure margin standards downwards.
- The exam skill is to match the weakness named in a scenario to its source.
- Too big to fail points to concentration.
- Margin rising in a crisis points to procyclicality.
- Prudent members paying for risk-takers points to moral hazard.
- Lost offset points to fragmentation.

31 Mistakes to avoid

- Clearing does not remove risk: it concentrates it
- Novation replaces the contract; it is not netting
- Compression leaves net positions unchanged
- Margin scales with √MPOR; waterfall order; pro rata
- Clearing may raise collateral; resources are finite

IN THE LESSON

- One: saying that clearing removes counterparty risk.
- Clearing concentrates and mutualises it, and the C C P's risk is credit risk on its members.
- Two: confusing novation with netting or with a guarantee.
- Novation replaces the old contract.
- Three: believing that compression changes net positions.
- It tears up trades and leaves net market risk unchanged.
- Four: scaling the margin period linearly, when it scales with the square root.
- Five: getting the waterfall wrong, by skipping a layer, using survivors' money before the C C P's capital, or splitting a mutualised loss equally instead of pro rata.
- And finally, do not say that clearing always reduces collateral.
- Margin and fund resources are also finite.

32 Recap: the main ideas

- CCP: credit risk on members; novation replaces contract
- Netting, offset, compression: within one CCP only
- IM = z × σ × √MPOR × Position; fund by cover-2
- Waterfall: defaulter, CCP, survivors, recovery tools
- Pros against concentration, procyclicality, moral hazard

IN THE LESSON

- Let us pull it together.
- A C C P becomes buyer to every seller and seller to every buyer, and its risk is credit risk on its members.
- Novation replaces the original contract with two contracts with the C C P.
- Netting, multilateral offset and compression cut exposure and gross notional, but only within one C C P.
- Initial margin follows zee times sigma times the square root of the margin period times the position, and the default fund is sized by cover two.
- The loss waterfall runs from the defaulter's margin and fund share, to C C P capital, to survivors, then recovery tools.
- Bilateral and central clearing trade exposure against concentration, and margin is defaulter pays while the fund is mutualised.

33 Try three quick questions

1. Loss 120m; IM 70m, fund share 15m, CCP capital 5m. Survivors bear?
   Answer: 120 − 70 − 15 − 5 = 30m, shared pro rata.
2. 50m position, 2% daily, z 2.33, 4 days. Initial margin?
   Answer: 2.33 × 0.02 × √4 × 50m = 4.66m.
3. Bought 60m from X, sold 45m of the same contract to Y, one CCP. Net?
   Answer: 60 − 45 = 15m long, by multilateral offset.

IN THE LESSON

- Now try three quick questions.
- Pause the video, think, then listen to the answers.
- Question one.
- A member defaults and the loss is one hundred and twenty million.
- Its initial margin is seventy million, its fund contribution is fifteen million, and the C C P's capital is five million.
- How much falls on the surviving members?
- One hundred and twenty minus seventy minus fifteen minus five leaves thirty million.
- Question two.
- A position is fifty million dollars, daily volatility is two per cent, zee is two point three three and the margin period is four days.
- What is the initial margin?
- The square root of four is two, so two point three three times point oh two times two times fifty is four point six six million.
- Question three.
- A firm bought sixty million of a contract from one member and sold forty five million of the same contract to another, all through one C C P.
- What is its net position?
- Fifteen million long.