CHARTA LEARNING · LESSON NOTES

Pricing Counterparty Risk: CVA and DVA

FRM Part II

1 A swap is not risk free

- Risk-free value assumes both sides always pay
- Corvane may default when it owes the bank money
- The bank then recovers only part of the claim
- That expected loss is a real cost of the trade

IN THE LESSON

- Meet Harbourline Bank.
- It has just agreed a three year interest rate swap with a manufacturer called Corvane Industries, with a notional of one hundred million dollars.
- A pricing model, using market rates alone, says what the swap is worth.
- That is the risk free value, because it quietly assumes that both sides always pay.
- But suppose that one year from now the swap is worth two million dollars to Harbourline, and Corvane fails.
- Corvane owes two million, and Harbourline will recover only a fraction of it.
- A bank that ignores this is treating a risky promise as a safe one, and its price is too generous.

2 Why price counterparty risk?

- Expected loss is a real cost: charge it in the price
- Limits control size; they do not pay for losses
- Fair-value accounting expects the credit adjustment
- Basel III charges capital for its volatility
- Crisis losses came mostly from spreads widening

IN THE LESSON

- There are four reasons to put the cost in the price.
- First, the expected loss from counterparty default is a genuine cost, so it should be charged to the client, not only managed with limits.
- A limit stops the loss growing too large, but it does not pay for the losses that are expected.
- Second, fair value accounting expects the credit adjustment to be included in the value of derivatives.
- Third, Basel three charges capital for the volatility of the adjustment, so a bank wants to measure it.
- Fourth, most of the losses banks took on counterparty risk in the crisis came from counterparty spreads widening, not from defaults.
- The value fell even where nobody failed.

3 What makes it hard

Reason: a real cost. Difficulty: five problems

Difficulty	Why
Stochastic exposure	Must be simulated
Two-sided	Both parties can default
Netting set	Not additive across trades
No traded CDS	PD estimated by proxy
Hedging	Fixed-notional CDS imperfect

IN THE LESSON

- Pricing is harder than it sounds, for five reasons.
- Exposure is stochastic: the value of a derivative changes with markets, so the amount at risk must be simulated.
- It is two sided, because a swap can be an asset today and a liability tomorrow, and both parties can default.
- It depends on the whole netting set, the group of trades that would be netted at default, so the charge is not additive across trades.
- Many counterparties have no traded C D S, so a default probability must be estimated by proxy.
- Finally, because exposure moves, hedging with a C D S of fixed notional is imperfect.
- An exam answer should name both the reason for pricing and the difficulty.

4 The idea of CVA

- CVA = value with no default − value allowing for default
- So value allowing for default = risk-free value − CVA
- CVA is the market price of expected counterparty loss
- Example: $10m − $70,000 = $9.93m

IN THE LESSON

- Credit valuation adjustment, C V A, is the difference between two values.
- The first is the value of the derivative portfolio if the counterparty could never default.
- The second is its value allowing for default.
- So the value allowing for default equals the risk free value minus C V A.
- C V A is the market price of the expected loss from counterparty default.
- For Harbourline, if the risk free value of the swap is ten million dollars and C V A is seventy thousand dollars, the swap is worth nine million nine hundred and thirty thousand once credit is recognised.
- C V A is a deduction from what the bank owns, and in effect the price of the credit risk.

5 The CVA formula

CVA = LGD × Σ (discounted EE × marginal PD)

Loss given default = 1 − R	One minus the recovery rate
Discounted expected positive exposure	Positive part of value, discounted
Marginal default probability	Default within this interval
Credit valuation adjustment	The market price of the loss

IN THE LESSON

- Here is how the loss is built.
- Take a set of exposure dates.
- At each date, the exposure is the expected positive part of the portfolio value, E E.
- We discount it.
- The default probability that matters is the marginal one, the chance that default happens within that one interval, not before it and not after it.
- Multiply, sum over the dates, and scale by loss given default, which is one minus the recovery rate.
- The result is the market price of the expected loss.
- Because exposure is the larger of the value and zero, it behaves like a call option struck at zero, and options have value even when they are out of the money.
- So C V A can be positive even when the position is now negative.

6 Inputs and mistakes

- Probabilities are risk-neutral, implied from CDS spreads
- Mistake: potential future exposure instead of expected
- Mistake: cumulative PD instead of marginal PD
- Mistake: recovery rate instead of LGD

IN THE LESSON

- Two things about the inputs.
- The default probabilities in C V A are risk neutral, implied from C D S spreads, because the aim is a market price that can be hedged, not a forecast of actual defaults.
- And the usual mistakes are three.
- Using potential future exposure, a high percentile, in place of expected exposure.
- That measures a limit, not a price.
- Using cumulative default probabilities instead of marginal ones, which counts early defaults again and again.
- And using the recovery rate where loss given default belongs, which turns the loss upside down.
- Keep those three straight and the formula is easy to apply.

7 The simple setting and the CDS curve

PD(t) = 1 − e^(−spread × t ÷ (1 − R))
Marginal PD = PD(t_i) − PD(t_{i-1})
Spread = CVA ÷ (Notional × risky annuity)

Flat CDS spread	Hazard rate = spread ÷ (1 − R)
Cumulative default probability	Probability of default by time t
Marginal default probability	Difference of cumulative figures
Risky annuity	Sum of discount × survival

IN THE LESSON

- Now we compute.
- The simple setting has no wrong way risk, no netting and no collateral.
- Exposure is independent of default, so we can multiply the two.
- Default probabilities come from a flat C D S spread.
- The hazard rate, the instantaneous default intensity, is the spread divided by one minus the recovery rate.
- The cumulative default probability by time t is one minus e to the power of minus the hazard rate times t.
- The marginal probability for each interval is the difference between neighbouring cumulative figures.
- To quote C V A as a running spread, divide by the notional and by the risky annuity: the sum of the discount factor times the survival probability, per unit of notional.

8 Example 1: the default probabilities

EE 1.8, 2.1, 1.2 ($m). CDS 1.5%, R = 40%: hazard 2.5%

	Year 1	Year 2	Year 3
Cumulative PD	2.47%	4.88%	7.23%
Marginal PD	2.47%	2.41%	2.35%
Discount e^(−0.03 t)	0.970	0.942	0.914

IN THE LESSON

- Harbourline's swap with Corvane has expected exposures of one point eight, two point one and one point two million dollars at the end of years one, two and three.
- Corvane's flat C D S spread is one point five per cent, the recovery rate is forty per cent, and the continuously compounded interest rate is three per cent.
- The hazard rate is one point five divided by sixty, which is two point five per cent.
- The cumulative default probabilities for the three years are two point four seven, four point eight eight and seven point two three per cent.
- Their differences are the marginal probabilities, two point four seven, two point four one and two point three five per cent.
- Using the cumulative figure in year two would be the classic error.

9 Example 1: summing to CVA

CVA = 60% × Σ (discounted EE × marginal PD)

	Year 1	Year 2	Year 3	Sum
DF × EE × marginal PD ($)	43,129	47,624	25,757	116,510
CVA = 60% × sum				$69,906
Wrong: cumulative PDs				$131,297

IN THE LESSON

- Now multiply.
- Year one: the discount factor of point nine seven zero four times the exposure of one point eight million is one million seven hundred and forty seven thousand dollars.
- Times the marginal probability, that is forty three thousand one hundred and twenty nine.
- Year two gives forty seven thousand six hundred and twenty four, and year three twenty five thousand seven hundred and fifty seven.
- The sum is one hundred and sixteen thousand five hundred and ten dollars.
- Multiply by loss given default of sixty per cent, and C V A is sixty nine thousand nine hundred and six dollars.
- If we had used cumulative probabilities, we would have got over one hundred and thirty one thousand dollars, nearly double.

10 Example 1: CVA as a running spread

CVA $69,906. Notional $100m

	Year 1	Year 2	Year 3	Total
Survival, 1 − cumulative PD	97.53%	95.12%	92.77%	
DF × survival: risky annuity	0.9465	0.8958	0.8479	2.6902
Spread: 69,906 ÷ (100m × 2.6902)				2.60 bp
Wrong: ÷ (100m × 2.8261)				2.47 bp

IN THE LESSON

- To turn that single amount into a running spread, we need the risky annuity.
- For each year, take the discount factor times the probability that Corvane has survived to that date.
- The survival probabilities are ninety seven point five three, ninety five point one two and ninety two point seven seven per cent.
- The products sum to two point six nine zero two.
- The spread is then sixty nine thousand nine hundred and six divided by one hundred million times two point six nine zero two, which is two point six basis points a year.
- The exam trap is the risk free annuity, the sum of discount factors alone, two point eight two six one.
- That would give two point four seven basis points.

11 Example 2: widening the credit spread

Same swap, only Corvane's spread changes. R = 40%

Spread 75 bp	hazard 1.25%	**$35,549**
Spread 150 bp	hazard 2.5%, base	**$69,906**
Spread 300 bp	hazard 5%: × 1.93	**$135,204**
Spread 600 bp	hazard 10%: × 3.62	**$253,183**

IN THE LESSON

- Now judge how C V A reacts to the inputs.
- Take the same swap and change only Corvane's spread.
- At seventy five basis points C V A is thirty five thousand five hundred and forty nine dollars.
- At one hundred and fifty, as before, it is sixty nine thousand nine hundred and six.
- At three hundred it is one hundred and thirty five thousand two hundred and four.
- Doubling the spread raised C V A by a factor of one point nine three, a bit less than double, because the cumulative probability is one minus an exponential, which flattens as it grows.
- At six hundred basis points C V A is two hundred and fifty three thousand dollars.
- The relationship is rising but slightly concave.

12 Example 2: changing the recovery rate

Base: spread 150 bp, R = 40%, CVA $69,906

PDs held fixed, R = 50%	× (1 − 50%) ÷ (1 − 40%)	**$58,255**
Calibrated to spread, R = 20%	hazard 1.875%	**$70,499**
Calibrated to spread, R = 40%	hazard 2.5%	**$69,906**
Calibrated to spread, R = 50%	hazard 3.0%	**$69,437**

IN THE LESSON

- Recovery is subtler.
- Loss given default is one minus the recovery rate.
- If the default probabilities are held fixed, C V A is proportional to loss given default.
- Lifting recovery from forty to fifty per cent cuts it by a sixth, to fifty eight thousand two hundred and fifty five dollars.
- But in practice probabilities are calibrated to the observed C D S spread.
- With the spread fixed, a higher recovery implies a higher hazard rate, spread divided by one minus R.
- That offsets almost all of the lower loss.
- At recovery of twenty per cent C V A is seventy thousand four hundred and ninety nine dollars, at forty per cent sixty nine thousand nine hundred and six, and at fifty per cent sixty nine thousand four hundred and thirty seven.
- C V A is only weakly sensitive.

13 Spreads, recovery and risk premium

- Wider spread raises CVA, slightly concave
- PDs fixed: higher recovery lowers CVA in proportion
- PDs calibrated to spread: CVA barely moves
- Wider risk premium raises CVA, defaults unchanged

IN THE LESSON

- Let us gather the sensitivity lessons.
- A wider credit spread raises C V A, because implied default probabilities rise, and the effect is slightly concave.
- Recovery matters in two ways, so be clear which case a question describes.
- With default probabilities fixed, higher recovery lowers C V A directly.
- With probabilities calibrated to a given spread, the higher hazard rate cancels most of the benefit, so C V A hardly moves.
- And one more point: because C V A uses risk neutral probabilities, it rises when the market demands a bigger premium for credit risk, even if historical default rates have not changed at all.
- A bank can lose on C V A in a calm year for defaults.

14 Bilateral CVA and DVA

- Bilateral CVA: both parties can default
- DVA: value to the bank of its own possible default
- A negative value owed is paid only in part if the bank fails
- Value = V − CVA + DVA

IN THE LESSON

- So far, only Corvane could fail.
- But Harbourline can fail too.
- Bilateral C V A recognises that both parties may default.
- Look at it from Harbourline's side.
- When the swap is worth less than zero to Harbourline, the bank owes Corvane money, and if Harbourline defaults, it will pay only part of that.
- That possibility is a gain to the bank, because it will not pay in full.
- Its value to the institution is called the debit value adjustment, or D V A.
- The institution's own credit risk reduces what its liabilities are worth.
- The bilateral value of the position, starting from the risk free value V, is V minus C V A plus D V A.

15 The DVA formula and BCVA

DVA = LGD(own) × Σ (ENE × PD(own))
BCVA = CVA − DVA
Value = V − CVA + DVA

Discounted expected negative exposure	Owed by us, positive amount
Debit value adjustment	Gain from our own default
Net charge to the institution	CVA minus DVA
Risk-free value, V	Value with no default at all

IN THE LESSON

- D V A is the mirror image of C V A.
- We swap the exposure and the probability.
- E N E is the discounted expected negative exposure at each date, taken as a positive amount.
- P D own is the institution's own marginal default probability, and loss given default is the institution's own.
- Summing gives D V A.
- The net charge to the institution is bilateral C V A, written B C V A, which equals C V A minus D V A.
- It is positive when the counterparty's risk outweighs the institution's own.
- The counterparty sees the mirror image.
- Its C V A is your D V A, and its D V A is your C V A, so the two bilateral valuations are symmetric and sum to zero.

16 The case against DVA

- DVA rises when the bank's own spread widens
- A gain from deteriorating credit: hard to realise or hedge
- CVA: positive exposure and counterparty PD
- DVA: negative exposure and own PD

IN THE LESSON

- D V A is controversial.
- It rises when the institution's own credit spread widens.
- That means the bank books a gain precisely because its own credit has deteriorated.
- It is hard to realise, because the bank cannot easily sell protection on itself, and hard to hedge.
- Regulators and risk managers therefore treat it with suspicion, and the main criticism is just that a deteriorating bank appears to profit.
- In exam answers, be careful about two confusions.
- Do not mix up the exposure measures: C V A uses positive exposure, D V A uses negative exposure.
- And do not mix up whose default probability is used: the counterparty's in C V A, the institution's own in D V A.

17 Unilateral against bilateral

Who can default decides the version

Version	Who can default
UCVA	Counterparty only
UDVA	Institution only
BCVA	Both: first to default
CVA term in BCVA	Below UCVA
DVA term in BCVA	Below UDVA

IN THE LESSON

- There are three versions to tell apart.
- Unilateral C V A, U C V A, assumes only the counterparty can default and treats the institution as default free.
- Unilateral D V A, U D V A, assumes only the institution can default and the counterparty is default free.
- Bilateral C V A accounts for both.
- Each leg is then conditioned on the other party's survival.
- This is the first to default effect: if the bank has already failed, the counterparty can no longer fail on it, and vice versa.
- So the C V A term in B C V A is smaller than U C V A, and the D V A term is smaller than U D V A.

18 Example 3: one period, two defaulters

UCVA $60,000; UDVA $30,000. Own PD 4%, counterparty PD 5%

CVA term in BCVA	60,000 × (1 − 4%)	**$57,600**
DVA term in BCVA	30,000 × (1 − 5%)	**$28,500**
BCVA	57,600 − 28,500	**$29,100**
Compare UCVA	ignores own default	**$60,000**

IN THE LESSON

- Here is a one period illustration with made up numbers.
- Suppose unilateral C V A is sixty thousand dollars and unilateral D V A is thirty thousand.
- The counterparty's default probability is five per cent and Harbourline's own is four per cent, and defaults are independent.
- The C V A term is the loss when the counterparty defaults while Harbourline survives, so it is sixty thousand times ninety six per cent, fifty seven thousand six hundred dollars.
- The D V A term is thirty thousand times ninety five per cent, twenty eight thousand five hundred.
- Bilateral C V A is the difference, twenty nine thousand one hundred dollars, below unilateral C V A of sixty thousand.

19 Example 4: working out the DVA

ENE 0.9, 1.3, 1.5 ($m). Own 80 bp, R = 40%: hazard 1.33%

	Year 1	Year 2	Year 3	DVA
Own marginal PD	1.32%	1.31%	1.29%	
60% × DF × ENE × PD ($)	6,941	9,600	10,608	$27,149

IN THE LESSON

- Back to the swap.
- Its expected negative exposure, as positive amounts, is point nine, one point three and one point five million dollars at years one, two and three.
- Harbourline's own C D S spread is eighty basis points with the same recovery, so its hazard rate is one point three three per cent and its marginal default probabilities are one point three two, one point three one and one point two nine per cent.
- The discounted amounts times these probabilities, times sixty per cent loss given default, give six thousand nine hundred and forty one, nine thousand six hundred, and ten thousand six hundred and eight dollars.
- D V A is twenty seven thousand one hundred and forty nine.
- Notice it uses the bank's own probabilities, not Corvane's.

20 Example 4: BCVA and its spread

CVA $69,906, DVA $27,149. Notional $100m, annuity 2.6902

BCVA	69,906 − 27,149	**$42,757**
BCVA as a running spread	42,757 ÷ (100m × 2.6902)	**1.59 bp**
Wrong: risk-free annuity	42,757 ÷ (100m × 2.8261)	**1.51 bp**
With survival conditioning	CVA 69,121; DVA 26,395	**BCVA $42,726**

Each leg × other party's survival to start of interval

IN THE LESSON

- Now combine.
- B C V A is C V A minus D V A, sixty nine thousand nine hundred and six minus twenty seven thousand one hundred and forty nine, which is forty two thousand seven hundred and fifty seven dollars.
- It is positive, so counterparty risk outweighs Harbourline's own.
- As a spread, divide by the notional and the risky annuity, two point six nine zero two.
- The answer is one point five nine basis points, not the one point five one from the risk free annuity.
- If survival conditioning is included, each leg is multiplied by the survival probability of the other party to the start of each interval.
- Then C V A is about sixty nine thousand one hundred and twenty one, D V A twenty six thousand three hundred and ninety five, and B C V A forty two thousand seven hundred and twenty six.

21 Mistakes with DVA and BCVA

- BCVA = CVA − DVA; never add DVA to CVA
- DVA leg uses the bank's own PD and negative exposure
- Marginal PDs, not cumulative ones
- Spread: divide by risky annuity, not risk-free
- Negative BCVA means the adjustment adds value

IN THE LESSON

- Four mistakes recur in this topic.
- The first is adding D V A to C V A.
- The bilateral charge is C V A minus D V A, because D V A is a gain.
- The second is using the counterparty's default probability in the D V A leg, when the leg belongs to the institution's own.
- The third is using cumulative default probabilities rather than marginal ones.
- The fourth is dividing by the risk free annuity when converting to a spread.
- Also remember the sign.
- B C V A is positive when counterparty risk dominates, and negative when own credit risk dominates, in which case the adjustment adds value to the position instead of removing it.

22 How netting enters CVA

Exposure = max($V_1 + V_2 + \dots$, 0)
Netted CVA ≤ $CVA_1 + CVA_2 + \dots$

Value of each trade, V1, V2	Add the values, then floor at zero
Exposure at a date	What is lost at default
Netted CVA	Never above the standalone sum
Loss given default = 1 − R	Same LGD, discounting and PD

IN THE LESSON

- Next, netting.
- Suppose a legally enforceable netting agreement covers a set of trades.
- If the counterparty defaults, the claim is the single net value of all the trades together.
- So exposure at each date is the net value floored at zero, not the sum of the positive parts of each trade.
- Then the C V A is computed from the expected netted exposure, using exactly the same formula as before, loss given default times discounted E E times marginal P D.
- Since the maximum of a sum is at most the sum of the maxima, netted C V A is never above the sum of the standalone C V As.
- The benefit is largest when trades offset one another, as with a payer and a receiver swap.

23 Example 5: two trades, with and without netting

Up/down equally likely. Trade 1: +6/−2. Trade 2: −4/+1 ($m)

	Trade 1	Trade 2	Gross	Netted
Expected exposure ($m)	3.0	0.5	3.5	1.0
CVA at $28,500 per $1m	$85,500	$14,250	$99,750	$28,500

IN THE LESSON

- A tiny example shows the effect.
- At one future date, two equally likely market scenarios, up and down.
- Trade one is worth plus six million in the up scenario and minus two in the down scenario.
- Trade two is worth minus four in the up scenario and plus one in the down scenario.
- Standalone, trade one has expected exposure of three million, and trade two half a million, a total of three and a half.
- Netted, the up scenario has net value two and the down scenario minus one, which floors at zero, so expected netted exposure is one million.
- With loss given default sixty per cent, discount factor point nine five and default probability five per cent, C V A falls from ninety nine thousand seven hundred and fifty dollars to twenty eight thousand five hundred.

24 Limits of netting

- Only trades inside one netting agreement are netted
- The agreement must be legally enforceable
- Trades outside it are added gross
- CVA is not additive across trades

IN THE LESSON

- Netting has limits that exams like to test.
- It applies only within one netting agreement, and only if the agreement is enforceable in the relevant jurisdiction.
- Trades outside the agreement are simply added gross.
- It follows that C V A is not additive across trades.
- You cannot price a new trade by computing its stand alone C V A and adding it to the existing total, because the answer depends on what else is in the netting set.
- A trade that offsets existing positions may reduce the bank's C V A, even though on its own it carries a positive charge.
- That observation leads straight to the question of how to charge a client for a new trade.

25 Incremental and marginal CVA

Two ways to attribute CVA to a trade

Measure	Meaning
Incremental	CVA with trade − CVA without
Use	The price charged to a client
Weakness	Order matters; parts do not sum
Marginal	Share of total CVA
Weight	Contribution to EE when net > 0

IN THE LESSON

- There are two answers to the question of what a trade costs.
- Incremental C V A is the C V A of the netting set with the trade, minus the C V A of the set without it.
- It is what the new trade adds, and it is the natural price to charge a client.
- It depends on the existing set and on the order in which trades arrive, and incremental amounts do not generally sum to the total.
- Marginal C V A is an allocation of the total C V A across the trades so that the parts do add up.
- It is typically proportional to each trade's contribution to expected exposure when the net exposure is positive, and it can be negative for a trade that offsets others.

26 Example 6: incremental and marginal CVA

Set holds trade 1; add trade 2. Contributions sum to netted EE 1.0

	Trade 1	Trade 2
Standalone CVA, 0.5 × 28,500	–	$14,250
Incremental, (1.0 − 3.0) × 28,500	–	−$57,000
Contribution to EE: ½ × value, up	3.0	−2.0
Marginal CVA, contribution × 28,500	$85,500	−$57,000

IN THE LESSON

- Use the same two trades, and suppose trade one is already in the set.
- Adding trade two cuts expected exposure from three million to one million, a change of minus two million, so incremental C V A is minus two times twenty eight thousand five hundred, minus fifty seven thousand dollars.
- Trade two actually reduces the charge, even though on its own it would cost fourteen thousand two hundred and fifty.
- For marginal C V A, find each trade's value in the scenarios where the net is positive, weighted by their probability.
- That is only the up scenario.
- Trade one contributes three, trade two minus two, summing to one.
- So the total of twenty eight thousand five hundred splits into eighty five thousand five hundred and minus fifty seven thousand.

27 Quoting a CVA as a running spread

New swap: notional $30m. Incremental CVA $42,000

Notional × risky annuity	30m × 2.6902	**$80.7m**
Running spread	42,000 ÷ 80.7m	**5.20 bp a year**
Wrong: standalone CVA	ignores the netting set	**mis-prices**

IN THE LESSON

- Clients prefer a running spread to a lump sum.
- The rule is the same as before: spread equals C V A divided by the notional and the risky annuity.
- Suppose Corvane asks for a new swap with a notional of thirty million dollars, and the incremental C V A is forty two thousand dollars.
- Using the same risky annuity of two point six nine zero two, the spread is forty two thousand divided by thirty million times two point six nine zero two, which is five point two basis points a year.
- Use the incremental figure, not the stand alone C V A, if the trade joins a netting set.
- And as always, use the risky annuity, not the risk free one, or you will understate the spread.

28 Recap: the main ideas

- CVA = LGD × Σ disc. EE × marginal PD
- Wider spread raises CVA; recovery matters little
- BCVA = CVA − DVA; each leg conditioned on survival
- Netting: max of the sum, so CVA is not additive
- Incremental prices a trade; marginal allocates the total

IN THE LESSON

- Let us pull it together.
- Counterparty risk is priced because the expected loss is a real cost, accounting and Basel three expect it, and the difficulty is stochastic, two sided, non additive exposure.
- C V A equals loss given default times discounted expected exposure times marginal default probability, summed over dates, using risk neutral probabilities.
- A flat C D S gives the hazard rate, and the running spread divides by the risky annuity.
- C V A rises, a little concavely, with spread, but hardly moves with recovery once calibrated.
- B C V A is C V A minus D V A.
- Netting lowers C V A.
- Incremental C V A prices a trade, and marginal C V A shares the total.

29 Try three quick questions

1. Discounted EE $4m, marginal PD 2%, R = 50%. CVA?
   Answer: LGD 50%. 0.5 × 4m × 0.02 = $40,000.
2. CVA $90,000 and DVA $35,000. What is BCVA?
   Answer: 90,000 − 35,000 = $55,000, a net charge.
3. CVA $120,000, notional $40m, risky annuity 3. Spread?
   Answer: 120,000 ÷ (40m × 3) = 0.001 = 10 bp.

IN THE LESSON

- Now try three quick questions.
- Pause the video, think, then listen to the answers.
- Question one.
- A single exposure date has discounted expected exposure of four million dollars, a marginal default probability of two per cent and a recovery rate of fifty per cent.
- What is the C V A?
- Loss given default is fifty per cent, so point five times four million times point zero two is forty thousand dollars.
- Question two.
- C V A is ninety thousand dollars and D V A is thirty five thousand.
- What is B C V A?
- Ninety minus thirty five is fifty five thousand dollars, a net charge.
- Question three.
- C V A is one hundred and twenty thousand dollars on a notional of forty million and a risky annuity of three.
- What is the spread?
- It is ten basis points.