Capital Regulation Before the Crisis

FRM Part II

1 A story: one bank fails, many are hurt

- 1974: Bankhaus Herstatt fails mid-day
- Counterparties abroad paid; their dollars never came
- One bank's problem crossed borders in an afternoon
- End of 1974: G10 governors set up the Basel Committee

IN THE LESSON

- In nineteen seventy four a German bank, Bankhaus Herstatt, failed.
- It was closed by its regulator in the middle of the trading day.
- Its counterparties abroad had already paid their side of foreign exchange trades, and the dollars they were owed never came.
- A problem at one bank had crossed borders in a single afternoon.
- National supervisors realised that banks were international but supervision was not.
- So, at the end of nineteen seventy four, the central bank governors of the G ten countries set up the Basel Committee on Banking Supervision, a forum where supervisors could agree common standards.

2 Why a common minimum standard

- 1980s: capital ratios falling
- Latin American debt crisis exposed thin equity
- Goal: a common minimum standard
- And a level playing field for international banks
- 1988 Accord (Basel I) targeted credit risk

IN THE LESSON

- Why did the committee go on to set capital rules?
- During the nineteen eighties, bank capital ratios had been falling.
- Then the Latin American debt crisis exposed how thin the equity of many large banks had become.
- Supervisors wanted a common minimum standard of capital.
- They also wanted a level playing field, so that no bank could undercut rivals abroad because its own regulator demanded less capital.
- The result was the nineteen eighty eight Basel Accord, now called Basel one.
- It targeted credit risk, the risk that borrowers do not repay, because that was then the dominant exposure of banks.

3 Each revision closed a gap

Tie each revision to the gap it closed

Rule	What it did	Gap it closed
1988 Accord	Credit risk capital	No common minimum
1995 amendment	Recognised netting	Gross derivative exposure
1996 amendment	Market risk capital	Trading book uncovered
Basel II (2004)	Op risk; finer credit weights	Crude, exploitable weights

IN THE LESSON

- The rules kept being revised, and the exam point is to tie each revision to the gap it closed.
- The nineteen eighty eight accord set capital for credit risk, closing the first gap: there was no common minimum.
- The nineteen ninety five amendment recognised netting of derivative contracts, which had been counted as gross derivative exposure.
- The nineteen ninety six amendment brought in market risk capital, because the trading book had been uncovered.
- Basel two, published in two thousand and four, added operational risk and finer credit weights.
- That replaced the crude, exploitable weights of nineteen eighty eight, where every corporate loan carried the same one hundred per cent weight, whatever its quality, which invited gaming.

4 Example 1: why crude weights invite gaming

Two $100m loans, both weighted 100%. Spreads 0.4% and 3.0%, before expected loss

Capital, Alder (AAA)	8% × 100% × 100	**$8m**
Capital, Birch (weak)	8% × 100% × 100	**$8m**
Alder: spread ÷ capital	0.4 ÷ 8	**5.0%**
Birch: spread ÷ capital	3.0 ÷ 8	**37.5%**

Securitise, sell or guarantee the safe loans: less capital, same risk

IN THE LESSON

- Larkspur Bank holds two corporate loans of one hundred million dollars each.
- Alder Corporation is rated triple A and pays a spread of zero point four per cent.
- Birch Limited is weak and pays three per cent.
- Under Basel one both carry a one hundred per cent weight, so each needs eight per cent capital, eight million dollars.
- Compare spread income per dollar of capital, before expected losses.
- Alder earns zero point four million on eight million, a return of five per cent.
- Birch earns three million on eight million, thirty seven point five per cent.
- Birch's wider spread partly pays for its higher expected losses, but the same capital now backs far more risk.
- So Larkspur securitises or sells the safe loans, or uses guarantees to move them into a lower weight, and keeps the risky ones.
- Required capital falls, but risk does not.
- That is regulatory arbitrage.

5 Basel I: the on-balance-sheet weights

Historical Basel I weights; do not apply them to current rules

Asset	Weight
Cash, OECD government securities	0%
Claims on OECD banks	20%
Residential mortgages	50%
Corporate loans	100%

IN THE LESSON

- Basel one measures credit risk with risk weighted assets.
- Each asset is multiplied by a risk weight that reflects the type of borrower.
- These weights are historical, so do not carry them over to the current rules.
- Cash, and securities issued by the governments of O E C D countries, the club of mostly rich economies, carry a weight of zero per cent.
- Claims on banks in O E C D countries carry twenty per cent.
- Residential mortgages carry fifty per cent.
- Corporate loans carry one hundred per cent, whatever the borrower's quality.

6 Risk-weighted assets and the 8% rule

RWA = Σ exposure × risk weight
Capital ≥ 8% × RWA; Tier 1 ≥ 4% × RWA

Exposure or credit equivalent	On or off the balance sheet
Risk weight	From the regulator's table
Risk-weighted assets	Not total assets
Capital held	Eligible Tier 2 ≤ Tier 1

IN THE LESSON

- Risk weighted assets are the sum, over every exposure, of the exposure times its risk weight.
- For an off balance sheet item, the exposure is a credit equivalent amount, which we meet in a moment.
- The bank must then hold capital of at least eight per cent of risk weighted assets.
- Capital comes in tiers.
- Tier one is the core: mainly shareholders' equity.
- Tier one alone must be at least four per cent of risk weighted assets.
- Tier two is supplementary capital, such as certain subordinated debt, and the eligible amount of Tier two cannot exceed Tier one.
- The classic mistake is to apply eight per cent to total assets rather than to risk weighted assets.

7 Off-balance-sheet items

- Credit equivalent amount × counterparty weight
- Guarantees, standby letters of credit: 100%
- Undrawn commitments over one year: 50%
- Derivatives: replacement cost (if positive) + add-on
- Add-on: % of notional, by contract type and maturity

IN THE LESSON

- Banks also take credit risk off the balance sheet, so Basel one first turns each such item into a credit equivalent amount, and then multiplies that by the weight of the counterparty.
- Guarantees and standby letters of credit, where the bank promises to pay if its customer does not, count at one hundred per cent of their amount.
- Undrawn commitments with a maturity of over one year count at fifty per cent.
- Derivatives count at their current replacement cost, if that is positive, plus an add on.
- The add on is a percentage of the notional principal that depends on the type of contract and its remaining maturity, and it allows for the exposure growing later.

8 Example 2: Larkspur's on-balance-sheet RWA

Larkspur Bank: total assets $1,000m. Amounts in $m

Cash, OECD govt bonds	(50 + 150) × 0%	**0**
Claims on OECD banks	100 × 20%	**20**
Residential mortgages	300 × 50%	**150**
Corporate loans	400 × 100%	**400**
On-balance-sheet RWA	0 + 20 + 150 + 400	**570**

IN THE LESSON

- Larkspur's balance sheet totals one thousand million dollars.
- It holds fifty million of cash and one hundred and fifty million of O E C D government bonds, two hundred million in all at zero per cent, so they add nothing.
- It has lent one hundred million to O E C D banks, which at twenty per cent gives twenty million.
- Its residential mortgages of three hundred million at fifty per cent give one hundred and fifty million.
- Its corporate loans of four hundred million at one hundred per cent give four hundred million.
- On balance sheet risk weighted assets are five hundred and seventy million, well below the one thousand million of assets.

9 Example 3: off-balance-sheet items

Counterparties: two companies (100%) and one OECD bank (20%). $m

Standby letter of credit	40 × 100% × 100%	**40**
Undrawn commitment, over 1 year	60 × 50% × 100%	**30**
Swap with an OECD bank	(6 + 4) × 20%	**2**
Off-balance-sheet RWA	40 + 30 + 2	**72**

IN THE LESSON

- Next, the off balance sheet items.
- The counterparties are two companies, weighted one hundred per cent, and one O E C D bank, weighted twenty.
- A standby letter of credit of forty million dollars for a corporate client converts at one hundred per cent, and at the corporate weight of one hundred per cent gives forty million.
- An undrawn commitment of sixty million to a company, with over a year to run, converts at fifty per cent, giving thirty million.
- Finally, a swap with an O E C D bank has a replacement cost of six million and an add on of four million, so ten million, at the bank weight of twenty per cent, gives two million.
- Off balance sheet risk weighted assets are seventy two million.

10 Example 4: is Larkspur adequately capitalised?

Tier 1 capital $30m; Tier 2 capital $35m. Amounts in $m

Total RWA	570 + 72	**642**
Minimum total capital	8% × 642	**51.36**
Minimum Tier 1	4% × 642	**25.68**
Eligible capital	30 + min(35, 30)	**60**
Wrong: 8% of total assets	8% × 1,000	**80**

IN THE LESSON

- Total risk weighted assets are five hundred and seventy plus seventy two, which is six hundred and forty two million dollars.
- Eight per cent of that is the minimum total capital, fifty one point three six million.
- Tier one must be at least four per cent, twenty five point six eight million.
- Larkspur has Tier one capital of thirty million, which passes the four per cent test.
- It also has thirty five million of Tier two, but only thirty million counts, because eligible Tier two cannot exceed Tier one.
- Eligible capital is sixty million, comfortably above fifty one point three six.
- The common error is to take eight per cent of total assets, eighty million, and wrongly find a shortfall.

11 The 1995 amendment: netting

Exposure = max(net value, 0) + Anet
Anet = 0.4 × Agross + 0.6 × NRR × Agross

Net current exposure	Net value, floored at zero
Net replacement ratio, NRR	Net ÷ sum of positive values
Gross add-on, Agross	Sum of the contract add-ons
Net add-on, Anet	No relief at NRR 1; 40% at NRR 0

IN THE LESSON

- The nineteen ninety five amendment dealt with netting.
- Suppose Larkspur has several derivatives with one counterparty, some with positive and some with negative value.
- Under a legally enforceable netting agreement, a default settles them all as one net amount.
- So the credit exposure becomes the net current exposure, that is the net value floored at zero, plus a reduced add on.
- The reduced add on, called the net add on, equals zero point four times the gross add on, plus zero point six times the net replacement ratio times the gross add on.
- The net replacement ratio is net current exposure over the sum of positive contract values.
- The gross add on is the sum of the add ons of the individual contracts.
- At one there is no relief; at zero the add on falls to forty per cent of the gross.

12 Example 5: netting three swaps

Three swaps with one counterparty: +10, −7, +3. Gross add-on 8. Amounts in $m

Net current exposure	max(10 − 7 + 3, 0)	**6**
Net replacement ratio	6 ÷ 13	**0.4615**
Net add-on	0.4×8 + 0.6×0.4615×8	**5.42**
Exposure with netting	6 + 5.42	**11.42**
Exposure without netting	13 + 8	**21**

IN THE LESSON

- Larkspur has three swaps with Dock Bank, under a netting agreement.
- Their values to Larkspur are plus ten million, minus seven million and plus three million.
- The net current exposure is six million.
- The positive values sum to thirteen million, so the net replacement ratio is six over thirteen, about zero point four six one five.
- The gross add on, summed across the three contracts, is eight million.
- The net add on is zero point four times eight, plus zero point six times zero point four six one five times eight, about five point four two million.
- The exposure is about eleven point four two million, against twenty one million, thirteen plus eight, without netting.
- A trap: netting is the nineteen ninety five change, not the nineteen ninety six one.

13 The 1996 amendment: market risk capital

Capital = max(VaR(t−1), k × VaR(avg 60)) + SRC
10-day, 99% VaR; RWA = 12.5 × capital

Yesterday's VaR	10-day 99%, previous day
60-day average VaR	Average of the last 60 days
Multiplier, k	At least 3; up with exceptions
Specific risk charge	Issuer-specific risk

IN THE LESSON

- The nineteen ninety six amendment, effective in nineteen ninety eight, added market risk capital for the trading book.
- Under the internal models approach, the bank uses its own value at risk, V a R, at ten days and ninety nine per cent.
- Capital is the larger of two amounts, plus a specific risk charge for risks tied to individual issuers.
- The first amount is the previous day's V a R.
- The second is a multiplier k times the average V a R over the last sixty days.
- The multiplier is at least three, and it is raised when backtesting shows too many exceptions, that is, days when losses exceeded V a R.
- To turn market risk capital into risk weighted assets, multiply it by twelve point five.

14 Example 6: Larkspur's trading book

VaR yesterday $12m; 60-day average $10m; k = 3; specific risk $4m

Multiplied average	3 × 10	**$30m**
Larger of the two	max(12, 30)	**$30m**
Market risk capital	30 + 4	**$34m**
As RWA	12.5 × 34	**$425m**
If k rose to 3.5	max(12, 35) + 4	**$39m**

IN THE LESSON

- Larkspur's trading book has a ten day ninety nine per cent V a R of twelve million dollars yesterday, and an average over the last sixty days of ten million.
- With the minimum multiplier of three, the average term is thirty million.
- The larger of twelve and thirty is thirty.
- Adding a specific risk charge of four million gives market risk capital of thirty four million.
- Multiplying by twelve point five converts this into four hundred and twenty five million of risk weighted assets.
- If backtesting exceptions pushed the multiplier up to three point five, capital would rise to thirty five plus four, thirty nine million.

15 Basel II: what stayed and what changed

- Published 2004; phased in from about 2007
- Kept: 8% minimum on total RWA
- Kept: 1996 market risk rules and capital definitions
- New: rebuilt on three pillars
- New: risk-sensitive credit; an operational risk charge

IN THE LESSON

- Basel two was published in two thousand and four and phased in from about two thousand and seven.
- It kept three things from before.
- The minimum ratio stayed at eight per cent of total risk weighted assets.
- The nineteen ninety six market risk rules stayed.
- And the definitions of capital, Tier one and Tier two, stayed.
- What changed was the architecture.
- The framework was rebuilt on three pillars, so that capital rules were joined by supervision and by disclosure.
- Within the first pillar, credit risk charges became far more sensitive to risk, and a new capital charge for operational risk was added.

16 The three pillars of Basel II

Capital rules, supervision and disclosure

Pillar	What it covers
1: minimum capital	Credit (3 approaches), market, operational
2: supervisory review	Bank's own assessment; can demand more
3: market discipline	Public disclosure of risk and capital

IN THE LESSON

- Here are the three pillars.
- Pillar one is minimum capital.
- It contains the more risk sensitive credit risk charges, with three approaches: standardised, foundation internal ratings based and advanced internal ratings based.
- Market risk is charged as before, and operational risk now has its own charge.
- Pillar two is supervisory review.
- Supervisors assess the bank's own process for judging how much capital it needs, and they can require more than the pillar one minimum, for example where the bank has a concentration of risk that pillar one ignores.
- Pillar three is market discipline.
- Banks publicly disclose their risk exposures and their capital adequacy, so that investors and creditors can judge them.

17 Total RWA under Basel II

Total RWA = Credit RWA + 12.5 × MRC + 12.5 × ORC
Capital ≥ 8% × total RWA

Credit RWA	Already in RWA terms
Market risk capital	A capital charge
Operational risk capital	A capital charge
Factor 12.5	= 1 ÷ 8%; turns capital into RWA

IN THE LESSON

- Pillar one now has three charges, but the eight per cent rule is written in terms of risk weighted assets.
- Credit risk produces risk weighted assets directly.
- Market risk and operational risk produce capital charges.
- To put everything on the same footing, each capital charge is multiplied by twelve point five, which is one divided by eight per cent.
- So total risk weighted assets equal credit risk weighted assets, plus twelve point five times market risk capital, plus twelve point five times operational risk capital.
- Capital must then be at least eight per cent of that total.
- The usual mistake is to add the capital charges to risk weighted assets without the factor of twelve point five.

18 Example 7: Larkspur's Basel II minimum

Credit RWA $600m; market risk capital $34m; operational risk capital $20m

Market risk as RWA	12.5 × 34	**$425m**
Operational risk as RWA	12.5 × 20	**$250m**
Total RWA	600 + 425 + 250	**$1,275m**
Minimum capital	8% × 1,275	**$102m**
Wrong: no 12.5 factor	8% × (600 + 34 + 20)	**$52.32m**

IN THE LESSON

- Larkspur's credit risk weighted assets under Basel two are six hundred million dollars.
- Its market risk capital is the thirty four million we found earlier, and its operational risk capital is twenty million.
- Market risk becomes twelve point five times thirty four, four hundred and twenty five million of risk weighted assets.
- Operational risk becomes twelve point five times twenty, two hundred and fifty million.
- Total risk weighted assets are six hundred plus four hundred and twenty five plus two hundred and fifty, one thousand two hundred and seventy five million.
- Minimum capital is eight per cent of that, one hundred and two million.
- Forgetting the factor gives six hundred and fifty four, and a minimum of just fifty two point three two million.

19 The standardised approach: corporate weights

Corporate exposures under the Basel II standardised approach

External rating	Weight
AAA to AA−	20%
A+ to A−	50%
BBB+ to BB−	100%
Below BB−	150%
Unrated	100%

IN THE LESSON

- Basel two offers three ways to compute credit risk capital.
- The simplest is the standardised approach.
- The risk weight comes from the regulator's table, and it depends on the type of exposure and on the borrower's external credit rating.
- For corporates, a rating from triple A to double A minus gets twenty per cent.
- Single A, from A plus to A minus, gets fifty per cent.
- Triple B plus down to double B minus gets one hundred per cent.
- Anything below double B minus gets one hundred and fifty per cent.
- And an unrated company gets one hundred per cent.
- Notice the oddity: an unrated firm can be treated better than a weak rated one.

20 Example 8: Larkspur under the standardised approach

Larkspur's loans by type and external rating. Amounts in $m

Corporate, AA	100 × 20%	**20**
Corporate, BB	80 × 100%	**80**
Corporate, B	40 × 150%	**60**
Residential mortgages	200 × 35%	**70**
Retail	100 × 75%	**75**

Total RWA 305. Basel I: the three corporates give 220, whatever the rating

IN THE LESSON

- At Larkspur, a one hundred million dollar loan to a double A rated company is weighted twenty per cent, giving twenty million.
- Eighty million to a double B company, inside the band from triple B plus to double B minus, is weighted one hundred per cent, giving eighty million.
- Forty million to a single B company, below double B minus, is weighted one hundred and fifty per cent, giving sixty million.
- Outside the corporate table, residential mortgages get thirty five per cent, so two hundred million gives seventy.
- Retail loans get seventy five per cent, so one hundred million gives seventy five.
- The total is three hundred and five million.
- Under Basel one, the three corporates would give two hundred and twenty million, whatever their ratings.

21 Standardised, foundation IRB and advanced IRB

IRB needs supervisory approval; retail has no foundation version

	Standardised	Foundation IRB	Advanced IRB
Weight from	Table	Formula	Formula
PD	Not used	Bank	Bank
LGD	Not used	Supervisor: 45%	Bank
EAD	Exposure	Supervisor	Bank
Maturity	Not used	Supervisor: 2.5 y	Bank

IN THE LESSON

- The two internal ratings based approaches, I R B for short, need supervisory approval.
- Retail exposures have no foundation version.
- The weight comes from the table in the standardised approach, and from the formula in both I R B approaches.
- The probability of default, P D, is not used in the standardised approach, and the bank estimates it in both I R B approaches.
- Loss given default, L G D, is not used in the standardised approach, is set by the supervisor at forty five per cent for senior unsecured claims in foundation, and is estimated by the bank in advanced.
- Exposure at default, E A D, is the exposure itself in the standardised approach, set by the supervisor in foundation, and the bank's estimate in advanced.
- Maturity is not used in the standardised approach, is two point five years in foundation, and is the bank's estimate in advanced.

22 The IRB formula: worst-case default rate

WCDR = N[(N^{-1}(PD) + √ρ × N^{-1}(0.999)) ÷ √(1 − ρ)]
K = EAD × LGD × (WCDR − PD) × MA; RWA = 12.5 × K

Probability of default, PD	One-year default probability
Asset correlation, ρ	Corporates: 0.24 down to 0.12
Worst-case default rate	Default rate in a 1-in-1,000 year
Capital per exposure, K	Unexpected loss only

IN THE LESSON

- The formula measures unexpected loss at a ninety nine point nine per cent one year confidence level.
- First comes the worst case default rate, W C D R.
- Write N for the standard normal distribution and rho for the asset correlation.
- The worst case default rate is N of the quantity: N inverse of P D, plus the square root of rho times N inverse of point nine nine nine, all divided by the square root of one minus rho.
- For corporates, rho falls from point two four at very low P D to point one two at high P D.
- The worst case default rate is the default rate we would expect in a one in a thousand year.
- Capital per exposure, K, is E A D times L G D times the worst case default rate minus P D, times a maturity adjustment, M A.
- Risk weighted assets are twelve point five times K.

23 The maturity adjustment

$$b = (0.11852 - 0.05478 \times \ln PD)^{2}$$
$$MA = (1 + (M - 2.5) \times b) \div (1 - 1.5 \times b)$$

Maturity factor, b	Larger for safer borrowers
Effective maturity, M	Effective maturity, years
Maturity adjustment, MA	Exactly 1 when M = 1

IN THE LESSON

- Longer loans are riskier, because credit quality has more time to slip.
- The maturity adjustment captures this.
- It depends on the default probability through a factor b, which equals the square of the quantity zero point one one eight five two minus zero point zero five four seven eight times the natural log of P D.
- With M the effective maturity in years, the maturity adjustment is one plus M minus two point five, times b, all divided by one minus one point five times b.
- When M is one year, the top and bottom are equal, so the adjustment is exactly one.
- Longer maturities push it above one.
- Because b is larger for safer borrowers, maturity matters more for them.

24 Example 9: IRB capital for a corporate loan

EAD $50m, PD 1%, LGD 45%, M = 3 years, ρ = 0.19, 99.9% confidence

Numerator	−2.3263 + 0.4359 × 3.0902	**−0.9793**
Divide by √(1 − 0.19)	−0.9793 ÷ 0.9	**−1.0882**
Worst-case default rate	N(−1.0882)	**13.83%**
Factor b	(0.11852 − 0.05478 ln 0.01)^{2}	**0.1375**
Maturity adjustment	(1 + 0.5b) ÷ (1 − 1.5b)	**1.3464**

IN THE LESSON

- Larkspur lends fifty million dollars to Kestrel Shipping: P D one per cent, L G D forty five per cent, maturity three years, and an assumed correlation of point one nine.
- N inverse of point zero one is minus two point three two six three.
- N inverse of point nine nine nine is three point zero nine zero two, and root point one nine is point four three five nine, so the numerator is minus point nine seven nine three.
- Divide by the square root of point eight one, which is point nine, to get minus one point zero eight eight two.
- N of that is thirteen point eight three per cent, the worst case default rate.
- Next, the factor b is zero point one three seven five.
- With M of three years, M minus two point five is a half, so the adjustment is one plus half of b, over one minus one point five b, which is one point three four six four.

25 Example 10: from K to RWA, and three errors

Kestrel: WCDR 13.83%, MA 1.3464, EAD $50m, LGD 45%, PD 1%

K	22.5 × 12.83% × 1.3464	**$3.89m**
RWA	12.5 × 3.886	**$48.57m**
Wrong: PD not subtracted	50 × 45% × 13.83% × 1.3464	**$4.19m**
Wrong: MA dropped	50 × 45% × (13.83% − 1%)	**$2.89m**
Wrong: no × 12.5	K reported as RWA	**$3.89m**

Risk weight = 48.57 ÷ 50 = 97%. Expected loss is left to provisions and pricing

IN THE LESSON

- For Kestrel, capital is fifty million times forty five per cent, which is twenty two point five million, times thirteen point eight three per cent minus one per cent, which is twelve point eight three per cent, times one point three four six four.
- That is about three point eight nine million dollars.
- Risk weighted assets are twelve point five times that, about forty eight point five seven million.
- Now the errors.
- Forgetting to subtract P D gives four point one nine million.
- Dropping the maturity adjustment gives two point eight nine million.
- And forgetting twelve point five reports K, three point eight nine million, as if it were risk weighted assets.
- The risk weight is forty eight point five seven over fifty, about ninety seven per cent.
- P D is subtracted because expected loss is left to provisions and pricing.

26 Example 11: the basic indicator approach

Gross income, last three years: $120m, −$20m, $100m

Positive years only	120 and 100	**2 years**
Average gross income	(120 + 100) ÷ 2	**$110m**
Capital charge	15% × 110	**$16.5m**
Wrong: all three years	15% × (200 ÷ 3)	**$10.0m**

IN THE LESSON

- Now operational risk.
- Basel two offers three methods.
- The simplest is the basic indicator approach.
- The charge is fifteen per cent of average annual gross income over the previous three years.
- Only years with positive gross income count, in both the numerator and the denominator.
- Larkspur's gross income over the last three years was one hundred and twenty million dollars, then minus twenty million, then one hundred million.
- The negative year is dropped entirely.
- The average of the two positive years is one hundred and twenty plus one hundred, over two, which is one hundred and ten million.
- Fifteen per cent of that is sixteen point five million.
- The trap is to average all three years, giving sixty six point six seven million and a charge of only ten million.

27 The standardised approach: eight business lines

Each business line's beta is a % of its gross income

Business lines	Beta
Corporate finance; trading and sales; payment, settlement	18%
Commercial banking; agency services	15%
Retail banking; asset management; retail brokerage	12%

IN THE LESSON

- The standardised approach for operational risk is finer.
- Gross income is split across eight business lines, and each line has its own beta, a percentage of its gross income that is held as capital.
- Corporate finance, trading and sales, and payment and settlement take eighteen per cent, the highest beta.
- Commercial banking and agency services take fifteen per cent.
- Retail banking, asset management and retail brokerage take twelve per cent, the lowest.
- The idea is that a dollar of income from a line with more operational risk should carry more capital.

28 Example 12: the standardised approach in numbers

Gross income $m: trading (18%), commercial (15%), retail (12%)

Year 1: 40, 60, 50	7.2 + 9.0 + 6.0	**22.2**
Year 2: −80, 50, 40	−14.4 + 7.5 + 4.8 = −2.1	**0 (floored)**
Year 3: 30, 70, 60	5.4 + 10.5 + 7.2	**23.1**
Capital charge	(22.2 + 0 + 23.1) ÷ 3	**$15.1m**

IN THE LESSON

- Larkspur has three of the lines: trading and sales at eighteen per cent, commercial banking at fifteen, and retail banking at twelve.
- In year one, gross income was forty, sixty and fifty million dollars, so the weighted total is seven point two plus nine plus six, twenty two point two million.
- In year two, trading lost eighty million, while commercial and retail earned fifty and forty.
- Within the year, negatives offset positives: minus fourteen point four plus seven point five plus four point eight is minus two point one, which is floored at zero.
- In year three, thirty, seventy and sixty give five point four plus ten point five plus seven point two, twenty three point one million.
- Capital is the three year average: twenty two point two plus zero plus twenty three point one, over three, which is fifteen point one million.

29 The advanced measurement approach

- AMA: the bank's own model, 99.9%, one year
- Uses internal and external loss data
- Plus scenario analysis and business and control factors
- Needs supervisory approval
- BIA: one %. Standardised: % by line. AMA: own model

IN THE LESSON

- The third method is the advanced measurement approach, A M A.
- Here the bank uses its own model of operational losses, and the capital is the loss at a ninety nine point nine per cent one year confidence level, the same standard as the I R B credit formula.
- The model must use four elements: the bank's internal loss data, external loss data from other firms, scenario analysis of severe but plausible events, and business environment and internal control factors.
- The A M A needs supervisory approval.
- To contrast the three: the basic indicator approach uses one percentage of total income, the standardised approach uses a percentage for each business line, and the A M A uses the bank's own model.

30 Solvency II: three pillars for insurers

- EU insurers and reinsurers, from 2016; three pillars
- Pillar 1: quantitative, market-consistent balance sheet
- SCR: 99.5% one-year VaR, a 1-in-200-year loss
- MCR: lower; below it, severe supervisory action
- Pillar 2: governance, ORSA. Pillar 3: reporting, disclosure

IN THE LESSON

- Solvency two is the risk based capital framework for insurers and reinsurers in the European Union, in force from two thousand and sixteen.
- Like Basel two, it has three pillars.
- Pillar one sets quantitative requirements, measured on a market consistent balance sheet.
- The Solvency Capital Requirement, S C R, is calibrated to a ninety nine point five per cent one year value at risk, which is a one in two hundred year loss.
- The lower Minimum Capital Requirement, M C R, is the level below which supervisory action becomes severe.
- Pillar two covers governance and the own risk and solvency assessment, O R S A, and pillar three covers reporting and disclosure.

31 The SCR standard formula

SCR = √(Σ ρij × SCRi × SCRj) + Op − Adj
Modules: market, default, life, health, non-life

Module charges, SCRi	One charge per risk module
Correlations, ρij	Equals 1 when i = j
Operational risk	Added after combining
Loss-absorbency adjustment	Deducted at the end

IN THE LESSON

- The S C R can be found with the standard formula, or with an internal model that the supervisor has approved.
- In the standard formula, a separate charge is computed for each risk module: market risk, counterparty default risk, life underwriting, health underwriting and non life underwriting.
- The modules are then combined with a correlation matrix, where rho i j is the correlation between modules i and j.
- The combined charge is the square root of the sum, over every pair i and j, of rho i j times S C R i times S C R j.
- When i equals j the correlation is one, so each module's own charge enters squared.
- Then a charge for operational risk is added, and an adjustment for loss absorbency is deducted.

32 Example 13: Larkspur Assurance's SCR

Market 100, non-life 80, correlation 0.25; op risk 10; adjustment 15. In €m

Sum of terms	100^{2} + 80^{2} + 2×0.25×100×80	**20,400**
Combined charge	√20,400	**142.83**
Diversification benefit	180 − 142.83	**37.17**
SCR	142.83 + 10 − 15	**137.83**

IN THE LESSON

- Larkspur Assurance, an insurance sister, writes non life business in the European Union.
- Its market risk module charge is one hundred million euros and its non life underwriting charge is eighty million, with an assumed correlation of zero point two five between them.
- The squares are ten thousand and six thousand four hundred, and the cross term, two times zero point two five times one hundred times eighty, is four thousand.
- The square root of twenty thousand four hundred is one hundred and forty two point eight three million.
- The diversification benefit is one hundred and eighty minus that, thirty seven point one seven million.
- Add ten million for operational risk and deduct fifteen million for loss absorbency: the S C R is about one hundred and thirty seven point eight three million.

33 Mistakes to avoid

- 8% applies to RWA, not total assets
- Basel II: capital charges × 12.5 before adding to RWA
- IRB: subtract PD, keep MA, × 12.5 for RWA
- BIA: drop negative-income years from the average
- 1995 = netting; 1996 = market risk capital

IN THE LESSON

- Here are the traps examiners use most.
- First, applying eight per cent to total assets rather than to risk weighted assets.
- Second, under Basel two, adding market and operational risk capital to risk weighted assets without multiplying by twelve point five.
- Third, in the I R B formula, forgetting to subtract P D, dropping the maturity adjustment, or stopping at K when the question asks for risk weighted assets.
- Fourth, in the basic indicator approach, counting a negative income year in the average.
- Fifth, mixing up the amendments: nineteen ninety five brought netting, and nineteen ninety six brought market risk capital.

34 Try three quick questions

1. Basel I: OECD bonds $40m, mortgages $100m, corporate loans $50m. Minimum capital?
   Answer: RWA = 0 + 50 + 50 = 100. 8% × 100 = $8m.
2. Gross income $80m, $60m, −$10m. Basic indicator charge?
   Answer: Drop the negative year. 15% × 70 = $10.5m.
3. Credit RWA $400m, market capital $8m, op capital $6m. Basel II minimum?
   Answer: 400 + 12.5×8 + 12.5×6 = 575. 8% × 575 = $46m.

IN THE LESSON

- Pause after each question, then listen to the answer.
- Question one.
- Under Basel one, a bank holds forty million dollars of O E C D government bonds, one hundred million of residential mortgages and fifty million of corporate loans.
- What is its minimum capital?
- Risk weighted assets are zero plus fifty plus fifty, one hundred million, so capital is eight million dollars.
- Question two.
- Gross income over three years was eighty million, sixty million and minus ten million.
- What is the basic indicator charge?
- Drop the negative year: fifteen per cent of seventy million is ten point five million.
- Question three.
- Credit risk weighted assets are four hundred million, market risk capital is eight million and operational risk capital six million.
- What is the Basel two minimum capital?
- Total risk weighted assets are four hundred plus twelve point five times eight, one hundred, plus twelve point five times six, seventy five: five hundred and seventy five million.
- So the minimum is forty six million dollars.