CHARTA LEARNING · LESSON NOTES

An Introduction to Securitisation

FRM Part II

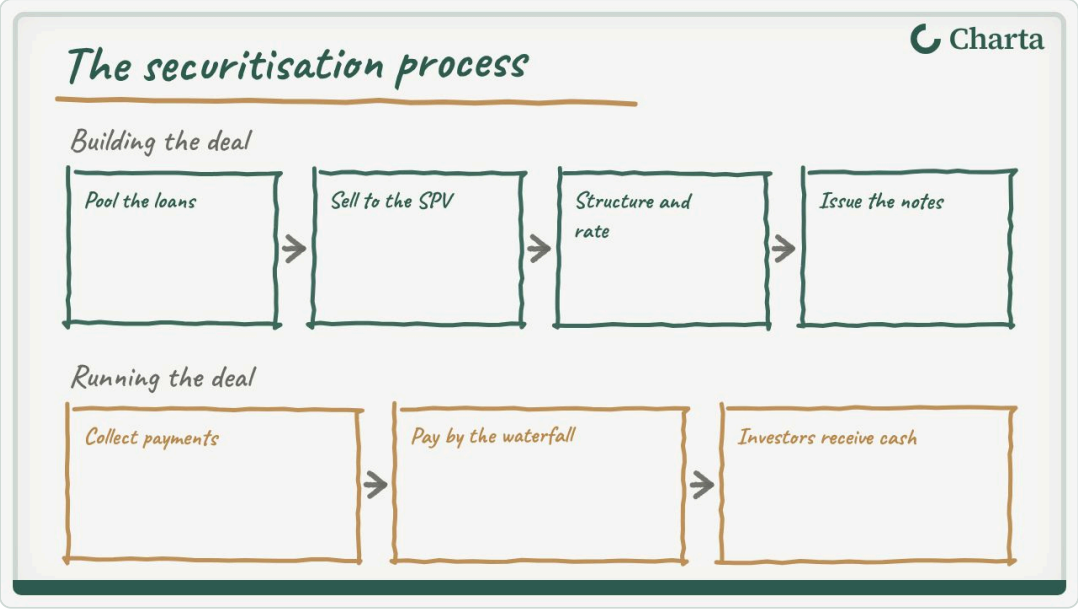
1 A story: Harbourline's mortgage pile

- Pool assets: mortgages, auto loans, card receivables
- Sell the pool to a separate legal entity
- The entity funds the purchase by issuing notes
- Notes are paid from the pool's cash flows

IN THE LESSON

- Harbourline Bank has made lots of home loans, five hundred and twenty million dollars in total.
- The money is tied up for years, and the bank wants to lend again.
- So it gathers the loans into a pool and sells the pool to a separate company.
- The company pays for the pool by selling notes to investors, and the monthly payments of the borrowers flow through to the noteholders.
- That whole idea is securitisation.
- It pools financial assets such as mortgages, auto loans or card receivables, sells them to a separate legal entity, and funds that purchase by issuing securities backed by the pool's cash flows.
- The lender gets cash now, and the investors get a claim on the pool rather than on the bank.

2 The securitisation process



IN THE LESSON

- Here is the whole process in two lines.
- First, building the deal.
- Harbourline pools its loans and sells the pool to the special purpose vehicle, or S P V.
- The arranger designs the tranches, which are slices of the notes with different priorities, and the rating agencies assess the structure and give each slice a rating.
- Then the S P V issues the notes to investors, and uses the money to pay Harbourline.
- Second, running the deal.
- Each month the servicer collects what the borrowers pay.
- The cash is paid out in the order that the documents set, which is called the waterfall.
- The investors receive their interest and principal.
- Remember the sequence: pool, sell, structure and rate, issue, then collect and distribute.

3 Who builds the deal

Four roles that set the deal up

Participant	What it does
Originator	Creates the loans, sells them: true sale
SPV or trust	Holds the pool, issues the notes
Arranger	Designs tranches, places them (a bank)
Rating agencies	Assess the structure, assign ratings

IN THE LESSON

- Now meet the cast, starting with the ones who build the deal.
- The originator creates the assets, here Harbourline, and sells them, ideally in a true sale.
- A true sale is real and final, so the pool sits outside the originator's bankruptcy estate.
- If Harbourline later fails, its creditors cannot reach the loans.
- The special purpose vehicle, or a trust, is a shell that holds the pool and issues the notes.
- It has no other business.
- The arranger is usually an investment bank.
- It designs the tranches and places them with investors.
- The rating agencies assess the structure and assign ratings, and investors lean heavily on those ratings.

4 Who runs the deal, and a classic slip

Three roles after closing, and the trap

Participant	What it does
Servicer	Collects from borrowers, manages arrears
Trustee	Protects noteholders, checks the waterfall
Investors	Buy the tranches
The slip	Servicer faces borrowers; trustee faces investors

IN THE LESSON

- Now the people who work after the deal closes.
- The servicer collects payments from borrowers and manages delinquencies, which are the loans where borrowers have fallen behind.
- The trustee protects the noteholders.
- It checks that cash is paid out under the documented waterfall.
- The investors buy the tranches and receive what the structure pays them.
- Here is the slip that examiners love.
- People mix up the servicer and the trustee.
- Keep it simple.
- The servicer faces the borrowers.
- The trustee faces the investors.
- If a question asks who chases a borrower who is behind on payments, that is the servicer.
- If it asks who checks that investors were paid in the right order, that is the trustee.

5 The cash waterfall and the equity piece

- Waterfall: rules for who is paid first from collections
- Order: fees, senior interest, junior interest, principal
- Whatever remains goes to the residual holder
- Equity piece = first-loss piece: the most junior claim
- It takes first losses, so highest return and highest risk

IN THE LESSON

- Now to the cash waterfall.
- The pool produces cash, and the notes are not all equal, so the documents say who is paid first.
- That set of priority-of-payments rules is the waterfall.
- Normally the order is this.
- First senior fees and expenses.
- Then interest on the senior notes.
- Then interest on the junior notes.
- Then principal.
- Whatever remains goes to the residual holder.
- The residual holder owns the equity piece, also called the first-loss piece.
- It is the most junior claim.
- It absorbs the first losses on the pool, and it receives the leftover cash.
- That is why it earns the highest return, and carries the most risk.
- Think of a row of buckets under a tap.
- Each fills before the next gets anything.

6 Example 1: one year through the waterfall

Pool $520m earning 6.0%. Class A $400m at 5%, Class B $100m at 7%, fees 0.5%

Interest collected	6.0% × 520	**$31.2m**
Fees and expenses	0.5% × 520	**$2.6m**
Class A interest	5% × 400	**$20.0m**
Class B interest	7% × 100	**$7.0m**
Residual to the equity piece	31.2 − 2.6 − 20 − 7	**$1.6m**

IN THE LESSON

- Let us run one year of Harbourline's pool through the waterfall.
- The loans earn a weighted average coupon of six per cent on five hundred and twenty million dollars, so thirty one point two million of interest is collected.
- Class A, the senior notes, are four hundred million at five per cent.
- Class B, the junior notes, are one hundred million at seven per cent.
- Fees and expenses are half of one per cent of the pool.
- Step one, fees take two point six million.
- Step two, Class A interest is twenty million.
- Step three, Class B interest is seven million.
- What is left is one point six million, and that goes to the residual holder.
- Had cash been short, the equity would have gone unpaid first, then Class B.

7 Over-collateralisation and who takes losses

- Over-collateralisation: collateral exceeds the notes
- Example: $520m of loans back $500m of notes
- The $20m excess is a cushion that takes losses first
- Losses go bottom up by seniority, never pro rata
- Failed OC test: residual cash repays senior principal

IN THE LESSON

- Over-collateralisation means the collateral balance is larger than the notes issued.
- Harbourline's pool is five hundred and twenty million dollars of loans, and the notes total only five hundred million.
- The extra twenty million is a cushion.
- Losses must eat through it before any note is hit.
- In this deal, that cushion is the equity piece.
- Losses are allocated from the bottom up, by seniority.
- They are never shared pro rata, which would mean in proportion to size.
- And there is a safety valve.
- Triggers, such as a failed over-collateralisation test, redirect the residual cash.
- Instead of paying equity, it repays senior principal, which rebuilds the cushion.

8 Example 2: a $30m loss, bottom up

Pool loses $30m. OC $20m, Class B $100m, Class A $400m

Loss to absorb	after recoveries	**$30m**
Absorbed by OC cushion	first 20	**$20m**
Written off on Class B	30 − 20	**$10m**
Written off on Class A	nothing left to hit it	**$0**
Wrong: pro rata to Class A	30 × 400 ÷ 520	**$23.1m**

IN THE LESSON

- Suppose bad luck hits and the pool loses thirty million dollars after recoveries.
- Follow the losses from the bottom.
- The first twenty million is absorbed by the over-collateralisation, the equity cushion.
- That leaves ten million.
- The next layer up is Class B, so Class B writes off ten million, and its balance falls from one hundred million to ninety.
- Class A, the senior note, loses nothing.
- Its four hundred million is still fully backed.
- If the loss had been shared pro rata instead, Class A would have lost more than twenty three million, and that is not how it works.
- Pay attention to who is paid first and who is hurt first.
- They sit at opposite ends of the structure.

9 Example 3: a failed over-collateralisation test

OC ratio = collateral ÷ notes. Trigger 102% (illustration)

OC ratio at the start	520 ÷ 500	**104.0%**
After $12m of losses	(520 − 12) ÷ 500	**101.6%**
Trigger level	set in the documents	**102%**
Test result	101.6% is below 102%	**Fails**
Leftover cash, say $1.6m	goes to Class A principal	**Not equity**

IN THE LESSON

- Now the trigger.
- The over-collateralisation ratio is collateral divided by notes.
- At the start, five hundred and twenty over five hundred is one hundred and four per cent.
- Suppose the documents set the trigger at one hundred and two per cent.
- That level is made up for this example.
- Now twelve million dollars of losses arrive.
- Collateral falls to five hundred and eight, and the ratio falls to one hundred and one point six per cent.
- That is below the trigger, so the test fails.
- From then on, the leftover cash, say the one point six million from before, is not paid to equity.
- It repays Class A principal, which lowers the notes and rebuilds the cushion.
- The senior holders are protected and the equity holder waits.

10 A special purpose vehicle or a trust

Different legal form, same aim

Form	How it works
SPV	Separate company: owns assets, issues notes
Trust	Trustee holds assets for noteholders
Trust is not	A corporate entity itself
Aim of both	Isolate the pool from the originator

IN THE LESSON

- A securitised product can be issued in two legal ways.
- In the first, a special purpose vehicle is a separate company.
- It owns the assets and issues the notes in its own name.
- In the second, a trust is a legal arrangement.
- A trustee holds the assets for the benefit of the noteholders, but the trust is not a corporate entity itself.
- It has no company personality of its own.
- The difference is the legal form.
- The aim is the same either way: to isolate the pool from the originator, so that noteholders depend on the pool and not on Harbourline's fortunes.
- Details differ between jurisdictions, so treat this as the general picture.

11 Amortising and revolving structures

What happens to principal collections

Structure	What it means
Amortising	To investors from start: mortgages, autos
Revolving	Buy new receivables: credit cards
Master trust	Many series, one pool, seller's interest
Early trigger	Ends the revolving period

IN THE LESSON

- Next, structures that describe how the pool behaves over time.
- An amortising structure passes principal collections to investors from the start, so the note balances fall as the pool falls.
- It suits mortgages and auto loans, whose borrowers repay gradually.
- A revolving structure behaves differently.
- During a revolving period, principal collections are used to buy new receivables, so the pool stays about the same size.
- Only when the revolving period ends does amortisation begin.
- That suits short-lived credit card balances, which repay within months, because a fixed amortising schedule would end the deal almost at once.
- The third structure, the master trust, is on the next slide.

12 The master trust and early amortisation

- Master trust: many series, issued at different dates
- All series are backed by one common pool
- Seller keeps a seller's interest in the pool
- Early amortisation triggers end the revolving period
- Then principal collections go to investors

IN THE LESSON

- A master trust issues many series of notes, at different dates, against one common pool.
- Picture Harbourline's credit card arm.
- Each year it adds a new series of notes, and every series is backed by the same large pool of card receivables.
- The seller, here Harbourline, keeps what is called the seller's interest, its own share of the pool, which acts as a buffer as balances move.
- Now the risk.
- A revolving period does not last for ever.
- Early amortisation triggers end it.
- If the pool's performance gets bad enough, the revolving period stops early, and principal collections go to investors instead of buying new receivables.

13 Why originators securitise

- Turn illiquid loans into cash
- Diversify funding away from deposits and unsecured debt
- Senior tranches rated above the bank: cheaper funding
- Possible regulatory capital relief; capacity for new lending
- Earn servicing fees

IN THE LESSON

- So why do banks do this?
- Originators securitise to turn illiquid loans into cash.
- They diversify funding away from deposits and unsecured debt.
- Because senior tranches are rated more highly than the originator itself, funding can cost less.
- In some cases the bank also obtains regulatory capital relief, since the loans leave its balance sheet.
- The freed capacity can go to new lending, and the originator can earn servicing fees for looking after the loans it sold.
- Harbourline sells five hundred and twenty million dollars of mortgages and raises cash it can lend again.
- Notice that these benefits hold only if risk really moves to someone else.
- That is the next slide.

14 Example 4: is the risk really transferred?

Pool $520m, expected loss 3%. First-loss piece $20m

Pool expected loss	3% × 520	**$15.6m**
First-loss piece absorbs	first 20 of loss	**$20m**
Expected loss on that piece	smaller of 15.6 and 20	**$15.6m**
Bank keeps the piece	15.6 ÷ 15.6 kept	**100% kept**
Bank sells the piece	none kept	**0% kept**

IN THE LESSON

- Here is why genuine risk transfer matters.
- Harbourline expects the pool to lose three per cent, which is fifteen point six million dollars on five hundred and twenty million.
- The first-loss piece is twenty million, so it soaks up all of that expected loss.
- Case one.
- Harbourline keeps the first-loss piece.
- Then fifteen point six out of fifteen point six, all of the expected loss, stays with the bank.
- Selling the senior notes moved little risk, so capital relief should be limited.
- Case two.
- It sells the first-loss piece to outside investors.
- Now none of the expected loss remains with Harbourline.
- Implicit support is the same trap.
- If the bank quietly promises to cover losses, the risk is still with it.

15 What investors get, and the catch

- Investors reach diversified pools they could not originate
- Seniority lets them choose a risk and return
- Benefits need genuine risk transfer
- Adverse selection: originator knows its loans better
- Retained risk, disclosure; risk moved, not removed

IN THE LESSON

- What do investors get?
- Access to diversified pools of loans that they could never originate themselves.
- And tranches let them choose a risk and return through seniority.
- A cautious investor buys senior, a hungry one buys junior.
- But there is a standard concern, adverse selection.
- The originator knows its loans better than the investors do, so it may sell the worst ones.
- That is why retained risk and disclosure matter.
- If the originator keeps some risk, it has a reason to lend carefully, and if it discloses well, investors can price what they buy.
- The key idea to remember is that securitisation moves and reshapes risk.
- It does not make it disappear.

16 Credit enhancement: internal and external

Any feature that lifts a tranche above the pool

Kind	Examples
Internal	Subordination: juniors take losses first
Internal	Over-collateralisation: assets exceed notes
Internal	Excess spread; reserve or cash accounts
External	Monoline insurance, guarantees, letters of credit
External	Guarantee from originator or parent

IN THE LESSON

- Credit enhancement is any feature that raises the credit quality of a tranche above that of the pool.
- There are two families.
- Internal enhancement comes from inside the structure.
- Subordination means junior tranches absorb losses first.
- Over-collateralisation means assets exceed notes.
- Excess spread is the pool's weighted average coupon minus the note coupons and the fees.
- And reserve accounts, also called cash collateral accounts, hold cash set aside for losses.
- External enhancement comes from third parties: monoline insurance or financial guarantees, letters of credit, and guarantees from the originator or its parent.
- The exam point is this split between internal and external.

17 Example 5: measuring excess spread

Excess spread = pool interest − note interest − fees

Interest collected	6.0% × 520	**$31.2m**
Note interest and fees	27.0 + 2.6	**$29.6m**
Excess spread	31.2 − 29.6	**$1.6m = 0.31%**
If $20m stops paying	6% × 20 lost	**−$1.2m**
Excess spread left	1.6 − 1.2	**$0.4m**

IN THE LESSON

- Let us measure Harbourline's excess spread, using the numbers from the waterfall.
- Interest collected is thirty one point two million dollars.
- The notes cost twenty seven million in interest, and fees are two point six million, so together twenty nine point six.
- The gap is one point six million, which is about point three one per cent of the pool.
- That is the cushion the pool earns as it goes.
- Now stress it.
- Suppose twenty million dollars of loans stop paying.
- The lost interest is six per cent of twenty, or one point two million, and the excess spread falls to point four million.
- This is why excess spread is free at closing, but not guaranteed.
- It moves with defaults, and with prepayments too.

18 Weighing the kinds of enhancement

Exam point: internal v external, and counterparty risk

Enhancement	Cost or risk
Subordination, OC	Reliable, but cuts proceeds raised
Excess spread	Free at closing, varies with defaults
Reserve account	Costs carry
External support	Counterparty risk: provider downgrade

IN THE LESSON

- How should we weigh the options?
- Subordination and over-collateralisation are reliable, because the cushion is there from day one.
- But they reduce the proceeds the originator can raise, because part of the pool is not funded by selling senior notes.
- Excess spread costs nothing at closing, but it varies with prepayments and defaults, as we just saw.
- A reserve account costs carry, because cash sits earning little while it is held back.
- External support adds counterparty risk.
- If the provider is downgraded, the tranche can be pulled down with it.
- So remember the exam point: the internal versus external split, and the counterparty risk of external support.

19 The right tool for each asset class

Match the measure to the asset

Asset class	Tools
Residential mortgages	CPR, SMM, PSA; WAL, WAM, WAC
Commercial mortgages	DSCR
Credit cards	MPR, excess spread, delinquency, charge-offs
Auto loans, consumer	Delinquency and default ratios

IN THE LESSON

- Different assets need different tools.
- For residential mortgage pools the key issue is prepayment, so analysts use C P R, S M M and the P S A benchmark, together with W A L, W A M and W A C.
- We build all of these shortly.
- For commercial mortgage pools and similar income-producing property loans, they use the debt service coverage ratio, D S C R, which is net operating income divided by debt service.
- For credit card trusts, whose balances revolve and have no scheduled amortisation, they track the monthly payment rate, excess spread, delinquency ratios and charge-offs.
- And delinquency and default ratios are used across consumer asset classes, including auto loans.

20 Weighted average life, and a typical mistake

- WAL summarises principal timing for any amortising pool
- Faster prepayments shorten WAL
- Delinquency and default ratios suit consumer assets
- Mistake: a PSA speed for a credit card trust
- Identify the asset first, then pick the tool

IN THE LESSON

- The weighted average life summarises the timing of principal for any amortising pool.
- It depends on the prepayment assumption, and faster prepayments shorten it.
- Now the typical mistake: applying a tool to the wrong asset class.
- Quoting a P S A speed for a credit card trust makes no sense, because card balances revolve and have no scheduled amortisation to measure prepayments against.
- In the same way, a debt service coverage ratio belongs with income-producing property, not with a pool of consumer loans.
- When you read an exam question, first identify the asset, then pick the tool.
- Delinquency and default ratios are the exception, because they work across consumer assets.

21 Weighted average coupon and maturity

WAC = Σ (balance × coupon) ÷ Σ balance
WAM = Σ (balance × months left) ÷ Σ balance

Loan balance, the weight	The weight: big loans count more
Coupon of each loan	Coupon of each loan
Months left on each loan	Months left on each loan

IN THE LESSON

- Now the calculations, starting with the weighted average coupon, or W A C, and the weighted average maturity, or W A M.
- W A C is the pool's loan coupons weighted by loan balance.
- W A M is the remaining terms weighted by balance.
- Neither is a simple average, because a big loan counts for more than a small one.
- In symbols, multiply each loan's balance by its coupon, add up, and divide by the total balance.
- For W A M, do the same with the months left.
- Why does it matter?
- W A C tells you how much interest the pool earns, which feeds the waterfall and the excess spread we met.
- W A M tells you how long the pool has left to run.

22 Example 6: WAC and WAM of the pool

A: $200m, 5.5%, 300 months. B: $220m, 6.0%, 330. C: $100m, 7.0%, 240

WAC, balance × coupon summed	(1,100 + 1,320 + 700) ÷ 520	**6.00%**
Wrong: simple average coupon	(5.5 + 6 + 7) ÷ 3	**6.17%**
Balance × months, summed	60,000 + 72,600 + 24,000	**156,600**
WAM	156,600 ÷ 520	**301.2 months**
Wrong: simple average term	(300 + 330 + 240) ÷ 3	**290 months**

IN THE LESSON

- Harbourline's pool has three groups of loans.
- Group A is two hundred million dollars at five and a half per cent with three hundred months left.
- Group B is two hundred and twenty million at six per cent with three hundred and thirty months left.
- Group C is one hundred million at seven per cent with two hundred and forty months left.
- The total is five hundred and twenty million.
- Weighted by balance, the coupon sums eleven hundred, thirteen hundred and twenty and seven hundred to three thousand one hundred and twenty, over five hundred and twenty, exactly six per cent.
- The simple average would give six point one seven per cent, which is wrong.
- The W A M sums sixty thousand, seventy two thousand six hundred, and twenty four thousand, to one hundred and fifty six thousand six hundred, over five hundred and twenty, about three hundred and one point two months, against a simple average of two hundred and ninety.

23 Weighted average life

WAL = Σ (principal × time) ÷ total principal
Faster prepayments → shorter WAL

Principal repaid at a date	Each repayment of principal
Years from today to that date	When it is received
All principal repaid	Principal repaid in all

IN THE LESSON

- The weighted average life, written W A L, measures the average time until principal is returned.
- Take each repayment of principal, multiply it by the time at which it is received, add all of those up, and divide by the total principal.
- Time is usually measured in years.
- It is not the same as maturity.
- A pool can have a final maturity of thirty years and a much shorter W A L, if a lot of principal comes back early.
- W A L depends on the prepayment assumption.
- Faster prepayments return principal sooner, so they shorten the W A L.
- Slower prepayments lengthen it.
- That is why you always quote the prepayment speed alongside a W A L.

24 Example 7: WAL and faster prepayments

$500m of principal repaid at the end of years 1, 2 and 3 ($ millions)

Year 1	100 × 1	**100**
Year 2	150 × 2	**300**
Year 3	250 × 3	**750**
WAL	(100 + 300 + 750) ÷ 500	**2.3 years**
Faster: 200, 150, 150	(200 + 300 + 450) ÷ 500	**1.9 years**

IN THE LESSON

- Take five hundred million dollars of principal that comes back over three years.
- One hundred million arrives at the end of year one, one hundred and fifty million at the end of year two, and two hundred and fifty million at the end of year three.
- Multiply each by its year: one hundred, three hundred and seven hundred and fifty.
- They add to one thousand one hundred and fifty.
- Divide by five hundred and the W A L is two point three years.
- Now suppose borrowers prepay faster, so the pattern becomes two hundred, one hundred and fifty and one hundred and fifty.
- The sum is two hundred plus three hundred plus four hundred and fifty, which is nine hundred and fifty.
- Divided by five hundred, the W A L falls to one point nine years.

25 DSCR and the monthly payment rate

DSCR = Net operating income ÷ Debt service
MPR = Cardholder payments in month ÷ Opening receivables
DSCR below 1.0: income does not cover payments

Net operating income	Income after running costs
Debt service due	Interest and principal due
Cardholder payments	All payments made by cardholders
Opening receivables	Balance at the start of the month

IN THE LESSON

- Two more ratios.
- The debt service coverage ratio, D S C R, suits commercial property loans.
- It is net operating income divided by debt service.
- Net operating income is what the property earns after running costs, and debt service is the interest and principal due.
- A value below one point oh means income does not cover payments.
- The monthly payment rate, M P R, suits credit card trusts.
- It is total cardholder payments in the month divided by the opening receivables balance.
- A high rate means cardholders are paying their balances down quickly.
- Both are direct ratios, so the only care needed is to use the right top and bottom.

26 Delinquency and default ratios

Delinquency ratio = Balance 30+ days past due ÷ Current pool balance
Default ratio = Defaulted balance ÷ Pool balance (state the basis)

Loans 30 or more days late	Late, but not yet defaulted
Defaulted balance	Treated as failed
Pool balance	Denominator set by convention

IN THE LESSON

- The last two ratios work across consumer pools, including auto loans.
- The delinquency ratio is the balance of loans past due, commonly thirty days or more, divided by the current pool balance.
- The default ratio is the defaulted balance divided by the pool balance.
- But here the denominator depends on the stated convention.
- Some reports divide by the current balance, others by the original balance.
- So a question will tell you which, and you should always state it.
- A delinquent loan is only late.
- A defaulted loan has gone further and is treated as failed.
- So delinquency is an early warning, and default is the loss itself.

27 Example 8: four ratios computed

$m. Debt service 4.0 a property. Cards: 800 opening. Mortgages: pool 480

DSCR, office	4.8 ÷ 4.0	**1.20**
DSCR, retail centre	3.6 ÷ 4.0	**0.90, below 1**
MPR, card trust	120 ÷ 800	**15%**
Delinquency ratio	14.4 ÷ 480	**3.0%**
Default ratio	9.6 ÷ 480	**2.0%**

On the original balance of $520m, default would be 1.85%: state the basis

IN THE LESSON

- Let us compute all four.
- Two commercial property loans each have debt service of four million dollars.
- The office building has net operating income of four point eight million, so the D S C R is one point two.
- The retail centre earns three point six million, so its D S C R is point nine, below one, which means income does not cover the payments.
- Next, a card trust opened the month with eight hundred million dollars of receivables, and cardholders paid one hundred and twenty million.
- The monthly payment rate is fifteen per cent.
- Finally, a mortgage pool has a current balance of four hundred and eighty million, with fourteen point four million thirty days or more past due and nine point six million defaulted.
- Delinquency is three per cent and default is two per cent.
- On the original balance of five hundred and twenty million, default would be one point eight five per cent.

28 Forecasting prepayments

- Refinancing incentive: rises as rates fall below coupons
- Seasoning: young loans prepay slowly, then speed up
- Seasonality: a yearly pattern of house moves
- Burnout: after a refinancing wave, speeds slow
- Housing turnover: house sales prepay loans

IN THE LESSON

- Now prepayments, the biggest unknown in mortgage pools.
- A borrower prepays by paying back early, perhaps by refinancing or by selling the house.
- Forecasters begin with the refinancing incentive.
- It rises as market rates fall below the coupons in the pool, because borrowers can swap into cheaper loans.
- Other drivers matter too.
- Seasoning means that new loans prepay slowly at first and speed up as they age.
- Seasonality is the yearly pattern, with more house moves in some months.
- Burnout means that after a wave of refinancing, the borrowers left behind are those unable or unwilling to refinance, so speeds slow.
- And housing turnover drives prepayments even when rates do not move.

29 PSA, CPR and SMM

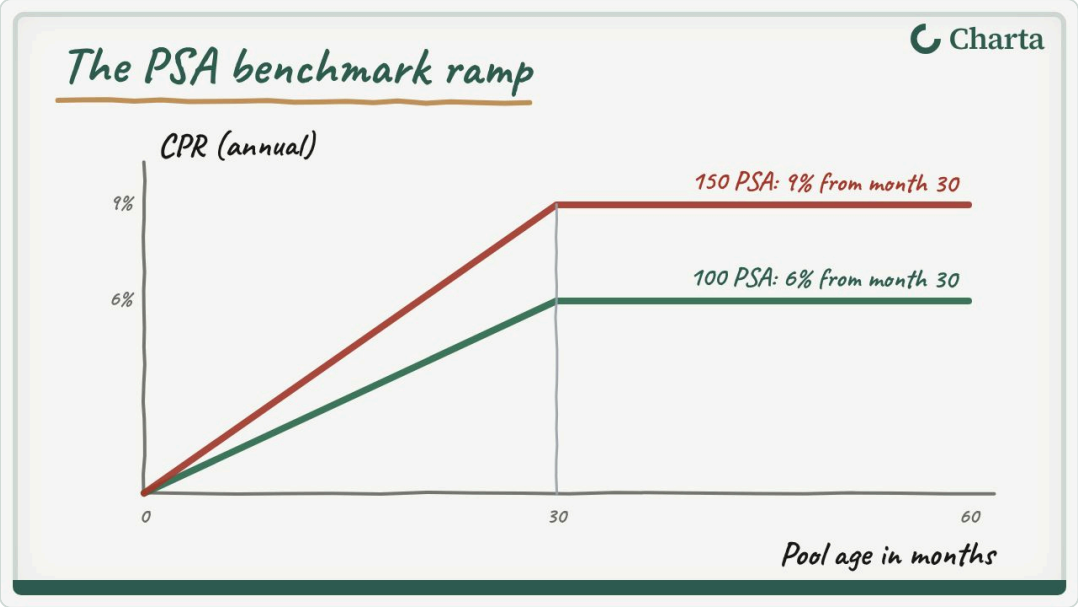
100 PSA: CPR = 0.2% × age, to month 30; 6% after
SMM = 1 − (1 − CPR)^(1/12)
Prepayment = SMM × balance after scheduled principal

Constant prepayment rate	Annualised share prepaid
Single monthly mortality	Monthly rate from the annual CPR
Prepayment in the month	SMM times the balance

IN THE LESSON

- Speeds are quoted against the P S A benchmark.
- The constant prepayment rate, C P R, is the annualised fraction of the balance prepaid.
- One hundred P S A assumes that C P R rises by point two per cent for every month of pool age until month thirty, and is six per cent after that.
- Other speeds scale this.
- One hundred and fifty P S A is one and a half times those rates, so it reaches nine per cent.
- The single monthly mortality rate, S M M, turns an annual C P R into a monthly figure: one minus the quantity one minus C P R, to the power one over twelve.
- The prepayment in a month is S M M times the balance after scheduled principal.

30 The PSA benchmark ramp



IN THE LESSON

- Here is the benchmark as a picture.
- Along the bottom is the age of the pool in months, up to sixty.
- Up the side is the C P R.
- The green line is one hundred P S A.
- It climbs by point two per cent a month, reaching six per cent at month thirty, and then it goes flat at six per cent.
- The red line is one hundred and fifty P S A.
- It climbs one and a half times as fast, reaching nine per cent at month thirty, and then it also goes flat.
- The common error is to forget to stop the ramp at month thirty and keep climbing.
- Remember that the speed is a scaling of the whole line, not a different shape.

31 Example 9: speeds, SMM and implied PSA

Month 12 at 150 PSA, balance $400m. Month 20: observed SMM 0.5%

CPR at 150 PSA, month 12	1.5 × 0.2% × 12	**3.60%**
SMM	1 − (1 − 0.036)^(1/12)	**0.305%**
Prepayment on $400m	0.305% × 400m	**$1.22m**
CPR from SMM of 0.5%	1 − 0.995^12	**5.84%**
Implied PSA, month 20	5.84% ÷ (0.2% × 20)	**146 PSA**

Errors: CPR ÷ 12 for SMM; ramp not stopped at month 30

IN THE LESSON

- Now Harbourline's pool in numbers.
- In month twelve, take one hundred and fifty P S A.
- The C P R is one and a half times point two per cent times twelve, which is three point six per cent.
- The single monthly mortality rate is one minus the quantity point nine six four raised to the power one over twelve, about point three zero five per cent.
- On a balance of four hundred million dollars after scheduled principal, the prepayment is about one point two two million.
- Now work backwards.
- In month twenty the pool shows a monthly rate of point five per cent, which is an annual figure of five point eight four per cent.
- One hundred P S A in month twenty is four per cent.
- So the implied speed is about one hundred and forty six P S A.

32 Recap: the main ideas

- Pool, sell, structure and rate, issue, collect and distribute
- Waterfall: fees, senior, junior, principal; rest to equity
- Losses bottom up; OC and excess spread are cushions
- Three structures; enhancement internal or external
- Match the tool to the asset; compute ratios carefully

IN THE LESSON

- Let us pull it together.
- Securitisation pools assets, sells them to an S P V or trust, and issues notes backed by the cash flows, with a servicer facing the borrowers and a trustee facing the investors.
- The waterfall pays fees, then senior interest, then junior interest, then principal, with the rest to the equity piece, which takes the first losses.
- Over-collateralisation is a cushion, and losses go bottom up.
- Structures can be amortising, revolving or a master trust.
- Credit enhancement is internal or external, and external adds counterparty risk.
- Match the tool to the asset, and compute the ratios carefully.

33 Try three quick questions

1. Loans: $300m at 4%, $100m at 8%. WAC?
   Answer: (12 + 8) ÷ 400 = 5.0%, not the simple 6%.
2. Card trust: $500m opening, $85m paid. MPR?
   Answer: 85 ÷ 500 = 17%.
3. Pool 330, notes 300 (240 A, 60 B). Loss 45?
   Answer: OC takes 30; Class B loses 15, left 45; Class A loses 0.

IN THE LESSON

- Now try three quick questions.
- Pause the video, think, then listen to the answers.
- Question one.
- A pool has three hundred million dollars of loans at four per cent and one hundred million at eight per cent.
- What is the weighted average coupon?
- Four per cent of three hundred is twelve, and eight per cent of one hundred is eight, so twenty over four hundred is five per cent, not the simple average of six.
- Question two.
- A credit card trust opens the month with five hundred million dollars of receivables, and cardholders pay eighty five million.
- What is the monthly payment rate?
- Eighty five over five hundred is seventeen per cent.
- Question three.
- A pool of three hundred and thirty million dollars backs notes of three hundred million, two hundred and forty million senior and sixty million junior.
- The pool loses forty five million.
- Who takes it?
- The thirty million of over-collateralisation takes the first thirty, the junior notes lose fifteen million and fall to forty five million, and the senior notes lose nothing.