CHARTA LEARNING · LESSON NOTES

Early Warning Indicators

FRM Part II

1 A story: the ratio that arrived too late

- Halden: $12bn deposits, $4bn wholesale
- It watched one number: its month-end LCR
- Mid-April: the March figure looks healthy
- By then, deposits and lenders are leaving
- Needed: signals that move first

IN THE LESSON

- Meet Halden Bank, a mid sized lender funded by twelve billion dollars of retail deposits and four billion dollars of wholesale funding, meaning money borrowed from other banks, funds and companies.
- For years Halden watched one number, its month end L C R.
- That is the liquidity coverage ratio, which compares a bank's stock of liquid assets with the cash it could lose in a thirty day stress.
- Many large banks now compute it daily, but Halden looked only at the month end figure.
- In the middle of April, the figure for the end of March looked healthy.
- But by then rumours about Halden were spreading, savers were moving money out, and wholesale lenders were shortening their loans.
- The report described a past date.
- What Halden needed were signals that move before funding actually dries up.

2 What an early warning indicator is

- EWI: signals rising liquidity vulnerability
- Early enough for management to act
- Sound EWIs are leading and measurable
- Relevant to the bank's own funding model
- The set is diversified and calibrated

IN THE LESSON

- Those signals are early warning indicators.
- An early warning indicator, E W I for short, is a measure that signals rising liquidity vulnerability, meaning a growing risk that the bank cannot meet its payments.
- And it does so early enough for management to act.
- That second part is the whole point.
- A warning that arrives after the damage is done is a report, not a warning.
- So how do we judge whether an indicator is sound?
- The exam looks for five features.
- A sound E W I is leading, and it is measurable.
- It is relevant to the bank's own funding model.
- And the set of indicators is diversified and calibrated.
- We take each feature in turn, using Halden's indicators as the examples.

3 Feature one: leading, not lagging

A report describes a past date; a warning moves before the funding goes

Measure	Leading or lagging
Month-end LCR, mid-month	Lagging: 15-45 days old
Daily deposit outflows	Leading: money leaving
Own CDS spread, daily	Leading: doubts show
Lenders shorten terms	Leading: pulling back

IN THE LESSON

- A report describes a past date, while a warning moves before the funding goes.
- Take the measures one at a time.
- Halden's month end L C R is published in the middle of the next month.
- The figure for the thirty first of March arrives on the fifteenth of April, already fifteen days old, and it is forty five days old just before the next figure arrives in mid May.
- That is lagging.
- Now compare daily retail deposit outflows, which move as the money leaves.
- Halden's own C D S spread, the price of insurance against its default, moves daily, and market doubts often show there first.
- And when wholesale lenders shorten the terms of their loans, they are pulling back early.
- Those three are leading.

4 Feature two: measurable

- Frequent, reliable data
- A threshold defined in advance
- Halden: deposit outflow, amber 0.40% a day
- 0.40% × $12bn = $48m in one day
- No threshold, no trigger: just a chart to admire

IN THE LESSON

- The second feature is that the indicator is measurable.
- It needs frequent, reliable data: a figure that arrives daily or weekly from a trusted source, not an occasional estimate.
- And it needs a threshold defined in advance, the level at which the bank has agreed it will act.
- Halden measures its daily retail deposit outflow and sets an amber threshold at zero point four per cent of deposits in a single day.
- On twelve billion dollars of deposits, that is forty eight million dollars leaving in one day.
- Without a threshold fixed in advance, an indicator triggers nothing.
- It becomes a chart to admire, and every alarm turns into a debate about whether this time is serious.

5 Feature three: relevant to the funding model

Different funding models need different indicators

Funding model	Indicators that matter
Retail-deposit bank	Deposit run-off
Repo-funded dealer	Rollover, haircuts, calls
Halden: both sources	Run-off and rollover

IN THE LESSON

- Different funding models need different indicators, and that is the third feature: relevance to the bank's own funding model.
- A bank funded mainly by retail deposits is hurt when savers withdraw, so it watches deposit run off, the pace at which deposits leave.
- A dealer funded by repo, that is, by short loans secured on its securities, is hurt when lenders refuse to roll those loans over, raise the haircut, which is the discount applied to the collateral, or call for more collateral.
- So it watches repo rollover, haircuts and collateral calls.
- A deposit indicator would tell the dealer little.
- Halden has both sources, twelve billion of deposits and four billion of wholesale funding, so it needs both deposit run off and wholesale rollover indicators.

6 Feature four: diversified

- Internal: deposit run-off, collateral calls
- External: CDS spreads, market volatility
- Internal: money leaving; external: doubt
- Not all from one data source
- Halden: 4 indicators, 4 data feeds

IN THE LESSON

- The fourth feature belongs to the set as a whole: it should be diversified.
- Internal signals come from the bank's own books, such as deposit run off or collateral calls, meaning demands from counterparties for more collateral.
- External signals come from markets, such as C D S spreads and market volatility.
- The two complement each other.
- Internal signals show money already starting to leave, while external signals show doubt building, often before anyone withdraws.
- The set should not all rest on one data source either, because if that one feed fails or is wrong, every warning fails together.
- Halden runs four indicators, deposit run off, wholesale rollover, its own C D S spread and market volatility, from four separate data feeds.

7 Example 1: a noisy indicator

Halden's daily deposit outflows in a calm week; amber at 0.40% a day

Days over 0.40%	day 2: 0.55%; day 4: 0.50%	**2 of 5 days**
Five-day total	0.20+0.55+0.10+0.50+0.15	**1.50%**
Five-day average	1.50% ÷ 5	**0.30% a day**
In dollars	0.30% × $12bn	**$36m a day**
Average against amber	0.30% < 0.40%	**No alert**

IN THE LESSON

- Here are Halden's daily deposit outflows in a calm week, with amber at zero point four per cent a day.
- They show a second way an indicator can fail: noise.
- The readings are zero point two, zero point five five, zero point one, zero point five and zero point one five per cent.
- Day two and day four are over the threshold, so the alert fires on two days out of five with nothing wrong, and staff soon learn to ignore it.
- A better design smooths the readings.
- The five day total is one point five per cent, an average of zero point three per cent a day.
- In dollars, that is zero point three per cent of twelve billion, thirty six million dollars a day.
- The average is below amber, so there is no alert.
- Smoothing has a cost, since a real run would show a little later, so the averaging window is itself calibrated by back testing.
- A noisy measure is as useless as a lagging one.

8 Example 2: back-testing two thresholds

200 weeks of history: 20 weeks ran up to a stress, 180 were calm

Tight: signals before stress	18 of 20, so 2 missed	**missed 10%**
Tight: false alarms	36 of 180 calm weeks	**20%**
Loose: signals before stress	12 of 20, so 8 missed	**missed 40%**
Loose: false alarms	9 of 180 calm weeks	**5%**

Tighter catches more stress, and raises more false alarms

IN THE LESSON

- Two hundred weeks of history, with twenty weeks that ran up to a real stress and one hundred and eighty calm weeks: that is the test data.
- The fifth feature is calibration.
- Thresholds are calibrated and back tested, meaning tried on past data to see how they would have performed.
- In the twenty run up weeks, a good indicator should be signalling.
- Halden tests a tight threshold for its wholesale rollover indicator.
- It signals in eighteen of the twenty, so it misses two, or ten per cent.
- But it also fires in thirty six of the one hundred and eighty calm weeks, false alarms of twenty per cent.
- A loose threshold signals in only twelve of the twenty, missing forty per cent, with false alarms in nine calm weeks, five per cent.
- So the tighter threshold catches more stress, and raises more false alarms.

9 Example 3: weighing misses against false alarms

Assumed cost: a missed stress $10m; a false alarm $0.25m

Tight: misses	2 × $10m	**$20m**
Tight: false alarms	36 × $0.25m	**$9m**
Tight: total	20 + 9	**$29m**
Loose: total	8 × 10 + 9 × 0.25	**$82.25m**
Choice	lower total cost	**Tight**

IN THE LESSON

- Halden assumes a missed stress costs ten million dollars, and a false alarm a quarter of a million, for the staff time and the cost of acting needlessly.
- For the tight threshold, two misses cost twenty million, and thirty six false alarms cost nine million, a total of twenty nine million.
- For the loose threshold, eight misses cost eighty million and nine false alarms two point two five million, a total of eighty two point two five million.
- With these costs, the tight threshold wins clearly, because in liquidity a missed signal can be fatal while a false alarm is merely annoying.
- The costs here are made up.
- The lesson is the method: calibrate by balancing missed signals against false alarms, then back test again as conditions change.

10 Judging Halden's candidates

Sound: leading, measurable, relevant, diversified, calibrated

Candidate	Verdict
Month-end LCR	Lagging: a report
Smoothed daily deposit outflows	Sound: leading, internal
Own CDS spread, amber set	Sound: leading, external
Raw daily outflows	Noisy: alerts on calm days
Every signal from one vendor	Not diversified

IN THE LESSON

- Sound means leading, measurable, relevant, diversified and calibrated, and here that test is applied.
- Halden's month end L C R is lagging, so it is a report, not an early warning.
- Smoothed daily deposit outflows are sound: leading and internal, measured daily against a threshold.
- Its own C D S spread, with an amber level set in advance, is sound too, leading and external.
- Raw daily outflows are noisy, raising alerts on calm days.
- And a design in which every signal comes from one vendor is not diversified.
- Accepting a lagging or noisy measure as an E W I is the usual mistake.
- On the exam, test each candidate against all five features before you accept it.

11 Who issued which guidance

BCBS sets international standards; national supervisors apply them

Authority	Guidance on EWIs
BCBS	2008 Principles
OCC, Fed, FDIC, others	2010 Interagency Statement
OCC	Handbook: Liquidity booklet

IN THE LESSON

- The Basel Committee sets international standards, and national supervisors apply them.
- With that in mind, here is who issued what.
- The Basel Committee on Banking Supervision, the B C B S, is the international standard setter.
- In two thousand and eight it issued the Principles for Sound Liquidity Risk Management and Supervision.
- In the United States, the Office of the Comptroller of the Currency, the O C C, together with the Federal Reserve, the F D I C, which is the Federal Deposit Insurance Corporation, and other agencies, issued the Interagency Policy Statement on Funding and Liquidity Risk Management in two thousand and ten.
- And the O C C's Comptroller's Handbook has a booklet on liquidity that gives its examiners, the staff who inspect banks, further detail.

12 The Basel Committee's 2008 principles

- Monitor EWIs of emerging stress
- Quantitative and qualitative
- Bank-specific and market-wide
- Linked to the contingency funding plan (CFP)

IN THE LESSON

- What do the Basel principles of two thousand and eight expect?
- First, that a bank monitors early warning indicators of emerging stress, so it sees trouble building rather than arriving.
- Second, the indicators should be both quantitative, meaning numbers such as deposit outflows or spreads, and qualitative, meaning judgments such as negative press coverage.
- Third, they should cover both bank specific stress, meaning trouble at this bank, and market wide stress, meaning trouble across the whole system.
- And fourth, they must be linked to the contingency funding plan, the C F P.
- That is the bank's written plan for raising cash in a stress: who decides, which actions are available, and in what order.
- An indicator with no link to the plan triggers nothing.

13 Typical indicators in the guidance, part one

Examples the supervisors list, viewed with Halden in mind

Indicator	What it warns of
Negative publicity	Depositors and lenders may leave
Rating downgrade	Dearer funding; collateral calls
Widening CDS spreads	Markets see more default risk
Falling equity price	Investors losing confidence

IN THE LESSON

- These are examples that supervisors list, viewed with Halden in mind.
- The first is negative publicity, a damaging news story or rumour, which warns that depositors and lenders may leave.
- The second is a rating downgrade, which makes funding dearer and can bring demands for more collateral under contracts that depend on the rating.
- The third is widening C D S spreads, which show markets pricing more default risk.
- The fourth is a falling equity price, the bank's own share price, which shows investors losing confidence.
- Notice that negative publicity is qualitative, a judgment about news, while the other three are numbers.
- Notice too that all four come from outside the bank's own books; market prices such as C D S spreads and the share price often move first, while a downgrade tends to come later.

14 Typical indicators in the guidance, part two

More examples, from inside the balance sheet

Indicator	What it warns of
Fast growth, volatile funding	Funding vanishes first
Rising collateral demands	Liquid assets drained
Deposit outflows	Funding already leaving

IN THE LESSON

- More examples come from inside the balance sheet.
- Rapid asset growth funded by volatile liabilities, such as short term wholesale money, warns that the funding can vanish faster than the assets can be sold.
- If Halden doubled its loan book in two years using overnight wholesale money, this one would flash.
- Rising collateral demands drain the liquid assets that the bank would rely on in a stress.
- And deposit outflows are funding already leaving.
- The exam asks you to recognise examples like these seven, and to see that each one is tied to an action in the contingency funding plan.
- On their own, these indicators are only facts about the bank.
- Tied to the plan, they become triggers for action.

15 Halden's dashboard on the Basel dimensions

Quantitative and qualitative; bank-specific and market-wide

Type	Bank-specific	Market-wide
Quantitative	Deposit outflows, own CDS	Market volatility
Qualitative	Negative publicity	Bad news on the sector

IN THE LESSON

- The Basel dimensions are quantitative and qualitative, bank specific and market wide, so Halden checks its dashboard against both.
- Across the top are the two kinds of stress, bank specific and market wide.
- Down the side are the two kinds of indicator.
- Quantitative and bank specific: its deposit outflows and its own C D S spread.
- Quantitative and market wide: market volatility.
- Qualitative and bank specific: negative publicity about Halden.
- Qualitative and market wide: bad news about the banking sector as a whole.
- Every cell is filled, so a stress that starts at Halden and one that starts in the wider system would both show up.
- A dashboard with only one cell filled would leave whole kinds of stress unseen.

16 Example 4: who issued what?

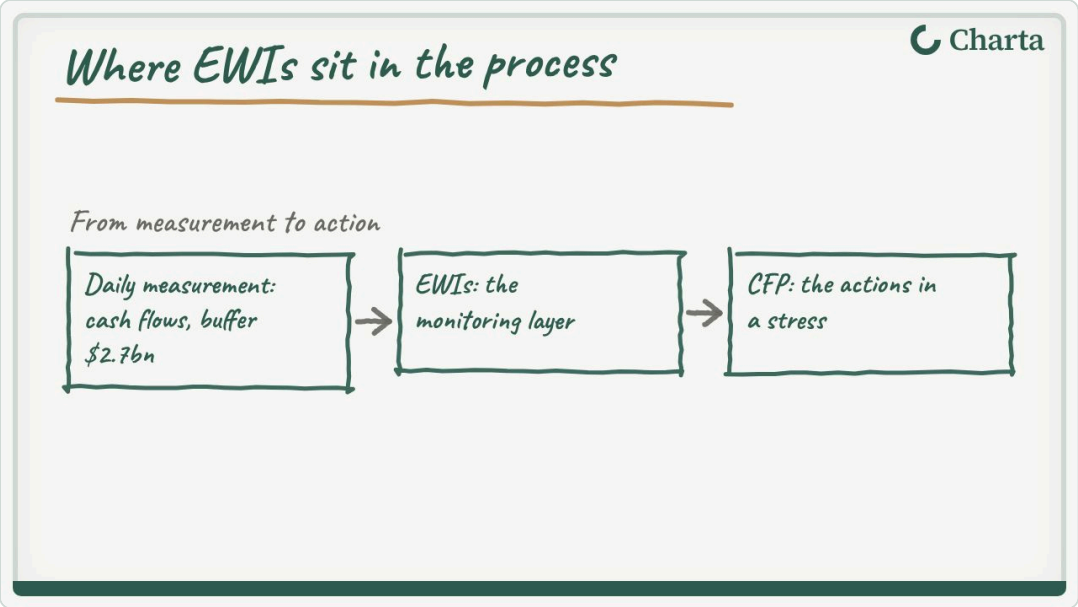
Match each piece of guidance to its author

International liquidity principles	2008	**BCBS**
US funding and liquidity statement	2010, jointly	**OCC, Fed, FDIC**
Liquidity booklet for examiners	Comptroller's Handbook	**OCC**
Applies the standards at home	not the BCBS	**Nat'l supervisors**
What all of them expect	the common thread	**Tied to the CFP**

IN THE LESSON

- Match each piece of guidance to its author.
- The international liquidity principles of two thousand and eight come from the B C B S.
- The American funding and liquidity statement of two thousand and ten was issued jointly by the O C C, the Federal Reserve, the F D I C and other agencies.
- The liquidity booklet for examiners is in the O C C's Comptroller's Handbook.
- Applying the standards to banks at home is the job of national supervisors, because the Basel Committee sets standards but does not supervise banks itself.
- And what do all of them expect?
- Early warning indicators tied to the contingency funding plan.
- A common trap is to credit the Basel Committee with the American policy statement, or the reverse.

17 Where EWIs sit in the process



IN THE LESSON

- Within the liquidity risk process, early warning indicators are the monitoring layer that connects day to day measurement to the contingency funding plan.
- The row runs from measurement to action.
- Look at the boxes from left to right.
- On the left is daily measurement: Halden's cash flows and its buffer of liquid assets, two point seven billion dollars.
- In the middle are the early warning indicators, the monitoring layer, which watch those numbers and the markets for signs of trouble.
- On the right is the C F P, the actions Halden would take in a stress.
- Without the middle box, the plan sits on a shelf, waiting for someone to notice that it is needed.
- The indicators are what tell management, in good time, to open it.

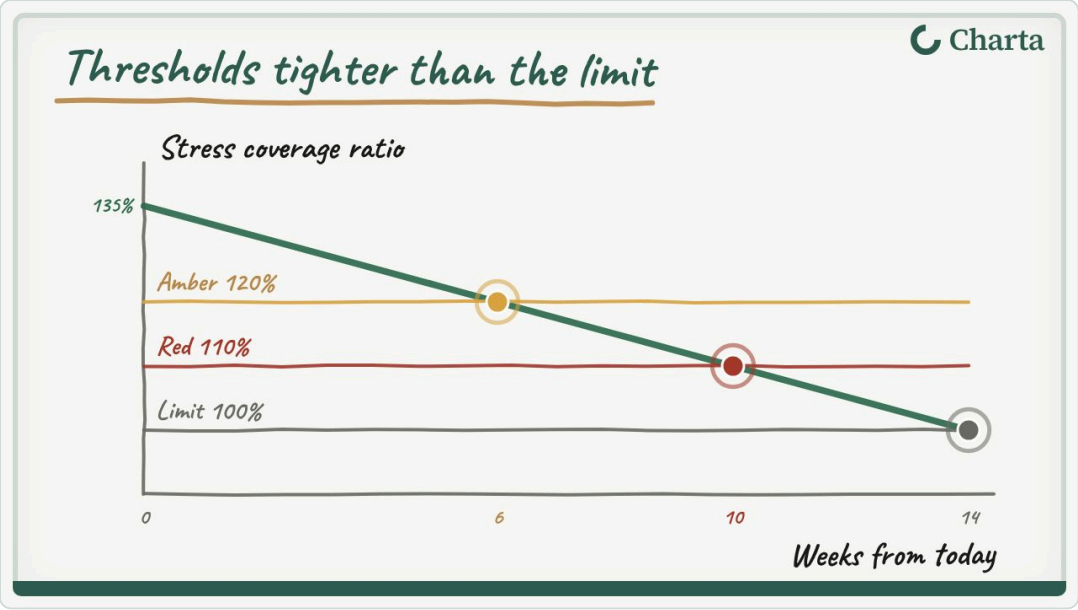
18 Graded thresholds: green, amber, red

- Each indicator has graded thresholds
- Green: normal monitoring
- Amber: closer monitoring, and report it
- Red: decide whether to activate CFP actions
- Set tighter than the limit, to buy lead time

IN THE LESSON

- Each indicator has graded thresholds, often green, amber and red, like traffic lights.
- Green means normal monitoring.
- Amber means the indicator has moved enough to watch it more closely and to report it.
- Red means management must decide whether to activate actions in the contingency funding plan.
- The key design rule is where the thresholds sit.
- They are set tighter than the risk tolerance or limit, the hard line the board has approved.
- If the warning sounded only at the limit, management would learn of the problem at the moment the bank was already in breach.
- Setting thresholds tighter than the limit buys lead time, the weeks in which management can still act calmly and cheaply.

19 Thresholds tighter than the limit



IN THE LESSON

- This chart shows Halden's stress coverage ratio: its buffer of liquid assets divided by the cash it would lose in a thirty day stress, recomputed daily.
- Along the bottom are the weeks from today.
- Up the side is the ratio.
- The green line is the path if the ratio drifts down steadily, from one hundred and thirty five per cent today to one hundred per cent.
- The amber line sits at one hundred and twenty per cent, and the red line at one hundred and ten.
- The board's limit is one hundred per cent, so both thresholds are tighter than the limit.
- Reading the weeks along the bottom, the line crosses amber at week six, red at week ten, and reaches the limit at week fourteen.
- The gap between the first warning and the breach is the lead time.

20 Example 5: the lead time

Ratio 135% today, falling 2.5 points a week. Limit 100%

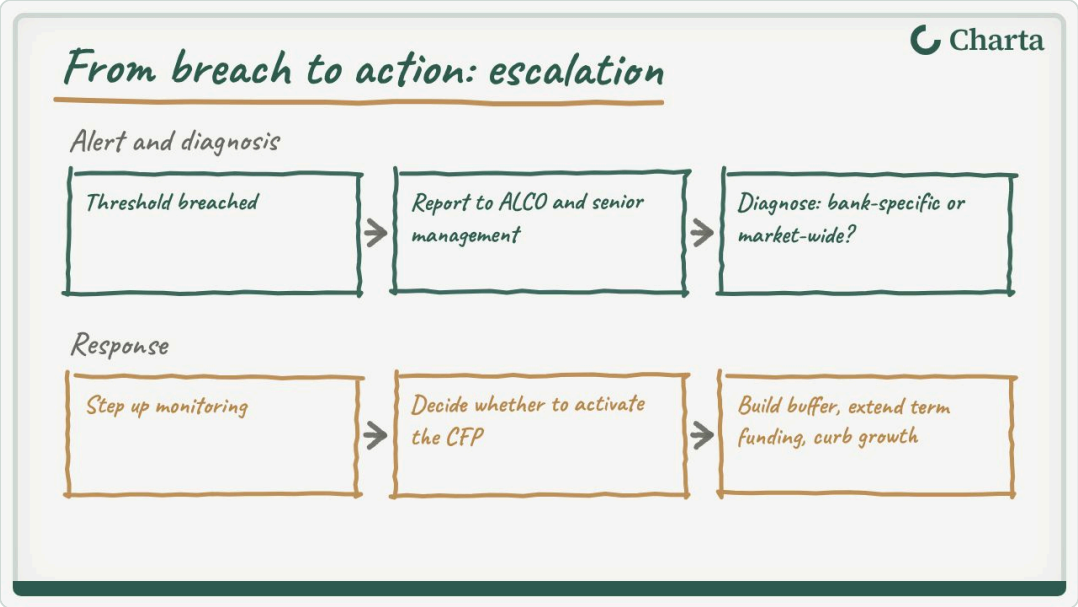
Today	$2.7bn ÷ $2.0bn	**135%**
Weeks to amber, 120%	(135 − 120) ÷ 2.5	**6 weeks**
Weeks to red, 110%	(135 − 110) ÷ 2.5	**10 weeks**
Weeks to the limit, 100%	(135 − 100) ÷ 2.5	**14 weeks**
Lead time from amber	14 − 6	**8 weeks**

From red: 14 − 10 = 4 weeks. A trigger at the limit: none

IN THE LESSON

- The ratio is one hundred and thirty five per cent today and falls two and a half points a week, against a limit of one hundred.
- Today's figure is the buffer of two point seven billion dollars divided by stressed outflows of two billion.
- To reach amber, the ratio must fall fifteen points, which at two and a half a week takes six weeks.
- To reach red, it must fall twenty five points, which takes ten weeks.
- To reach the limit, thirty five points, fourteen weeks.
- So the amber alert arrives fourteen minus six, eight weeks before the limit is breached.
- Red gives fourteen minus ten, four weeks.
- A trigger set at the limit itself would give no lead time at all.

21 From breach to action: escalation



IN THE LESSON

- When a threshold is breached, a set path follows.
- Look at the top row, alert and diagnosis.
- First, the threshold is breached.
- Second, the breach is reported to the asset liability committee, known as A L C O, the senior group that manages the balance sheet, and to senior management.
- Third, management diagnoses the cause: is it bank specific, trouble at Halden, or market wide, trouble everywhere?
- The answer shapes the response.
- Now the bottom row, the response.
- Monitoring is stepped up, so that daily figures may become hourly.
- Management decides whether to activate the contingency funding plan.
- And its actions include building the buffer, extending term funding so that less of it falls due soon, and curbing asset growth.

22 Example 6: an amber alert at Halden

Halden's 5-year CDS: 90bp to 160bp in a month; amber at 150bp

Halden's widening	160 − 90	**+70bp**
Against amber	160 > 150	**Amber**
Peers' average widening	100 − 95	**+5bp**
Specific to Halden	70 − 5	**65bp**
Diagnosis	peers barely moved	**Bank-specific**

IN THE LESSON

- Halden's five year C D S spread has risen from ninety to one hundred and sixty basis points in a month, and amber is at one hundred and fifty.
- A basis point is one hundredth of a percentage point.
- So Halden's spread has widened by seventy basis points.
- One hundred and sixty is above one hundred and fifty, so the indicator is amber, and it is reported to A L C O.
- Now the diagnosis.
- The average spread of its peers moved from ninety five to one hundred, just five basis points.
- So seventy minus five, sixty five basis points, is specific to Halden.
- The diagnosis is bank specific stress.
- Investors are worried about Halden itself, which makes its deposit and wholesale indicators the next ones to watch.

23 Example 7: the CFP actions and their cost

Buffer $2.7bn; stressed outflows $2.0bn; overnight funding $1.2bn

Extend overnight to 6 months	$1.2bn × 0.40% × 6/12	**$2.4m cost**
Add to buffer, from term funding	2.7 + 0.3	**$3.0bn**
New coverage ratio	3.0 ÷ 2.0	**150%**
Curb asset growth	pause planned new loans	**$0.5bn**

Outflows held at $2.0bn for simplicity

IN THE LESSON

- Halden's buffer is two point seven billion dollars, its stressed outflows two billion, and its overnight wholesale funding one point two billion.
- Suppose Halden's other indicators then reach red.
- A L C O then decides to activate three actions.
- First, extend term funding.
- It replaces the one point two billion of overnight money with six month funding, at an extra zero point four per cent a year.
- For half a year that costs one point two billion times zero point four per cent times six twelfths, two point four million dollars.
- Second, raise three hundred million dollars of extra term funding and hold it as liquid assets, taking the buffer to three billion.
- The coverage ratio rises to three divided by two, one hundred and fifty per cent.
- Third, curb asset growth by pausing five hundred million dollars of planned new loans.
- For simplicity we hold stressed outflows at two billion, although the longer funding would reduce them.
- Acting before the limit is breached, with time to spare, keeps these costs small.

24 EWIs, limits and stress tests

They complement each other; none replaces the others

Tool	Job	Halden example
Limits	Cap current exposures	Coverage at least 100%
Stress tests	Size the losses	$2.0bn outflow in 30 days
EWIs	Detect the onset	CDS amber at 150bp

IN THE LESSON

- Early warning indicators complement limits and stress tests, and none of the three replaces the others.
- Each tool has its own job.
- Limits cap current exposures: Halden's coverage ratio must stay at or above one hundred per cent.
- Stress tests size the losses: Halden's stress test says it could lose two billion dollars of funding in thirty days.
- Early warning indicators detect the onset: Halden's C D S spread turns amber at one hundred and fifty basis points.
- A bank with only limits learns of trouble when it is already in breach.
- A bank with only stress tests knows how bad things could get, but not when they are starting.
- The indicators supply the timing, so they trigger escalation before limits are breached.

25 Keeping the indicators honest

- EWIs inform stress scenario design
- Reviewed and back-tested regularly
- Funding model changes: the set must change
- Each breach and false alarm is evidence
- Thresholds change only by formal review

IN THE LESSON

- Early warning indicators also feed the rest of the framework.
- They inform stress scenario design.
- If Halden's C D S and deposit indicators moved together in a past episode, its stress scenarios should assume they move together again.
- They are reviewed and back tested regularly, as in our earlier test on two hundred weeks of history.
- When the funding model changes, for instance if Halden starts to borrow much more through repo, the set must change too, with new indicators for repo rollover and collateral calls.
- Each breach and each false alarm is evidence for the next calibration.
- And thresholds are changed only through a formal review, with the reasons recorded, never in the middle of an alert.

26 Example 8: moving the threshold

CDS 160bp is above amber at 150bp. Someone proposes amber at 175bp

Spread after the change	unchanged	**160bp**
Alert after the change	160 < 175	**Green**
Coverage: amber 120% to 112.5%	(135 − 112.5) ÷ 2.5	**week 9**
Lead time left	14 − 9	**5 weeks, not 8**

IN THE LESSON

- Halden's C D S spread is one hundred and sixty basis points, above amber at one hundred and fifty, and someone proposes moving amber to one hundred and seventy five.
- After the change, the spread is still one hundred and sixty.
- But one hundred and sixty is below one hundred and seventy five, so the light turns green.
- Nothing about the risk has changed.
- Only the warning has gone.
- The same trick on the coverage ratio is just as costly.
- Move amber from one hundred and twenty down to one hundred and twelve and a half, and the ratio, falling from one hundred and thirty five, reaches it after twenty two and a half divided by two and a half, nine weeks.
- The lead time left is fourteen minus nine, five weeks, not eight.
- Moving a threshold to clear an alert is the classic mistake.

27 Mistakes to avoid

- A lagging or noisy measure as an EWI
- One data source for every signal
- Thresholds at the limit: no lead time
- Moving a threshold to clear an alert
- EWIs with no link to the CFP

IN THE LESSON

- Let us gather the mistakes to avoid.
- First, accepting a lagging or noisy measure as an early warning indicator, like the month end L C R or raw daily outflows.
- Second, resting every signal on one data source, so that a single failure blinds the bank.
- Third, setting thresholds at the limit, which leaves no lead time.
- Fourth, moving a threshold to clear an alert, which removes the warning and leaves the risk where it was.
- Fifth, keeping indicators with no link to the contingency funding plan, which raise alarms that trigger nothing.
- All five have the same effect.
- Management learns of the trouble too late to act calmly, which is exactly what early warning indicators exist to prevent.

28 What to remember

- Sound: leading, measurable, relevant
- Set: diversified and calibrated
- BCBS 2008; US 2010; OCC Handbook
- Green, amber, red: tighter than the limit
- Breach: ALCO, diagnose, then CFP actions

IN THE LESSON

- Here is what to remember.
- A sound early warning indicator is leading, measurable, relevant, diversified and calibrated.
- On the guidance, the B C B S issued its Principles for Sound Liquidity Risk Management and Supervision in two thousand and eight, and in the United States the O C C, the Federal Reserve and the F D I C, with other agencies, issued the Interagency Policy Statement in two thousand and ten.
- The O C C's Comptroller's Handbook gives examiners the detail.
- In use, each indicator has green, amber and red thresholds, tighter than the limit to buy lead time.
- A breach goes to A L C O, management diagnoses the cause, and then decides on contingency funding plan actions.

29 Try three quick questions

1. Ratio 140%, falls 4 points a week. Amber 120%, limit 100%. Lead time from amber?
   Answer: Amber at week 5, limit at week 10: 5 weeks.
2. Signals in 15 of 20 pre-stress weeks and 18 of 180 calm weeks. Miss and false-alarm rates?
   Answer: Missed 5 ÷ 20 = 25%. False alarms 18 ÷ 180 = 10%.
3. Who issued the 2008 Principles for Sound Liquidity Risk Management and Supervision? EWIs tied to what?
   Answer: The BCBS. Tied to the CFP.

IN THE LESSON

- Now try three quick questions.
- Pause the video, think, then listen to the answers.
- Question one.
- A coverage ratio is one hundred and forty per cent and falls four points a week.
- Amber is at one hundred and twenty and the limit at one hundred.
- How much lead time does amber give?
- Amber comes after five weeks and the limit after ten, so five weeks.
- Question two.
- In a back test, an indicator signals in fifteen of twenty weeks before a stress, and in eighteen of one hundred and eighty calm weeks.
- What are its missed signal and false alarm rates?
- Twenty five per cent and ten per cent.
- Question three.
- Who issued the two thousand and eight Principles for Sound Liquidity Risk Management and Supervision, and what must indicators be tied to?
- The B C B S, and the contingency funding plan.