BANK MANAGEMENT · CREDIT MANAGEMENT

Quantitative Techniques in Credit Management

A Detailed Breakdown with Worked, Scenario-Based Practical Examples

Running Scenario: ABC Manufacturing Ltd : $500,000 Term Loan

ABC Manufacturing Ltd

Borrower: A mid-sized manufacturer of plastic packaging.
Request: A $500,000 term loan (5-year tenor) to buy new moulding equipment.

Financial statements submitted (most recent year-end, $)

Balance Sheet Item	Amount ($)
Cash & bank	100,000
Receivables	250,000
Inventory	300,000
Other current assets	150,000
Total current assets	800,000
Net fixed assets	1,200,000
Total assets	2,000,000
Current liabilities	400,000
Long-term debt	800,000
Total liabilities	1,200,000
Shareholders' equity	800,000

Income Statement Item	Amount ($)
Sales revenue	3,000,000
Cost of goods sold	2,100,000
Gross profit	900,000
Operating expenses	500,000
EBIT (operating profit)	400,000
Interest expense	100,000
Earnings before tax	300,000
Tax (30%)	90,000
Net profit after tax	210,000
Depreciation (in opex)	80,000
Retained earnings (b/s)	300,000

We'll refer back to these figures repeatedly : every technique below draws on the same underlying data, but asks a different question of it.

Ratio Analysis : What It Is

Ratio analysis restates raw financial-statement numbers as relationships, so the credit officer can judge a borrower's financial health in a way that is comparable across companies and over time. The slide deck groups ratios into five categories; each answers a different credit question.

1. **Liquidity**
   Can it pay its short-term bills?
2. **Leverage / Solvency**
   How much does it rely on debt?
3. **Profitability**
   Does it earn enough, and how efficiently?
4. **Coverage**
   Can cash flow actually service the debt?
5. **Efficiency / Activity**
   How well does it use its assets?

Each ratio category below is worked through using ABC Manufacturing's own figures from the Running Scenario, with a credit verdict at the end of each.

Sections that follow:

1.1 Liquidity Ratios

1.2 Leverage / Solvency Ratios

1.3 Profitability Ratios

1.4 Coverage Ratios

1.5 Efficiency / Activity Ratios

Liquidity Ratios

Current Ratio = Current Assets ÷ Current Liabilities

Quick (Acid-Test) Ratio = (Current Assets − Inventory) ÷ Current Liabilities

Worked Example

Current Ratio = 800,000 ÷ 400,000 = 2.0

Quick Ratio = (800,000 − 300,000) ÷ 400,000 = 500,000 ÷ 400,000 = 1.25

Credit Interpretation

A current ratio of 2.0 means ABC has $2 of short-term assets for every $1 of short-term debt , comfortably above the conventional 1.5–2.0 benchmark for manufacturers. The quick ratio of 1.25 confirms the company isn't relying on selling inventory to meet obligations.

Verdict: Pass — good liquidity cushion

Leverage / Solvency Ratios

Debt-to-Equity Ratio = Total Debt ÷ Shareholders' Equity

Debt-to-Assets Ratio = Total Debt ÷ Total Assets

Worked Example

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Debt-to-Equity  =  1,200,000 ÷ 800,000  =  1.5 : 1
Debt-to-Assets  =  1,200,000 ÷ 2,000,000  =  0.60  (60%)
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Credit Interpretation

For every $1 of equity, ABC carries $1.50 of debt, and 60% of its asset base is debt-financed , moderate-to-somewhat-high leverage (many banks look for D/E below 2:1). Adding the new $500,000 loan would push debt to 1,700,000, raising D/E to about 2.13:1; the new loan should be stress-tested against this rise in leverage.

Verdict: Acceptable now — stress-test the new loan

Profitability Ratios

Gross Profit Margin = Gross Profit ÷ Sales **Net Profit Margin = Net Profit ÷ Sales**

ROA = Net Profit ÷ Total Assets **ROE = Net Profit ÷ Shareholders' Equity**

Worked Example

Gross Margin = 900,000 ÷ 3,000,000 = 30% Net Margin = 210,000 ÷ 3,000,000 = 7%

ROA = 210,000 ÷ 2,000,000 = 10.5% ROE = 210,000 ÷ 800,000 = 26.25%

Credit Interpretation

A 30% gross margin suggests decent pricing power/cost control, and a 26.25% ROE means shareholders are earning a strong return; partly because leverage is amplifying returns (and would equally amplify losses if profits fell).

Verdict: Healthy, but ROE is leverage-boosted

Coverage Ratios

Interest Coverage Ratio = EBIT ÷ Interest Expense

DSCR = Cash Available for Debt Service ÷ Total Debt Service (Principal + Interest)

Worked Example

Interest Coverage = 400,000 ÷ 100,000 = 4.0 times

DSCR = (400,000 EBIT + 80,000 Depreciation) ÷ 250,000 = 480,000 ÷ 250,000 = 1.92

Credit Interpretation

Interest coverage of 4x means operating profit covers interest nearly four times over; comfortable (banks typically want ≥2–3x). DSCR of 1.92 means ABC generates almost $2 of debt-servicing cash for every $1 it owes, well above the typical 1.20–1.25x minimum. Often the single most important ratio for a term-loan decision, because it looks at cash, not accounting profit.

Verdict: Strong coverage

Efficiency / Activity Ratios

Inventory Turnover = COGS ÷ Avg. Inventory

Receivables Turnover = Sales ÷ Avg. Receivables

Avg. Collection Period = 365 ÷ Receivables Turnover

Asset Turnover = Sales ÷ Total Assets

Worked Example

Inventory Turnover = 2,100,000 ÷ 300,000 = 7.0× (≈ every 52 days)

Receivables Turnover = 3,000,000 ÷ 250,000 = 12.0× → Collection Period = 365 ÷ 12 ≈ 30 days

Total Asset Turnover = 3,000,000 ÷ 2,000,000 = 1.5 times

Credit Interpretation

ABC turns over inventory roughly every 52 days and collects receivables in about 30 days, both reasonable for a manufacturer and suggesting no obvious build-up of slow-moving stock or bad debt risk.

Verdict: Efficient working-capital cycle

Ratio Analysis : Overall Verdict

Category	Key Result	Status
Liquidity	Current 2.0 / Quick 1.25	✓ Pass
Leverage	D/E 1.5:1 / D/A 60%	⚠ Watch
Profitability	Net margin 7% / ROE 26.25%	✓ Pass
Coverage	Interest cover 4.0x / DSCR 1.92	✓ Pass
Efficiency	Inventory 52 days / Collection 30 days	✓ Pass

On ratios alone, ABC looks like a bankable, if moderately leveraged, borrower.

Cash-Flow Analysis — Base Case

Because "loans are repaid from cash, not accounting profit," banks build a cash-flow forecast to test whether the borrower will have cash on hand, when needed, to make each repayment under both a base case and a stressed case. ABC's $500,000 loan is repaid over 5 years at 10% interest, ≈ $127,400/year.

Base-Case Projected Cash Flow — Year 1	Amount ($)
Operating cash flow (Net profit + Depreciation)	290,000
Add: incremental profit from new equipment (est.)	+150,000
Total cash available for debt service	440,000
Less: existing debt service	(250,000)
Less: new loan debt service	(127,400)
Net free cash flow after all debt service	62,600

Combined DSCR (base case)

`440,000 ÷ 377,400`

= 1.17

Thinner than the 1.92 on existing debt alone — close to many banks' 1.20–1.25x minimum, so this would be flagged for closer scrutiny.

Base case: adequate but thin

Cash-Flow Analysis — Stressed Scenario

What if the new equipment underperforms and only delivers half the expected profit uplift, and sales dip 10%?

Stressed Projected Cash Flow	Amount ($)
Operating cash flow (reduced ~10% by sales fall)	261,000
Add: incremental profit from equipment (halved)	+75,000
Total cash available for debt service	336,000
Less: total debt service (existing + new)	(377,400)
Net free cash flow	(41,400) — shortfall

Stressed DSCR

336,000 ÷ 377,400 = 0.89

Below 1.0

A cash shortfall of about $46,000 in the downside case.

Credit Interpretation

This is the key output of cash-flow/sensitivity analysis: it doesn't just ask "is the base case fine?" but "how much room for error is there?"

Approve only with a buffer — e.g. require a cash reserve/covenant, extend tenor to reduce annual instalments, or request additional collateral, because the base case is only marginally adequate and the downside case shows a shortfall.

Verdict: Approve with a buffer/covenant

Credit Scoring Models

A statistical, point-based system that converts borrower characteristics (income, employment, existing debt, repayment history) into a single score predicting default probability. Used heavily for consumer and small-business lending, where volumes are too high for individualised analysis of every application.

Worked Example — Consumer Loan Applicant

Factor	Applicant's Situation	Points
Monthly income	$2,800/month	15 / 25
Employment stability	6 years, current employer	25 / 25
Existing debt-to-income	25%	10 / 20
Repayment history (bureau)	No defaults on record	20 / 20
Years as bank customer	4 years	10 / 10

Total Score: 80 / 100

Score Bands

80–100 Low risk → Approve at standard rate

60–79 Medium risk → Approve with conditions

< 60 High risk → Decline / manual review

Credit interpretation: The applicant scores 80/100 — the "Low risk" band. Scoring compresses several qualitative-feeling factors into one comparable number, which is what makes it fast enough for high-volume retail lending.

Verdict: Approve

Altman's Z-Score

A multivariate statistical model combining five weighted financial ratios into a single score predicting the probability of corporate bankruptcy within roughly the next two years.

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 1.0X_5$$

Var.	Ratio	Calculation	Value
X_1	Working Capital ÷ Total Assets	(800,000 − 400,000) ÷ 2,000,000	0.20
X_2	Retained Earnings ÷ Total Assets	300,000 ÷ 2,000,000	0.15
X_3	EBIT ÷ Total Assets	400,000 ÷ 2,000,000	0.20
X_4	Book Equity ÷ Total Liabilities	800,000 ÷ 1,200,000	0.667
X_5	Sales ÷ Total Assets	3,000,000 ÷ 2,000,000	1.50

$$Z = 1.2(0.20) + 1.4(0.15) + 3.3(0.20) + 0.6(0.667) + 1.0(1.50) = 0.24 + 0.21 + 0.66 + 0.40 + 1.50$$

Z = 3.01

Safe zone (> 2.99)

Interpretation bands: Z > 2.99 Safe · 1.81–2.99 Grey (needs closer analysis) · Z < 1.81 Distress

Just inside the "Safe" zone — consistent with the healthy liquidity/coverage picture from ratio analysis. But since it's only marginally above the threshold, the bank should still run the cash-flow stress test as a second check, not rely on Z-Score alone.

Internal Credit Ratings

Banks translate the outputs of quantitative techniques plus qualitative judgement (5 Cs, CAMPARI, management, industry outlook) into a single internal risk grade (e.g. AAA to D), which drives loan pricing, provisioning, and approval authority.

Input	Weight	ABC's Result	Weighted
Financial ratios (liquidity, leverage, profitability, coverage)	40%	85 / 100	34.0
Altman Z-Score band	20%	90 / 100	18.0
Cash-flow / DSCR stress test	20%	65 / 100	13.0
Qualitative (5 Cs / CAMPARI / management)	20%	80 / 100	16.0

Total Weighted Score: 81.0 / 100 → Grade A / BBB

Score	Grade	Meaning
90–100	AAA / AA	Minimal risk
75–89	A / BBB	Low-to-moderate risk — standard approval
60–74	BB / B	Watch list — senior approval, tighter covenants
< 60	CCC and below	High risk — decline or workout unit

ABC scores 81/100 (A/BBB — low-to-moderate risk): approvable at standard branch/regional credit-committee level, priced at a modest risk premium, with standard (not enhanced) provisioning. This rating is a weighted synthesis of everything computed in the sections before it.

Collateral Valuation Loan-to-Value

A quantitative check on the market value, liquidity, and loan-to-value (LTV) ratio of pledged collateral, including a "haircut" (margin) for the fact that a forced sale typically realises less than open-market value.

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LTV Ratio = Loan Amount ÷ Value of Collateral (after haircut)
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Worked Example

ABC pledges its factory building. Open-market valuation: $900,000. The bank applies a standard 30% haircut for forced-sale risk on industrial property.

Step	Result
Open-market value	$900,000
Forced-sale value = 900,000 × (1 − 0.30)	$630,000
LTV = 500,000 ÷ 630,000	≈ 79.4%

LTV ≈ 79.4%

Above the typical 60–75% cap for commercial/industrial property.

Options: (a) reduce the loan to fit a 70% LTV cap — 630,000 × 0.70 = $441,000 max; (b) require additional collateral (equipment, receivables) to bring blended LTV down; or (c) accept the higher LTV but price in a risk premium — the cash-flow analysis already showed the loan is bankable on a going-concern basis, with collateral as the fallback, not the primary repayment source.

Break-Even and Sensitivity Analysis

Used especially for project and business loans: break-even identifies the sales level at which revenue exactly covers costs; sensitivity tests how changes in key variables affect repayment capacity.

Break-Even Calculation	Result
Selling price per unit	$50
Variable cost per unit	$30
Contribution margin per unit	$20
Additional fixed costs (new equipment)	$120,000 / yr
Break-even volume = 120,000 ÷ 20	6,000 units
Break-even sales = 6,000 × $50	$300,000

Margin of Safety

`(15,000 − 6,000) ÷ 15,000`

= 60%

Based on a projected 15,000 units in Year 1 vs. 6,000 needed to break even.

Sensitivity Test — 30% Sales Shortfall (10,500 units)

`Revenue 525,000 − Variable costs 315,000 = Contribution 210,000 − Fixed costs 120,000 = Net contribution $90,000 — still comfortably above break-even.`

Even a 30% sales shortfall keeps ABC well above break-even (10,500 vs. 6,000 units required). Combined with the cash-flow stress test, the picture is: the equipment/project itself is low-risk, but the combined debt burden (existing + new loan) needs a buffer — a good example of why banks run several quantitative techniques together rather than relying on just one.

Verdict: Resilient to a sales downturn

PUTTING IT ALL TOGETHER

ABC Manufacturing Ltd — Credit Decision Summary

Technique	Result	Verdict
Ratio analysis	Strong liquidity, moderate leverage, healthy profitability & coverage	✓ Pass
Cash-flow (base case)	DSCR 1.15	⚠ Watch
Cash-flow (stress case)	DSCR 0.88 — shortfall	⚠ Watch
Altman's Z-Score	3.01 (Safe zone)	✓ Pass
Internal credit rating	81/100 (A/BBB grade)	✓ Pass
Collateral LTV	≈79.4% (above typical 70% cap)	⚠ Watch
Break-even & sensitivity	60% margin of safety; resilient to 30% sales drop	✓ Pass

Overall Recommendation: Approve

Structure the facility to address the amber flags — cap the loan (or require extra collateral) so LTV stays near 70%, and build in a debt-service reserve covenant or slightly longer tenor to widen the DSCR buffer under stress. No single technique decides alone — they're triangulated together, synthesised into the internal rating that drives pricing and approval authority.