CREDIT RISK

Most important risk for Lendig FI: if inadequate then default rates grow => could push BNK into insolvency
high probability of limited upside payoff — as in loans you cannot be paid more that Coupon + Par
low probability of large loss — you screen + add covenants or collaterals

Observations on Credit Risk
- Credit Quality is cyclical — recession -> high % of default; booming -> low % of default
- Minor adjustment to the expected losses of loans have major effects on Net Income
  - The write off of a substantial portion of the portfolio could render the FI insolvent

Individual Loan Risk: default Risk Models

◊ The Five C's of Credit
- Character — creditor past
- Cash Flows
- Capital
- Collateral
- Conditions — what happen in the worst case?

◊ qualitative models:
- maket specific
- borrower specific

business cycle based
interest rate based
experience based
require long history
often non validated

◊ Ratio Analysis
- Liquidity = Total dollar value of cash and marketable securities divided by current liabilities
- Solvency = total net worth (A-L) / total assets.
- Profitability = ROE, ROI, Net profit Margin, Gross Profit Margin
- Turnover = COGS / av Inventory
- Book to Market = BF of Firm / MV of Firm

◊ Proforma Analysis — basen on expected sales (for corporations)

◊ credit score modeling: linear discriminant model

Z-score =ß1 (NWC / TA) + ß2 (R/E / TA) + ß3 (EBIT / TA) + ß4 (MV of E / BV of D) + ß5 (Sales / TA)

- Z > 2.99 — low risk borrower
- 2.99 > Z > 1.8 — avarage risk
- 1.8 > Z — high risk: change strategy or go to finance companies

- gives a low default rate
- doesn't recognize:
  - non monotonic relationships
  - non linear relationships

Ratio analysis: quality of Loan

◊ *Prov for LL %* = Prov LL / av TA — if growing
- existing loas are more risky
- moving in more risky areas
- more conservative policies

◊ *Credit Loss Coverage* = (EBT + Prov LL) / Prov LL
- EBT = earning before taxes
- (EBT + prov LL) is a kind of operating profit

◊ Reserve for LL/ TA **Note that it is NOT avarage TA**
- represents the % of TA that can be decleared uncollectible
- higher -> lower quality loans

◊ *Net Charge off* = (Loans written-offs - Collectible bad loans) / av TA
- higher -> lower quality loans

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Pricing the Loan- Marginal Cost of Funds or Wacc

Loans	DD
	Savings
	TD
	Debt
	Equity

} Capital structure of the institution raised and invested in Financial Assets

in the analysis, rates are before taxes

Cost of Equity Ke = D1/ Price + g [gordon model]

Ke = Rf + ßs (E(Rm)-Rf) [CAPM]

Rf = t-Bill

ßs < 1 for banks, it is a defensive stock; I-bank has ßs <= 1

(E(Rm)-Rf) = MKT premium ≈ 7.5 for canadian FI

≈ 5.5 for US' FI

Cost of Debt Kb = YTM

Cost of Time Deposit and Savings $Kds = \frac{\text{Cost of Servicing Accounts + Interests}}{\text{Av. Deposits - Reserve}}$ (amount to be lent)

Cost of non Interest Bearing Deposits $Kd = \frac{\text{Cost of Servicing Accounts + Interests}}{\text{Av. Deposits - Reserve}}$

$$Wacc = Kd * \frac{\text{Av Dep - Res}}{\text{TA - Res}} + Ksd * \frac{\text{Av Dep - Res}}{\text{TA - Res}} + Kb * \frac{B}{\text{TA - Res}} + Ke * \frac{E}{\text{TA - Res}}$$

Base Lending Rate = Marginal Costs of Funds + Administrative costs of the Loan + Profit Goal
(Wacc)

=> Base L = Wacc + Adm + profit

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Evaluation of WACC, BR (Base Lending Rate), Return (Lending Rate)

			costs				
sources	Dep	Dep-Res	Interest	Oper exp	K(s)	costs	
DD	60	53	1	3	7.55%	2.31%	Net: what is available for loan
TD	100	96	5.5	1.5	7.29%	4.05%	
Bonds	10	10	0.9		9.00%	0.52%	
Equity	14	14			22.22%	0.00%	
TA =	184					6.88%	**MCF (marginal costs of funds) = WACC**
	TA - Res =	173					evaluated as the weighted avarage of Cost % over NET

Bond is selling @ Par => YTM = Cr

Equity: D1= 4 $/Share

P/Sh = 50

g = 4%

Tc = 46% (Tax rate)

Ke = 12.00% **(after tax)** = D1/ P/Sh + g

Ke = 22.22% **(before tax)** = Ke(after taxes) / (1-Tc)

Loan rate = Base L + m = [WACC + Adm costs + goal profit] + risk premium

Adm. Cost of loan 1%

Risk Premium 3% m

Profit Goal 2%

Base Lending Rate 9.88% *Base L*

Lending Rate 12.88%

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Profitability of the Loan (ROA) = Return of a Loan

Base L	12%		Base L	obtained from "Pricing the Loan" or from "term structure"
Risk Premium	200	[bp]	m	income for Loan
Origination fees	0.125%		f	
compensating balances	10%		b	investiment of borrower
reserve requirement	10%	of b	R	perceived by BNK as a tax on profitability
Loan amount	100,000	[$]	Loan	

Income for Loan	12,000	*base L*
	2,000	*m*
	125	*f*
	14,125	

= Loan Rate

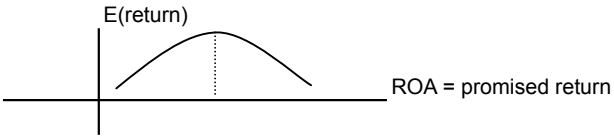
Amount Invested	100,000	*Loan*
	(10,000)	*b*
	1,000	*R*
	91,000	

$$ROA = \frac{f + Base\ L + m}{1 - [\,b\,(1-R)]} \quad <= \quad 0.1552 \quad = \frac{Income\ for\ Loan}{Amount\ Invested}$$

ROA is the contractually promised return

E(return)= p (ROA+1) -1

(1-p) = prob of default



=> BNKs must set m high enough to compensate for default risk

regognize that set high m, high f, high Base L, increase (1-p)

… but ROA doesn't assume risk

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CREDIT RISK MEASUREMENT: Risk Adjusted Return On Capital

$$\text{RAROC} = \frac{\text{One year net pretax income on the loan}}{\text{Capital at Risk}}$$

Capital at Risk

◊ *Extreme loss Rate* % of loan not recovered in case of default

Loan * (1-recovery rate) * EDR

recovery rate = proportion of Loan recaptured

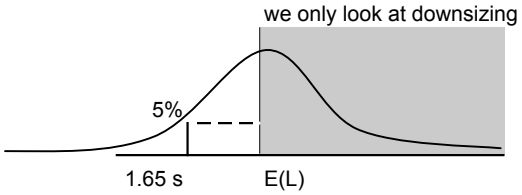
EDR = extreme default rate = 99% percentile historic default rate

◊ *Duration* $\Delta L = -DL * L * \Delta r/(1+r)$

where r is the current rate

Δr = MAX (Δ(r-bond - r-tbill) >0)

◊ *Value at Risk* VAR(%, 1yrs)



VAR(1%, 1 yr) = 2.33 s

VAR(5%, 1 yr) = 1.65 s

s (sigma) is most of the time based on historical data

5% represents 1 potential loss in 20 years

1% represents 1 potential loss in 100 years

Example

cost rate of providing the loan	10.30%
recovery rate	25%
extreme default rate	3%

one year net pretax income on the loan	4,752	= income for Loan - amount invested * rate cost
Capital at risk (extreme loss)	2,250	= principal * (1-recovery rate) * extreme default rate
RAROC =	2.1120	

ROE is used as BCHMK

if RAROC > ROE => we are adding value

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CREDIT RISK MEASUREMENT: Term Structure Derivation of Credit Risk

g = 0.900

yrs	yield yi	yield k	fw(i)	fw(k)	p	phi	Cp
1	0.100	0.158	0.1000	0.1580	0.950	0.006	0.0501
2	0.110	0.180	0.1201	0.2024	0.932	0.008	0.1151
3	0.115	0.192	0.1251	0.2041	0.934	0.007	0.1732
4	0.118	0.200	0.1270	0.2081	0.933	0.008	0.2287

yi = yield for a ZCB t-bill **(SPOT RATE)** 0.058
k = yield for a ZCB Corporate **(SPOT RATE)** 0.070
g = proportion of loan's principal collectible on default = recovery rate 0.077
phi = risk premium 0.082
0.000

p = implied probability of repayment of the security
= 1+fw(i) / 1+ fw(k)
=> expected prob of default = (1-p)

1 + yi = (1-p) g (1+k) + p(1+k)
phi = f (k, yi, g)

Cp = Cumulative probability of default between year 0 and year (I)
= 1 - Π (p)

CREDIT RISK MEASUREMENT: Mortality Rate Derivation

risk measurement through the historic mortality rate
marginal mortality rate (MMR) = prob of default in a given year after issue

$$MMR1 = \frac{\text{total value of Bonds defaulting in year 1}}{\text{total value of Bonds outstanding year 1}}$$

$$MMR(i) = \frac{\text{total value of Bonds defaulting in year i}}{\text{total value of Bonds outstanding year i}}$$

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