Economics 435
Fall 2021
University of Wisconsin-Madison

Menzie D. Chinn
Social Sciences 7418

Notes on Bank Balance Sheets

Table 12.3 Risks Banks Face and How They Manage Them

Type of Risk	Source of Risk	Recommended Responses
Liquidity Risk	Sudden withdrawals by depositors or takedowns of credit lines	1. Hold sufficient cash reserves to meet customer demand. 2. Manage assets–sell securities or loans (contracts the size of the balance sheet) 3. Manage liabilities–attract more deposits (maintains the size of the balance sheet)
Credit Risk	Default by borrowers on their loans	1. Diversify to spread risk. 2. Use statistical models to screen for creditworthy borrowers. 3. Monitor to reduce moral hazard.
Interest-Rate Risk	Mismatch in maturity of assets and liabilities coupled with a change in interest rates	1. Closely match the maturity of both sides of the balance sheet. 2. Use derivatives such as interest-rate swaps.
Trading (Market) Risk	Trading losses in the bank's own account	Closely monitor traders using risk management tools, including value at risk.

Liquidity Risk

Figure 12.6 Balance Sheet of a Bank Following a $5 Million Withdrawal and Asset Adjustment

Withdrawal Is Met by Selling Securities

Assets		Liabilities	
Reserves	$10 million	Deposits	$95 million
Loans	$100 million	Borrowed funds	$30 million
Securities	$35 million	Bank capital	$20 million

Withdrawal Is Met by Reducing Loans

Assets		Liabilities	
Reserves	$10 million	Deposits	$95 million
Loans	$95 million	Borrowed funds	$30 million
Securities	$40 million	Bank capital	$20 million

Deposits initially at $100m; Loans at $100m, Securities at $40m

Figure 12.7 Balance Sheet of a Bank Following a $5 Million Withdrawal and Liability Adjustment

Withdrawal Is Met by Borrowing

Assets		Liabilities	
Reserves	$10 million	Deposits	$95 million
Loans	$100 million	Borrowed funds	$35 million
Securities	$40 million	Bank capital	$20 million

Withdrawal Is Met by Attracting Deposits

Assets		Liabilities	
Reserves	$10 million	Deposits	$100 million
Loans	$100 million	Borrowed funds	$30 million
Securities	$40 million	Bank capital	$20 million

Deposits initially at $100m; borrowed funds at $30m.

Credit Risk and Capital Adequacy

Consider two banks: one with high capital and one with low capital.

Commercial Bank (Before)			
Assets		Liabilities	
Reserves	$10M	Deposits	$90M
Loans (Mortgages, CRE) T-Bills Other bonds (GSEs)	$90M	Bank Capital (or "equity"	$10M

Commercial Bank (After)			
Assets		Liabilities	
Reserves	$10M	Deposits	$90M
Loans (Mortgages, CRE) T-Bills Other bonds (GSEs)	$81M	Bank Capital (or "equity")	$01M

A $9 million loss leaves the high capital bank still solvent. However, the low capital bank is not so fortunate. In the case illustrated below, a $9 million loss wipes out bank capital. Since the loss exceeds the capital, the rest of the loss is incurred on the depositors.

Commercial Bank (Before)			
Assets		Liabilities	
Reserves	$10M	Deposits	$95M
Loans (Mortgages, CRE) T-Bills Other bonds (GSEs)	$90M	Bank Capital (or "equity"	$5M

Commercial Bank (After)			
Assets		Liabilities	
Reserves	$10M	Deposits	$91M
Loans (Mortgages, CRE) T-Bills Other bonds (GSEs)	$81M	Bank Capital (or "equity")	$0M

ROA = after tax profit/assets
ROE = after tax profits/capital
Net interest margin = net interest income/assets

Assume interest rate on assets is 5%, interest rate on deposits is 2%. Now compare the two ROE's.

ROE for high capital bank: $((0.05-0.02)\times 90)/10 = 2.7/10 = 0.27$ (27%)
ROE for low capital bank: $((0.05\times 90)-(0.02\times 95))/5 = (4.5-1.9)/5 = 2.6/5 = 0.52$ (52%)

Hence there is an incentive to have high leverage.

<u>Interest Rate Risk</u>

Table 12.2 An Example of Interest-Rate Risk

The impact of an interest-rate increase on bank profits (per $100 of assets)

	Assets	Liabilities
Interest-rate sensitive	$20	$50
Not interest-rate sensitive	$80	$50
Initial interest rate	5%	3%
New interest rate on interest-rate-sensitive assets and liabilities	6%	4%
	Revenue from Assets	**Cost of Liabilities**
At initial interest rate	(0.05 × $20) + (0.05 × $80) = $5.00	(0.03 × $50) + (0.03 × $50) = $3.00
After interest-rate change	(0.06 × $20) + (0.05 × $80) = $5.20	(0.04 × $50) + (0.03 × $50) = $3.50
Profits at initial interest rate: ($5.00) – ($3.00) = $2.00 per $100 in assets		
Profits after interest-rate change: ($5.20) – ($3.50) = $1.70 per $100 in assets		

Gap Analysis

Gap between interest-rate-sensitive assets and interest-rate-sensitive liabilities:

(Interest-rate-sensitive assets of $20) – (Interest-rate-sensitive liabilities of $50) = (Gap of –$30)

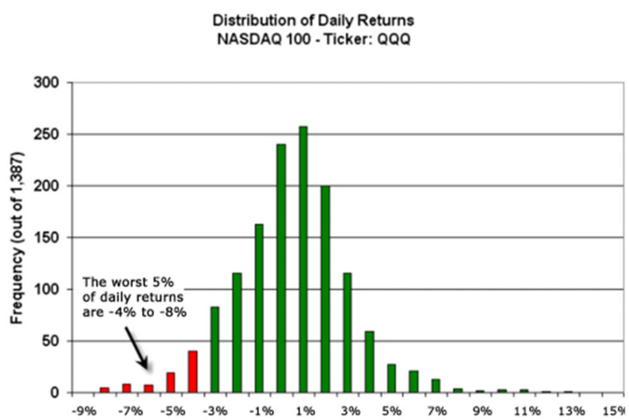
Trading Risk

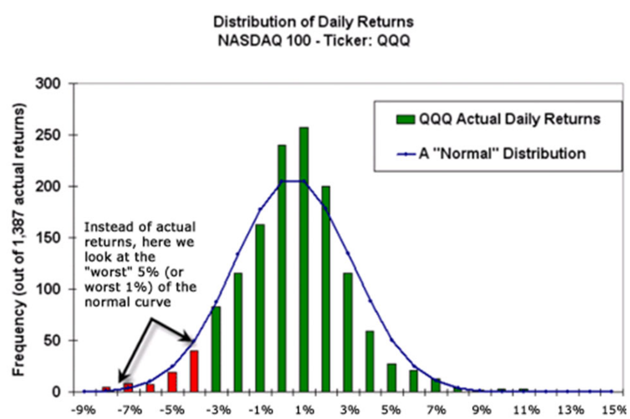
Value at Risk (VaR): What is the most I can - with a 95% or 99% level of confidence - expect to lose in dollars over the next month (or quarter or year)?
http://www.investopedia.com/articles/04/092904.asp#axzz29y4NhSHp

Using the distribution of returns, one can answer this question. The issue is how to obtain the estimate the distribution. There are three approaches:

- Historical
- Variance-Covariance: assume Normal distribution, or mixture of Normals
- Monte Carlo: simulate distributions

Assume for the moment all that is being held in the portfolio is a single stock. Then one can examine the returns of this single stock.





In general, portfolios include more than one asset, so one would need to examine the distribution of returns for the portfolio. This depends upon the variances and most importantly covariances of the returns of the individual assets. When these are stable, then one can proceed as illustrated above.

This approach to risk management became quite popular in the mid-1990's, particularly in the form of JP Morgan's *RiskMetrics*.

There are many potential issues to contend with; for the approach to be accurate, especially when using the Variance-Covariance approach. With many assets in a typical portfolio, precise estimation of the covariances can be difficult (even if they remain stable over time). Also, the variance-covariance approach assumes that Normal distributions (or mixture of Normals) can properly describe asset returns.

For more, see Aswath Damodaran (NYU) notes on VaR:
http://people.stern.nyu.edu/adamodar/pdfiles/papers/VAR.pdf