

Managing Liquidity Risk

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Learning Outcome

- Understand the concept of liquidity
- Describe the relationships between cash holdings and liquidity requirements
- Demonstrate the requirements for meeting legal reserves.
- Demonstrate the requirement for Basel III Liquidity Coverage Ratio
- Explain the conditional pricing on bank's deposit

Liquidity

Liquidity describes the degree to which an asset or security can be quickly bought or sold in the market at price reflecting its intrinsic value.

Liquidity is also a measure of the extent to which bank has cash to meet immediate and short-term obligations

Liquidity Scale



Liquidity (Cont.)

- One of the most important tasks the management of any bank faces is ensuring adequate liquidity at all times.
- A bank is considered to be “liquid” if it has ready access to immediately spendable funds at reasonable cost at precisely the time those funds are needed.
- Lack of adequate liquidity can be one of the first signs that a bank is in trouble.
- A bank can be closed if it cannot raise sufficient liquidity even though, technically, it may still be solvent.

The Demand for and Supply of Liquidity

- **Demands for Liquidity**
 - Customer deposit withdrawals
 - Credit requests from quality loan customers
 - Repayment of non-deposit borrowings
 - Operating expenses and taxes
 - Payment of stockholder dividends

The Demand for and Supply of Liquidity (Cont.)

- **Supplies of Liquid Funds**
 - Incoming customer deposits
 - Revenues from the sale of non-deposit services
 - Customer loan repayments
 - Sales of bank assets
 - Borrowings from the money market

The Demand for and Supply of Liquidity (Cont.)

These various sources of liquidity demand and supply come together to determine each financial firm's net liquidity position at any moment in time

$$\begin{array}{c}
 \text{A financial firm's} \\
 \text{net liquidity} \\
 \text{position} \\
 (L_t)
 \end{array}
 =
 \begin{array}{c}
 \text{Supplies of Liquidity Flowing into the Financial Firm} \\
 \hline
 \begin{array}{ccccc}
 \text{Incoming} & \text{Revenues from} & \text{Customer} & \text{Sales of} & \text{Borrowings} \\
 \text{deposits} & \text{the sale of} & \text{loan} & \text{assets} & \text{from the} \\
 \text{(inflows)} & \text{nondeposit} & \text{repayments} & & \text{money} \\
 & \text{services} & & & \text{market}
 \end{array} \\
 + \\
 \hline
 \text{Demands on the Financial Firm for Liquidity} \\
 \hline
 \begin{array}{ccccc}
 \text{Deposit} & \text{Volume of} & \text{Repayments} & \text{Other} & \text{Dividend} \\
 \text{withdrawals} & \text{acceptable} & \text{of} & \text{operating} & \text{payments} \\
 \text{(outflows)} & \text{loan requests} & \text{borrowings} & \text{expenses} & \text{to} \\
 & & & & \text{stockholders}
 \end{array}
 \end{array}$$

Liquidity Deficit is $L_t < 0$ and Liquidity Surplus is $L_t > 0$

Why Banks Often Face Significant Liquidity Problems

- Liability-side liquidity risk occurs when depositors or policyholders cash in claims
 - With low cash holdings, bank may be forced to liquidate assets too rapidly
 - Faster sale may require fire-sale price
- Asset-side liquidity risk can result from off-balance-sheet loan commitments
 - Liquidity requirements from the borrowing of funds can be met by the bank's running down cash assets, selling liquid assets, or additional borrowing

Regulator's Concerns on Banks' liquidity

Banks play a central role in maintaining the payment process, reputation and public confidence in the system.

As a result, regulators prefer banks to hold more liquid assets because this ensures that they are able to withstand unexpected and sudden withdrawals.

Regulators can also conduct monetary policy by influencing the money supply through liquidity assets held by banks.

Having banks hold cash in the vault or cash reserves at the central bank requires banks to transfer resources to the central bank.

Reserve Balances at the Federal Reserve Bank

- Banks hold deposits at the Federal Reserve:
 - because the Federal Reserve imposes legal reserve requirements and deposit balances qualify as legal reserves.
 - to help process deposit inflows and outflows caused by check clearings, maturing time deposits and securities, wire transfers, and other transactions.

Required Reserves and Monetary Policy

- Purpose of required reserves is to enable Federal Reserve to control the nation's money supply.
- The Fed has three distinct monetary policy tools:
 - **Open market operations.** Sale or purchase of U.S. government securities in the open market is Fed's most flexible means of carrying out policy objectives.
 - **Discount window** borrowing occurs when banks borrow directly from the Feds. Changes in the discount rate directly affect the cost of borrowing.
 - **Changes in the reserve requirement** impact the amount that banks can lend.

Required Reserves and Monetary Policy (cont.)

The effect on the banking system of an injection of \$5m of money, under a reserve ratio of 20%

	Change in deposits, \$m	Change in loans, \$m	Change in reserves, \$m
Bank A	5.00	4.00	1.00
Bank B	4.00	3.20	0.80
Bank C	3.20	2.56	0.64
Bank D	2.56	2.05	0.51
Bank E	2.05	1.64	0.41
Bank F
Bank G
Total of all banks	25	20	5

Credit multiplier is one over the reserve ratio,
therefore in this case $= 1 \div 0.20 = 5$

Meeting Legal Reserve Requirements

- Required reserves are calculated over a two-week period.
 - Bank does not have to hold a specific amount of cash each day but a minimum amount over a longer period.
- Fed follows a lagged reserve accounting system (LRA) which requires banks to hold reserves against deposit balances from 3-5 weeks earlier.
 - Facilitates planning but reduces Fed's ability to control the money supply and may increase interest rate volatility.

Meeting Legal Reserve Requirements (cont.)

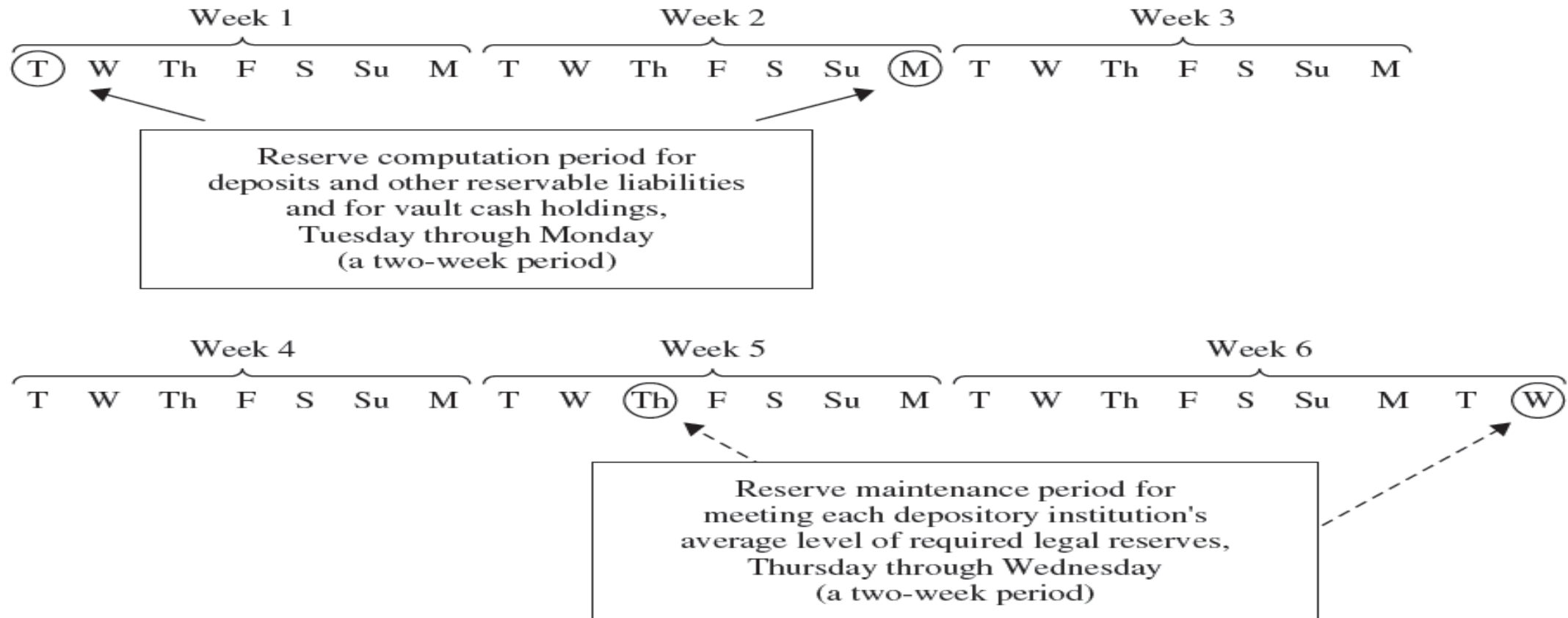
- Three elements of required reserves:
 - Dollar magnitude of base liabilities.
 - Required reserve fraction.
 - Dollar magnitude of qualifying cash assets.
- Base liabilities are composed of net transaction accounts.
 - Bank's qualifying reserve assets include vault cash, deposits held at the Federal Reserve Banks and deposits held in pass-through accounts at other institutions.

Lagged Reserve Accounting

- Computation Period (CP):
 - Consists of two one-week reporting periods beginning on a Tuesday and ending on the second Monday thereafter.
- Maintenance Period (MP):
 - Consists of 14 consecutive days beginning on a Thursday and ending on the second Wednesday thereafter.
- Reserve balance requirement to be maintained in any given 14-day MP equals:
 - Reserve requirement calculated as of the CP ending 17 days prior to the start of the MP minus vault cash as of the same CP used to calculate the reserve requirement.

Lagged Reserve Accounting (LRA)

Federal Reserve rules for calculating and maintaining required legal reserves
(Regulation D):



An Application: Reserve Calculation Under LRA

- Four steps:
 1. Calculate daily average balances outstanding during the lagged computation period.
 2. Apply the reserve percentages.
 3. Subtract vault cash.
 4. Add or subtract the allowable reserve ($\pm 4\%$) carried forward from the prior period.

Example:

EXHIBIT 11.3 Reserve Requirement Percentages for Depository Institutions Effective in 2014

Type of Deposit		Percentage
Net transactions accounts		
Exempt amount	\$13.3 million	0
Up to	\$89.0 million	3
Over	\$89.0 million	10
All other liabilities		0

Source: Board of Governors of the Federal Reserve System, Press Release, November 5, 2013.

Example (cont.)

EXHIBIT 11.5 Report of Reservable Liabilities and Offsetting Asset Balances

Balances at Close of Business Day (Millions of Dollars)																
Lagged Computation Period	Tue 10-Aug	Wed 11-Aug	Thu 12-Aug	Fri 13-Aug	Sat 14-Aug	Sun 15-Aug	Mon 16-Aug	Tue 17-Aug	Wed 18-Aug	Thu 19-Aug	Fri 20-Aug	Sat 21-Aug	Sun 22-Aug	Mon 23-Aug	Two-Week Total	Daily Average
DDAs	992	995	956	954	954	954	989	996	960	959	958	958	958	990	\$13,573	\$969.50
Auto trans. from savings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	\$0	\$0.0
NOW and Super NOW	221	221	222	223	223	223	223	224	225	225	225	225	225	225	\$3,130	\$223.57
<i>Deductions:</i>																
DD bal. from U.S. dep.	163	281	190	186	186	186	159	159	274	178	182	182	182	164	\$2,672	\$190.86
CIPC	96	96	78	78	78	78	95	98	92	79	81	81	81	88	\$1,199	\$85.64
Net trans. accounts	954	839	910	913	913	913	958	963	819	927	920	920	920	963	\$12,832	\$916.57
Vault Cash	28	30	31	33	33	33	38	30	31	32	32	32	32	36	\$451	\$32.21

Example (cont.)

EXHIBIT 11.6 Required Reserves Report, September 9–22

Reservable Liabilities for:	Daily Avg. Deposit Liab. (\$ mill)	Reserve Percentage	Daily Avg. Requirement (\$ mill)
September 9–22			
Net trans. accounts			
Exempt up to \$13.3 million	13.30	0.0%	0.000
\$13.3–\$89 million	75.70	3.0%	2.271
Over \$89 million	827.57	10.0%	82.757
Total	916.57		
Gross reserve requirement			85.028
Daily average vault cash			32.214
Net reserve requirement			52.814
Reserve carry-forward (from prior period)			(2.276)
<i>Minimum reserves to be maintained with Federal Reserve</i>			53.042
<i>Maximum reserves to be maintained</i>			61.545
$(0.10 \times 85.028) + 53.042$			

Liquidity versus Profitability

- Trade-off between liquidity and profitability.
 - The more liquid a bank is, the lower its return on equity and return on assets, all other things being equal.
 - Large holdings of cash assets decrease profits because of the opportunity loss of interest income.
 - Short-term securities normally carry lower yields than comparable longer-term securities.
 - Loans carrying the highest yields generally the least liquid.
- Liquidity planning focuses on guaranteeing that immediately available funds are available at the lowest cost.

The Relationship Between Liquidity, Credit Risk, and Interest Rate Risk

- Liquidity risk for a poorly managed bank closely follows credit and interest rate risk.
- Liquidity planning forces management to monitor overall risk position such that credit risk partially offsets interest rate risk assumed.
- Potential liquidity needs must reflect estimates of new loan demand and potential deposit losses.

Basel III and the Liquidity Coverage Ratio

- Effective in 2015, Federal Reserve Board of Governors, FDIC, and OCC proposed internationally active banks meet minimum liquidity requirement linked to holding of liquid assets:
 - Impacts banks with \$250 billion + in assets or \$10 billion + in foreign exposure on balance sheet.
- Establishes liquidity coverage ratio (LCR) measured as ratio of high-quality liquid assets to projected net cash outflows.
 - Objective is to improve large organizations' liquidity risk management.

Liquidity Coverage Ratio

Basel III requires the LCR should $\geq 100\%$

$$\frac{\text{stock of high quality assets}}{\text{total net cash outflow over the next 30 calendar days}} \geq 100\%$$

Example:

Central Bank has the following balance sheet (in millions of dollar)

Assets		Liquidity level	Liabilities and Equity		Run-off factor
Cash	<u>\$ 15</u>	Level 1	Stable retail deposits	\$190	3%
Deposits at the Fed	30	Level 1	Less stable retail deposits	70	10
Treasury bonds	145	Level 1	CDs maturing in 6 months	100	0
Qualifying marketable securities	50	Level 1	Unsecured wholesale funding from:		
GNMA bonds	60	Level 2A	Stable small business deposits	125	5
Loans to AA- corporations	540	Level 2A	Less stable small business deposits	100	10
Mortgages	285		Nonfinancial corporates	450	75
Premises	<u>40</u>		Equity	<u>130</u>	

Cash inflows over the next 30 days from the bank's performing assets are \$7.5 million.
Calculate the LCR for Central Bank.

Example (cont.)

The liquidity coverage ratio for Central Bank is calculated as follows:

Level 1 assets = \$15 + \$30 + \$145 + \$50 =	240
Level 2A assets = (\$60 + \$540) x 0.85 = \$510.00	
Capped at 40% of high-quality liquid assets = \$240 x 0.40 =	<u>96</u>
Stock of high-quality liquid assets	\$336

Cash outflows:

Stable retail deposits	\$190 x 0.03 =	\$5.70
Less stable retail deposits	\$70 x 0.10 =	7.00
CDs maturing in 6 months	\$100 x 0.00 =	0.00
Stable small business deposits	\$125 x 0.05 =	6.25
Less stable small business deposits	\$100 x 0.10 =	10.00
Non-financial corporates	\$450 x 0.75 =	<u>337.50</u>
Total cash outflows over next 30 days		\$366.45
Total cash inflows over next 30 days		<u>7.50</u>
Total net cash outflows over next 30 days		\$358.95

Liquidity coverage ratio = \$336m/\$358.95m = 93.61%. The bank is not in compliance with liquidity requirements based on the LCR.

Longer-Term Liquidity Planning

Involves projecting cash inflows and outflows over 90 days, 180 days, one year and beyond if needed.

- Objective is to ensure bank does not face an unanticipated liquidity crisis.
- Forecasts in deposit growth and loan demand required.
- Projections are separated into three categories: base trend, short-term seasonal, and cyclical values.
- Analysis assesses a bank's liquidity gap, measured as the difference between potential uses of funds and anticipated sources of funds, over monthly intervals.

Example:

EXHIBIT 11.8 Forecast of Trend, Seasonal, and Cyclical Components of Deposits and Loans

Reference Balance Sheet (Millions of Dollars)

Assets		Liabilities	
Cash and due from banks	\$160	Transactions accounts and nonnegotiable deposits	\$1,600
Loans	1,400	Certificates of deposit and other borrowing	280
Investment securities	400	Stockholders equity	120
Other assets	40	Total	\$2,000
Total	\$2,000		

Deposit Forecast	(1)	(2)	(3)	(4)	(5)
End of Month	Trend Deposits*	Seasonal Deposit Index**	Seasonal Deposits – December Deposits	Cyclical Deposits	Total
January	\$1,608	99%	(\$16)	(\$3)	\$1,589
February	1,616	102	32	8	1,656
March	1,623	105	80	7	1,710
April	1,631	107	112	10	1,753
May	1,639	101	16	1	1,656
June	1,647	96	–64	–8	1,575
July	1,655	93	–112	–15	1,528
August	1,663	95	–80	–9	1,574
September	1,671	97	–48	–4	1,619
October	1,680	101	16	0	1,696
November	1,688	104	64	3	1,755
December	1,696	100	0	0	1696

Example (cont.)

EXHIBIT 11.8 Forecast of Trend, Seasonal, and Cyclical Components of Deposits and Loans

Reference Balance Sheet (Millions of Dollars)

Loan Forecast

End of Month	Trend Loans*	Seasonal Loan Index**	Seasonal Loans – December Loans	Cyclical Loans	Total
January	\$1,413	101%	\$14	\$6	\$1,433
February	1,427	97	–42	–9	1,376
March	1,440	95	–70	–18	1,352
April	1,454	94	–84	–21	1,349
May	1,467	97	–42	–15	1,410
June	1,481	102	28	–3	1,506
July	1,495	108	112	9	1,616
August	1,510	106	84	17	1,611
September	1,524	103	42	11	1,577
October	1,538	99	–14	5	1,529
November	1,553	98	–28	0	1,525
December	1,568	100	0	0	1,568

*Growth trend for December to December averaged 6 percent for deposits and 12 percent for loans.

Longer-Term Liquidity Planning

- Bank's monthly liquidity needs estimated as forecasted change in loans plus required reserves minus forecast change in deposits:
 - $\text{Liquidity needs} = \text{Forecasted } \Delta \text{loans} + \Delta \text{Required reserves} - \text{Forecasted } \Delta \text{deposits}$
 - Positive figure means bank needs additional liquid funds.
 - Negative figure suggests bank will have surplus funds to invest.
- Analysis can be used to identify longer-term trends in fund flow.

Example (cont.)

EXHIBIT 11.9 Estimates of Liquidity Needs (Millions of Dollars)

End of Month	Δ Deposits*	Δ Required Reserves	Δ Loans*	Liquidity Needs**
January	-\$11.00	-\$1.10	\$33.00	\$42.90
February	56.00	5.60	-24.00	-74.40
March	110.00	11.00	-48.00	-147.00
April	153.00	15.30	-51.00	-188.70
May	56.00	5.60	10.00	-40.40
June	-25.00	-2.50	106.00	128.50
July	-72.00	-7.20	216.00	280.80
August	-26.00	-2.60	211.00	234.40
September	19.00	1.90	177.00	159.90
October	96.00	9.60	129.00	42.60
November	155.00	15.50	125.00	-14.50
December	96.00	9.60	168.00	81.60

* Δ Deposits equals the difference in the end-of-year balance sheet figure (\$1,600) and the monthly total forecast from . Δ Loans equals the difference in the end-of-year balance sheet figure (\$1,400) and the monthly total forecast from .

**Estimates of liquidity needs equal the change in loans plus change in required reserves minus the change in deposits. The reserve ratio equals 10 percent. A positive figure represents a shortage, while a negative figure means the bank has surplus funds to invest.

Example (cont.)

EXHIBIT 11.10 Liquidity Gap Estimates (Millions of Dollars)

	Time Frame		
	0 to 30 Days	31 to 90 Days	91 to 365 Days
Potential Uses of Funds			
Add: Maturing time deposits			
Small time deposits	\$5.5	\$8	\$34
Certificates of deposit over \$100,000	40	70	100
Eurodollar deposits	10	10	30
Plus: Forecast new loans			
Commercial loans	60	112	686
Consumer loans	22	46	210
Real estate and other loans	31	23	223
Minus: Forecast net change in transactions accounts*			
Demand deposits	-6.5	105.5	10
NOW accounts	0.4	5.5	7
Money market deposit accounts	1.6	3	6
Total uses	\$173	\$155	\$1,260
Potential Sources of Funds			
Add: Maturing investments			
Money market instruments	\$8	\$16.5	\$36.5
U.S. Treasury and agency securities	7.5	10.5	40
Municipal securities	2.5	1	12.5
Plus: Principal payments on loans	80	262	903
Total sources	98	290	992
Periodic Liquidity Gap**	\$75	-\$135	\$268
Cumulative Liquidity Gap	\$75	-\$60	\$208

*Net of required reserves

**Potential uses of funds minus potential sources of funds.

Example (cont.)

EXHIBIT 11.11 Potential Funding Sources (Millions of Dollars)

	Time Frame		
	0 to 30 Days	31 to 90 Days	91 to 365 Days
Purchased Funds Capacity			
Federal funds purchased (overnight and term)	\$20	\$20	\$30
Repurchase agreements	10	10	10
Negotiable certificates of deposit			
Local	50	50	60
National	20	20	25
Eurodollar certificates of deposit	20	20	20
Total	\$120	\$120	\$145
Additional Funding Sources			
Reductions in federal funds sold	\$5	\$5	\$5
Loan participations	20	20	20
Sale of money market securities	5	5	5
Sale of unpledged securities	10	10	10
Total	\$40	\$40	\$40
Potential Funding Sources*	\$160	\$160	\$185
Potential extraordinary funding needs			
50% of outstanding letters of credit	5	10	15
20% of unfunded loan commitments	25	30	35
Total	\$30	\$40	\$50
Excess Potential Funding Sources	\$130	\$120	\$135

*Purchased funds capacity plus additional funding sources.

Funding the Bank

Transaction deposits

- An account used primarily to make payments for purchases of goods and services

Types of Transaction Deposits

- Noninterest-Bearing Demand Deposits
- Interest-Bearing Demand Deposits
 - Negotiable Order of Withdrawal (NOW)
 - Money Market Deposit Account (MMDA) and Super NOW

Legal required reserve only apply to transaction accounts

Funding the Bank (Cont.)

- Nontransaction Deposit
 - An account whose primary purpose is to encourage the bank customer to save rather than make payments
- Types of Nontransaction Deposits
 - Passbook Savings Account
 - Statement Savings Deposit
 - Time Deposit (CD)
 - Retirement Savings Deposits
 - Individual Retirement Account (IRA) - The Economic Recovery Tax Act of 1981
 - Keogh Plan retirement accounts – available to self-employed persons
 - Roth IRA – The Tax Relief Act of 1997 allows non-tax-deductible contributions that can grow tax free and pay no tax on investment earnings when withdrawn
 - Default Option Retirement Plans – The Pension Protection Act of 2006

Cost of Deposit

- Conditional Pricing
 - Where a depository sets up a schedule of fees in which the customer pays a low fee or no fee if the deposit balance remains above some minimum level, but faces a higher fee if the average balance falls below that minimum
 - Conditional pricing techniques vary deposit prices based on one or more of these factors
 1. The number of transactions passing through the account (e.g., number of checks written, deposits made, wire transfers, stop-payment orders, or notices of insufficient funds issued)
 2. The average balance held in the account over a designated period (usually per month)
 3. The maturity of the deposit in days, weeks, months, or years

Example:

A NOW account requires a minimum balance of \$750 for interest to be earned at an annual rate of 4 percent. An account holder has maintained an average balance of \$500 for the first six months and \$1,000 for the remaining six months. The account holder writes an average of 60 checks per month and pays \$0.02 per check, although it costs the bank \$0.05 to clear a check.

- a) What average return does the account holder earn on the account?
- b) What is the average return if the bank lowers the minimum balance to \$400?
- c) What is the average return if the bank pays interest only on the amount in excess of \$400? Assume that the minimum required balance is \$400.
- d) How much should the bank increase its check fee to the account holder to ensure that the average interest it pays on this account is 5 percent? Assume that the minimum required balance is \$750.

Example:

a) What average return does the account holder earn on the account?

Gross interest return = Explicit interest return + Implicit interest return

Interest earned by account holder $(\$500 \times 0.00 \times 6/12) + (\$1,000 \times 0.04 \times 6/12) = \20.00

Implicit fee earned on checks $(\$0.05 - \$0.02) \times 60 \times 12 = \21.60

Average deposit maintained during the year $(6/12 \times 500) + (6/12 \times 1,000) = \750.00

Average interest earned $= (\$20.00 + \$21.60) / 750 = 5.55 \text{ percent}$

Example (cont.)

b) What is the average return if the bank lowers the minimum balance to \$400?

If the minimum balance requirement is lowered to \$400, the account holder earns an extra $\$500 \times 0.04 \times 6/12 = \10 in interest.

The average interest earned = $\$51.60/750 = 6.88$ percent.

Example (cont.)

c) What is the average return if the bank pays interest only on the amount in excess of \$400? Assume that the minimum required balance is \$400.

If the bank only pays interest on balances in excess of \$400, the explicit interest earned = $(\$100 \times 0.04 \times 6/12) + (\$600 \times 0.04 \times 6/12) = \$2 + \$12 = \14 .

The implicit fee earned on checks = \$21.60, and the average interest earned = $\$35.60/\$750 = 4.75\%$

Example (cont.)

d) How much should the bank increase its check fee to the account holder to ensure that the average interest it pays on this account is 5 percent? Assume that the minimum required balance is \$750.

Interest earned (both explicit and implicit) = $\$750 \times 0.05 = \37.50 .

Fees to be earned through check clearing = $\$37.50 - \$20 = \$17.50$.

Fee subsidy per check = $17.50 / (60 \times 12) = \0.0243 .

So, the bank should charge $\$0.05 - \$0.0243 = \$0.0257$ per check.

Summary

- We reviewed the concept of liquidity - bought or sold in the market at price reflecting its intrinsic value.
- We went through how to calculate the required reserve for US banks
- We demonstrate how to calculate the LCR required in Basel III
- We also introduced how to conditional price bank's deposit.