# Solutions for End-of-Chapter Questions and Problems: Chapter Eighteen

1. What are the benefits and costs to an FI of holding large amounts of liquid assets? Why are Treasury securities considered good examples of liquid assets?

A major benefit to an FI of holding a large amount of liquid assets is that it can offset any unexpected and large withdrawals without reverting to asset sales or emergency funding. If assets have to be sold at short notice, FIs may not be able to obtain a fair market value. It is more prudent to anticipate withdrawals and keep liquid assets to meet the demand. On the other hand, liquid assets provide lower yields, so the opportunity cost for holding a large amount of liquid assets is high. FIs taking conservative positions by holding large amounts of liquid assets will therefore have lower profits.

Treasury securities are considered good examples of liquid assets because they can be converted into cash quickly with very little loss of value from current market levels.

2. How is an FI’s liability and liquidity risk management problem related to the maturity of its assets relative to its liabilities?

For most FIs, the maturity of assets is greater than the maturity of liabilities. As the difference in the average maturity between the assets and liabilities increases, liquidity risk increases. In the event that liabilities begin to leave the FI or are not reinvested by investors at maturity, the FI may need to liquidate some of its assets at fire-sale prices. These prices would tend to deviate further from their market value as the maturity of the assets increase. Thus, the FI may sustain larger losses.

3. Consider the assets (in millions) of two banks, A and B. Both banks are funded by $120 million in deposits and $20 million in equity. Which bank has a stronger liquidity position? Which bank probably has a higher profit?

**Bank A Asset Bank B Assets**

Cash $10 Cash $20

Treasury securities 40 Consumer loans 30

Commercial loans 90 Commercial loans 90

Total assets $140 Total assets $140

Bank A is more liquid because it has more liquid assets than Bank B, although it has less cash. Bank B probably earns a higher profit because the return on consumer loans should be greater than the return on Treasury securities. However, comparing the loan portfolios is difficult because it is impossible to evaluate the credit risk contained in each portfolio using just the information provided.

4. What concerns motivate regulators to require DIs to hold minimum amounts of liquid assets?

Regulators prefer DIs to hold more liquid assets because this ensures that they are able to withstand unexpected and sudden withdrawals. In addition, regulators are able to conduct monetary policy by influencing the money supply through liquid assets held by DIs. Finally, reserves held at the Fed by financial institutions also are a source of funds to regulators, since they pay little interest on these deposits.

5. How do liquid asset reserve requirements enhance the implementation of monetary policy? How are reserve requirements a tax on DIs?

In the case of DIs, reserve requirements on demand deposits allow regulators to increase or decrease the money supply in an economy. The reserve requirement against deposits limits the ability of DIs to expand lending activity. Further, reserves represent a form of tax that regulators can impose on DIs. By raising the reserve requirements, regulators cause DIs to transfer more balances into non-earning assets. This tax effect is even larger in cases where inflation is stronger.

6. Rank these financial assets according to their liquidity: cash, corporate bonds, NYSE-traded stocks, and T-bills.

The liquidity ranking from most liquid to least liquid would be cash, T-bills, NYSE-traded stocks, and corporate bonds.

7. Define the reserve computation period, the reserve maintenance period, and the lagged reserve accounting system.

The reserve computation period is a two-week period beginning on a Tuesday and ending on a Monday over which the required reserves are calculated. The actual reserve calculation is accomplished by multiplying the average daily net transaction accounts balance over this 14-day period times the required reserve ratio. The exact amount of this reserve calculation is not known with certainty until the end of the computation period.

The reserve maintenance period is the 14-day period over which the average level of reserves must equal or exceed the required reserve target.

The lagged reserve accounting system occurs when the reserve maintenance period begins after the reserve computation period is completed. As long as these two periods do not overlap, the DI should have little uncertainty regarding the amount of reserves necessary to be in compliance with regulatory guidelines.

8. City Bank has estimated that its average daily net transaction accounts deposit balance over the recent 14-day reserve computation period was $225 million. The average daily balance with the Fed over the 14-day maintenance period was $9 million, and the average daily balance of vault cash over the two-week computation period was $7.5 million.

a. Under the rules effective in 2012, what is the amount of average daily reserves required to be held during the reserve maintenance period for these net transaction accounts balances?

Reserve requirements = (0 x $11.5m) + ($71.0m - $11.5m)(0.03) + ($225m - $71.0m) (0.10)

= 0 + $1.785m + $15.40m = $17.185 million

After subtracting the average daily balance of vault cash of $7.5 million, the bank needs to maintain a daily average of $9.685 million ($17.185 million - $7.5 million) during the maintenance period.

b. What is the average daily balance of reserves held by the bank over the maintenance period? By what amount were the average reserves held higher or lower than the required reserves?

The average daily balance over the maintenance period was $9 million. Therefore, average reserves held were short $0.685 million.

c. If the bank had transferred $20 million of its deposits every Friday over the two-week computation period to one of its offshore facilities, what would be the revised average daily reserve requirement?

For the 14-day period, the sum of its daily average is = $225m x 14 = $3,150m. If $20 million is transferred on Friday, the total reduction is $120 million over two weekends ($20m x 3 days x 2 weekends), and the total 14-day balance is $3,030m. The average daily deposits will be $216.4286 million.

Reserve requirements = (0 x $11.5m) + ($71.0m - $11.5m)(0.03) + ($216.4286m - $71.0m) (0.10) = 0 + $1.785m + $14.643m = $16.428 million. City Bank needs to maintain average reserves of $8.928 million ($16.428 million - $7.5 million) during the maintenance period. Since it had $9 million of reserves, extra reserves of $0.072m per day can be carried forward to the next reserve maintenance period.

9. Assume that the 14-day reserve computation period for problem (8) above extended from May 18 through May 31.

a. What is the corresponding reserve maintenance period under the rules effective in 2012?

The reserve maintenance period would extend from June 17 through June 30. The period begins 30 days after the beginning of the reserve computation period. This makes it easier for bank managers to meet their reserve requirements. By beginning two weeks and two days after the end of the computation period, managers can more easily make up for any errors in their forecast of reserve requirements.

b. Given your answers to parts (a) and (b) of problem (8), what would the average required reserves need to be for the maintenance period for the bank to be in reserve compliance?

The average required reserves necessary to be in compliance is $9.685 million and they could be as low as $8.998m ($9.685m - $17.185m(0.04)) or as high as $10.372m ($9.685m + $17.185m(0.04)).

10. The average daily net transaction accounts deposit balance of a local bank during the most recent reserve computation period is $325 million. The amount of average daily reserves at the Fed during the reserve maintenance period is $24.60 million, and the average daily vault cash corresponding to the maintenance period is $4.3 million.

a. What is the average daily reserve balance required to be held by the bank during the maintenance period?

Reserve requirements = (0 x $11.5m) + ($71.0m - $11.5m)(0.03) + ($325m - $71.0m) (0.10) = 0 + $1.785m + $25.400m = $27.185 million

After subtracting the average daily balance of vault cash of $4.3 million, the bank needs to maintain a target daily average of $22.885million ($27.185 million - $4.3 million) during the maintenance period.

b. Is the bank in compliance with the reserve requirements?

Yes. The bank has average reserves of $24.6 million. This amount exceeds the required amount by $1.715 million.

c. What amount of reserves can be carried over to the next maintenance period either as excess or shortfall?

A maximum of 4 percent of the gross required reserves can be carried over to the next maintenance period. Thus, 0.04 x $27.185 million = $1.0894 million can be carried over to the next maintenance period. The bank has deposited $0.6276 million ($1.715m - $1.0894m) in low interest paying accounts at the Fed that cannot be counted towards next period’s required reserves.

d. If the local bank has an opportunity cost of 6 percent and deposits at the Fed pay 0.5 percent, what is the effect on the income statement from this reserve period?

A total of $0.6276 million has an opportunity cost of no earnings at the 6 percent rate. Thus, the loss would be $0.6276m(0.060 - 0.005)(14/365) = $1,323.98.

11. The following net transaction accounts and cash reserves at the Fed have been documented by a bank for computation of its reserve requirements (in millions) under lagged reserve accounting.

**Monday Tuesday Wednesday Thursday Friday**

**April**  **10th 11th 12th 13th 14th**

Net transaction

accounts $200 $300 $250 $280 $260

Reserves at Fed 20 22 21 18 27

**Monday Tuesday Wednesday Thursday Friday**

**17th 18th 19th 20th 21th**

Net transaction

accounts $280 $300 $270 $260 $250

Reserves at Fed 20 35 21 18 28

**Monday Tuesday Wednesday Thursday Friday**

**24th 25th 26th 27th 28th**

Net transaction

accounts $240 $230 $250 $260 $270

Reserves at Fed 19 19 21 19 24

**Monday Tuesday Wednesday Thursday Friday**

**May**  **1st 2nd 3rd 4th 5th**

Net transaction

accounts $200 $300 $250 $280 $260

Reserves at Fed 20 22 21 18 27

**Monday Tuesday Wednesday Thursday Friday**

**8th 9th 10th 11th 12th**

Net transaction

accounts $280 $300 $270 $260 $250

Reserves at Fed 20 35 21 18 27

**Monday Tuesday Wednesday Thursday Friday**

**15th 16th 17th 18th 19th**

Net transaction

accounts $240 $230 $250 $260 $270

Reserves at Fed 20 35 21 18 28

**Monday Tuesday Wednesday Thursday Friday**

**22th 23th 24th 25th 26th**

Net transaction

accounts $200 $300 $250 $280 $260

Reserves at Fed 19 19 21 19 24

The average vault cash for the computation period has been estimated to be $1 million per day.

a. What level of average daily reserves is required to be held by the bank during the maintenance period, May 11 - 24?

Average daily net transaction accounts deposits = $300m + $250m + $280m + $260m + $260m + $260m + $280m + $300m + $270m + $260m + $250m + $250m + $250m + $240m = $3,710m/14 = $265m

Reserve requirement = ($11.5m - $0)(0) + ($71.0m – $11.5m)(0.03) + ($265m – $71.0m)(0.10) = $0 + $1.785m + $19.400m = $21.185m

b. Is the bank in compliance with the requirements?

The maintenance period begins on Thursday, May 11th.

Average Reserves at Fed = $18m + $27m + $27m + $27m + $20m + $35m + $21m + $18m + $28m + $28m + $28m + $19m + $19m + $21m = $336m/14 = $24m.

Average reserves maintained = $24m + $1m = $25m

Excess over required reserves = $25m - $21.185m = $3.815m

c. What amount of required reserves can be carried over to the following computation period?

Excess that can be carried over = 0.04 x $21.185 million = $0.8474 million.

d. If the average cost of funds to the bank is 8 percent per year and deposits at the Fed pay 0.5 percent, what is the effect on the income statement for this bank for this reserve period?

Loss = (3.815m - 0.8474m) x (0.080 - 0.005)(14/365) = $8,536.93.

12. In July of 1998 the lagged reserve accounting (LRA) system replaced a contemporaneous reserve accounting (CRA) system as the method of reserve calculation for DIs.

a. Contrast a contemporaneous reserve accounting (CRA) system with a lagged reserve accounting (LRA) system.

Under LRA, the DI holds reserves against the amount of deposits that had been in the DI 30 days prior. The DI knows its required reserves on every day of the reserve maintenance period. Since reserve requirements are stated in the form of average daily balances, the DI can adjust its reserves over the maintenance period to exactly equal the average reserve requirement. Under CRA, the two-week reserve maintenance period for meeting the reserve target began only two days after the start of the computation period. Thus, CRA resulted in only a two-day window during which required reserves were know with certainty.

b. Under which accounting system, CRA or LRA, are DI reserves higher? Why?

Ceteris paribus, one would expect reserves to be higher under the CRA than under the LRA, because under the LRA the DI knows its reserve requirement exactly on every day of the reserve maintenance period. There is no need for the DI to hold excess reserves as a cushion against an unforeseen increase in reserve requirements. DIs are able to keep their reserves to the minimum required level. Under CRA, the DI does not know its reserve requirement until the last two days of the reserve maintenance period. Since those are the days during which Fed fund rates are most volatile, DIs attempt to avoid large reserve shortages late in the reserve maintenance period. They will therefore tend to hold excess reserves early in the maintenance period that may be reduced on the last two days of the settlement week.

c. Under which accounting system, CRA or LRA, is DI uncertainty higher? Why?

Since information is complete during the entire settlement week under LRA, but complete under CRA only during the last two days of the maintenance period, there is more uncertainty about reserve requirements under the CRA than under the LRA.

13. What is the “weekend game”? Contrast the DI's ability and incentive to play the weekend game under LRA as opposed to CRA.

Since Friday balances are carried over the weekend and are counted for Saturday and Sunday, they carry more weight in the reserve computations. Thus, DIs developed a strategy to send deposits offshore on Friday, thereby reducing their Friday closing deposit balances. When these deposits were bought back on Monday, average daily deposit balances were reduced, thereby decreasing reserve requirements. Although the ratio of weekends to total days in the reserve computation period is the same under LRA as under CRA (2/7 or 4/14), there is greater flexibility for DIs to play the weekend game under LRA. That is because the DI has complete information about reserve requirements on each day of the maintenance period. However, because of the uncertainty under CRA, there is greater incentive for DIs to play the weekend game under CRA than under LRA.

14. Under CRA, when is the uncertainty about the reserve requirement resolved? Discuss the feasibility of making large reserve adjustments during this period of complete information.

Under CRA, the uncertainty regarding reserve requirements is resolved on the last two days of the reserve maintenance period (on the last Tuesday and Wednesday of the 14 day period). However, since these are also the days of greatest volatility in the Fed funds rate, it could be very costly for the reserve manager to make large reserve adjustments or corrections during this two-day period. Moreover, since the Fed funds market is comprised of active traders that deal daily with one another, a large reserve imbalance would lead to abnormal Fed funds transactions and would be quickly detected and exploited (to the detriment of the original DI) by other DI traders.

15. What is the relationship between funding cost and funding or withdrawal risk?

Liabilities that have a low cost often have the highest risk of withdrawal. Thus, a DI that chooses to attract low cost deposits may have high withdrawal risk.

16. An FI has estimated the following annual costs for its demand deposits: management cost per account = $140, average account size = $1,500, average number of checks processed per account per month = 75, cost of clearing a check = $0.10, fees charged to customer per check = $0.05, and average fee charged per customer per month = $8.

a. What is the implicit interest cost of demand deposits for the FI?

Cost of clearing checks = $0.10 x 75 x 12 = $90.00

Cost of managing each account = $140.00

Per check fee per account = $0.05 x 75 x 12 = -$45.00

Fee received per account = $8 x 12 = -$96.00

Total cost per account = $89.00

The average (imputed) interest cost of demand deposits = $89.00/1,500 = 5.93 percent.

b. If the FI has to keep an average of 8 percent of demand deposits as required reserves with the Fed paying no interest, what is the implicit interest cost of demand deposits for the FI?

If the bank has to keep 8 percent as reserves, its use of funds is limited to 0.92 x $1,500 per account, or $1,380. The average (imputed) interest cost = $89/$1,380 = 6.45 percent.

c. What should be the per-check fee charged to customers to reduce the implicit interest costs to 3 percent? Ignore the reserve requirements.

For an average imputed interest cost of 3 percent, the total cost per account = 1,500 x 0.03 = $45. This means that the total cost per account should be decreased by $44 ($89 - $45) and the per-check fee charged to customers should be increased to $89 ($45 + $44). Thus, the fee per-check should be raised to $89/(75 x 12) = $0.0989 per check.

17. 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?

Gross interest return = Explicit interest return + Implicit interest return

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

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

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

Average interest earned = $41.60/750 = 5.55 percent

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 x 0.04 x 6/12 = $10 in interest. The average interest earned = $51.60/750 = 6.88 percent.

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 x 0.04 x 6/12) + ($600 x 0.04 x 6/12) = $2 + $12 = $14. The implicit fee earned on checks = $21.60, and the average interest earned = $35.60/$750 = 4.75%

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 x 0.05 = $37.50. Fees to be earned through check clearing = $37.50 - $20 = $17.50. Fee subsidy per check = 17.50/(60 x 12) = $0.0243. So, the bank should charge $0.05 - $0.0243 = $0.0257 per check.

18. Rank the following liabilities, with respect, first, to funding risk and second to funding cost:

Funding Risk Funding Cost

a. Money market deposit account. 8 4

b. Demand deposits. 11 1

c. Certificates of deposit. 7 5 d. Federal funds. 5 7

e. Bankers’ acceptances. 3 9 f. Eurodollar deposits. 2 10

g. NOW accounts. 10 2

h. Wholesale CDs. 6 6

i. Passbook savings. 9 3

j. Repos. 4 8

k. Commercial paper. 1 11

The rankings above are not meant to be definitively precise, but are made to illustrate that the funding cost and the funding risk are inversely related. For example, demand deposits usually are considered to be the least-cost source of funding, but they also are easily withdrawn from the FI. On the other hand, repos, wholesale CDs, and fed funds are not liquid during their term, but can be extremely liquid at maturity if the FI has any kind of financial distress. The cost of each of these types of funds is directly linked to money market conditions. The contrast between funding risk and funding cost for several of the liabilities is discussed below:

Demand deposits have low funding costs, but technically have high amounts of funding risk since they can be withdrawn at any time. However, in practical terms, demand deposits are often quite stable and may behave like long-term core deposits.

Certificates of deposit have high funding costs (because of reserve requirements and risk premiums on negotiable CDs), but they have low funding risk since they can be withdrawn only upon payment of interest penalties.

Federal funds have relatively low funding costs (although these costs are higher than those for demand deposits) because of their overnight maturity, but they can have high funding risk if the FI is distressed or not an active participant in the Fed funds market. However, for major money center banks, the funding risk on Fed funds is quite low.

Eurodollar deposits have high funding costs because of the default risk premium, but they are low funding risk. Eurodollar interbank deposits, however, are akin to demand deposits and may have high funding risks, particularly if the FI is rumored to be in financial distress.

19. How is the withdrawal risk different for federal funds and repurchase agreements?

Withdrawal risk is lower for repurchase agreements (RPs) because they are collateralized usually by government securities. Since RPs are collateralized, they require a lower risk premium but they require time to process because of the need to post collateral. In every other respect, the transaction of an RP is similar to federal funds.

20. How does the cash balance, or liquidity, of an FI determine the types of repurchase agreements into which it will enter?

If the FI has surplus cash, it would buy securities with the understanding that the seller would repurchase them later. In this case, the repurchase agreement is an asset for the firm that bought the securities. If an FI is low on cash, it would sell securities for cash with the understanding that it would repurchase the securities later. Here the repo is a liability.

21. How does the cost of MMMFs differ from the cost of MMDAs? How is the spread useful in managing the withdrawal risk of MMDAs?

MMMFs earn rates of return that are directly related to the money market conditions for the assets held by the funds. MMDAs can be priced to reflect these conditions, but they do not necessarily need to be priced in this manner. Since the two products compete for investor funds, FIs can control the rate of withdrawal of funds from the MMDAs by raising or lowering the explicit interest rate paid to depositors. Allowing the MMDA-MMMF spread to become increasingly negative will increase the rate of withdrawal from the MMDA accounts.

22. Why do wholesale CDs have minimal withdrawal risk to the issuing FI?

Wholesale CDs are negotiable instruments that can be sold (discounted) in the secondary market. Thus, if the initial investor needs funds before the CDs mature, the CDs can be liquidated at money market rates by the investor without withdrawing the funds from the issuing bank.

23. What characteristics of fed funds may constrain a DI’s ability to use fed funds to expand its liquidity quickly?

Fed funds are uncollateralized loans. As such, DIs selling fed funds often will limit the amount of funds they will provide to any one borrowing institution. Further, fed funds do have risk of non-rollover at maturity.

24. What does a low fed funds rate indicate about the level of DI reserves? Why does the fed funds rate have higher-than-normal variability around the last two days in the reserve maintenance period?

A low fed funds rate would indicate low levels of DI borrowing and an ample or at least adequate supply of reserves among DIs. Whether the general level of the fed funds rate is low or high, the variability of the rate around the last two days in the reserve maintenance period will accelerate as DIs attempt to meet the required reserve levels.

25. What trends have been observed between 1960 and 2012 in regard to liquidity and liability structures of commercial banks? What changes have occurred in the management of assets that may cause the measured trends to be overstated?

From Table 18-5, it is clear that commercial banks have reduced their composition of liquid assets to illiquid assets from 44 percent to 22.67 percent (liquid assets = cash and government and agency securities). However, this may be overstated because the illiquid assets, such as commercial and mortgage loans, are significantly different today from prior years because they can be securitized and sold in the secondary markets. As a result, they are not as illiquid as they were in the past, which may be one reason why banks held more liquid assets in prior years. Table 18-6 also shows that there has been a shift away from transaction accounts to time accounts, CDs, and borrowed funds. Although this reduces withdrawal risk, these funds are more expensive for commercial banks.

26. What are the primary methods that insurance companies can use to reduce their exposure to liquidity risk?

First, insurance companies can reduce their exposure by diversifying the distribution of risk in the contracts they write. In addition, insurance companies can meet liquidity needs by holding relatively marketable assets to cover claim payments.