

End of Chapter 5 Problems

Numeric Response

1. What is the discount yield, bond equivalent yield, and effective annual return on a \$1 million Treasury bill that currently sells at 97 $\frac{3}{8}$ percent of its face value and is 65 days from maturity?

2. Calculate the bond equivalent yield and effective annual return on a jumbo CD that is 115 days from maturity and has a quoted nominal yield of 6.56 percent.

3. You would like to purchase a Treasury bill that has a \$10,000 face value and is 68 days from maturity. The current price of the Treasury bill is \$9,875. Calculate the discount yield on this Treasury bill.

4. Suppose you purchase a T-bill that is 125 days from maturity for \$9,765. The T-bill has a face value of \$10,000.
 - a. Calculate the T-bill's quoted discount yield.
 - b. Calculate the T-bill's bond equivalent yield.

5. Refer to Table 5-5.
 - a. Calculate the ask price of the T-bill maturing on December 13, 2007, as of September 21, 2007
 - b. Calculate the bid price off the T-bill maturing on January 24, 2007 as of September 21, 2007

6. Using a Spreadsheet to Calculate T-bill Prices: What is the bid price of a \$10,000 face value T-bill with a bid rate of 2.23 percent if there are 10, 25, 50, 100, and 250 days to maturity?

Face Value	Bid rate	Days to maturity	The answer will be
\$10,000	2.23%	10	\$9,993.81
10,000	2.23	25	9,984.51
10,000	2.23	50	9,969.03
10,000	2.23	100	9,938.06
10,000	2.23	250	9,845.14

7. A T-bill that is 225 days from maturity is selling for \$95,850. The T-bill has a face value of \$100,000.

- Calculate the discount yield and bond equivalent yield on the T-bill.
- Calculate the discount yield and bond equivalent yield on the T-bill if it matures in 300 days.

8. Using a Spreadsheet to Calculate T-bill Yield: What is the quoted yield of a \$10,000 face value T-bill with a market price of \$8,885 if there are 10, 25, 50, 100, and 250 days to maturity?

Face Value	Market Price	Days to Maturity	The Answer Will Be
\$10,000	\$8,885	10	4.014%
10,000	8,885	25	1.606
10,000	8,885	50	0.803
10,000	8,885	100	0.401
10,000	8,885	250	0.161

9. If the overnight fed funds rate is quoted as 2.25 percent, what is the bond equivalent rate? Calculate the bond equivalent rate on fed funds if the quoted rate is 3.75 percent.

10. Suppose a bank enters a repurchase agreement in which it agrees to buy Treasury securities from a correspondent bank at a price of \$24,950,000, with the promise to buy them back at a price of \$25,000,000.
 - a. Calculate the yield on the repo if it has a 7-day maturity.
 - b. Calculate the yield on the repo if it has a 21-day maturity.

11. You can buy commercial paper of a major U.S. corporation for \$495,000. The paper has a face value of \$500,000 and is 45 days from maturity. Calculate the discount yield and bond equivalent yield on the commercial paper.

12. You have just purchased a four-month, \$500,000 negotiable CD, which will pay a 5.5 percent annual interest rate.
 - a. If the market rate on the CD rises to 6 percent, what is its current market value?
 - b. If the market rate on the CD falls to 5.25 percent, what is its current market value?

Short Answer

13. What are the three characteristics common to money market securities?

14. What is the difference between a discount yield and a bond equivalent yield? Which yield is used for Treasury bill quotes?

15. Why can discount yields not generally be compared to yields on other (nondiscount) securities?

16. Describe the T-bill auction process.

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17. What is the difference between a competitive bid and a noncompetitive bid in a T-bill auction?
18. What are federal funds? How are they recorded on the balance sheets of commercial banks?
19. Describe the two types of fed funds transactions.
20. What is the difference between a repurchase agreement and a reverse repurchase agreement?
21. Why do commercial paper issues have an original maturity of 270 days or less?
22. Why do commercial paper issuers almost always obtain a rating of their issues?
23. What is the process through which negotiable CDs are issued?
24. Describe the process by which a banker's acceptance is created.
25. Who are the major issuers of and investors in money market securities?
26. What are Eurodollar CDs and Eurocommercial paper'!

End of Chapter 5 Problems Answer Section

NUMERIC RESPONSE

1. ANS:

Discount yield: $i_{dy} = ((\$1m. - \$973,750)/\$1m.)(360/65) = 14.538\%$

Bond equivalent yield: $i_{bey} = ((\$1m. - \$973,750)/\$973,750)(365/65) = 15.138\%$

EAR: $EAR = (1 + .15138/(365/65))^{365/65} - 1 = 16.111\%$

PTS: 10

BNK: Chapter 05 – Money Markets, EOC

2. ANS:

The nominal bond equivalent yield is calculated as

$$i_{bey} = 6.56\%(365/360) = 6.651\%$$

The EAR on the CD is calculated as

$$EAR = (1 + (.06651)/(365/115))^{365/115} - 1 = 6.804\%$$

PTS: 10

BNK: Chapter 05 – Money Markets, EOC

3. ANS: $i_{dy} = ((10,000 - 9,875)/10,000) (360/68) = 6.62\%$

PTS: 10

BNK: Chapter 05 – Money Markets, EOC

4. ANS:

a. The T-bill's quoted yield is calculated as

$$i_{T\text{-bill}} (dy) = \frac{\$10,000 - \$9,765}{\$10,000} \times \frac{360}{125} = 6.768\%$$

b. The T-bill's bond equivalent yield is calculated as

$$i_{T\text{-bill}} (dy) = \frac{\$10,000 - \$9,765}{\$9,765} \times \frac{365}{125} = 7.027\%$$

PTS: 10

BNK: Chapter 05 – Money Markets, EOC

5. ANS:

a. The T-bill ask price is calculated as

$$P_o = \$10,000 - \left[\frac{.0191 \times 57}{360} \times \$10,000 \right] = \$9,969.76$$

b. The T-bill bid price is calculated as,

$$P_o = \$10,000 - \left[\frac{.0212 \times 127}{360} \times \$10,000 \right] = \$9,925.21$$

PTS: 10

BNK: Chapter 05 – Money Markets, EOC

6. ANS:

EXCEL Problem: Bid Price = \$9,993.81
 Bid Price = \$9,984.51
 Bid Price = \$9,969.03
 Bid Price = \$9,938.06
 Bid Price = \$9,845.14

PTS: 10

BNK: Chapter 05 – Money Markets, EOC

7. ANS:

a. $i_{\text{bey}} = (\$100,000 - \$95,850) / \$100,000 \times (360/225) = 6.64\%$
 $i_{\text{bey}} = (\$100,000 - \$95,850) / \$95,850 \times (365/225) = 7.02\%$

b. $i_{\text{bey}} = (\$100,000 - \$95,850) / \$100,000 \times (360/300) = 4.98\%$
 $i_{\text{bey}} = (\$100,000 - \$95,850) / \$95,850 \times (365/300) = 5.27\%$

PTS: 10

BNK: Chapter 05 – Money Markets, EOC

8. ANS:

EXCEL Problem: Yield = 4.014%
 Yield = 1.606%
 Yield = 0.803%
 Yield = 0.401%
 Yield = 0.161%

PTS: 10

BNK: Chapter 05 – Money Markets, EOC

9. ANS:

$$i_{\text{bey}} = 2.25\% (365/360) = 2.28125\%$$

$$i_{\text{bey}} = 3.75\% (365/360) = 3.80\%$$

PTS: 10

BNK: Chapter 05 – Money Markets, EOC

10. ANS:

a. The yield on this repo to the bank is calculated as follows

$$i_{RA} = \frac{\$25,000,000 - \$24,950,000}{\$24,950,000} \cdot \frac{360}{7} = 10.31\%$$

The yield on this repo to the bank is calculated as follows

$$i_{RA} = \frac{\$25,000,000 - \$24,950,000}{\$24,950,000} \cdot \frac{360}{21} = 3.44\%$$

PTS: 10

BNK: Chapter 05 – Money Markets, EOC

11. ANS:

The return on the commercial paper is calculated as

$$i_{cp}(dy) = \frac{\$500,000 - \$495,000}{\$500,000} \cdot \frac{360}{45} = 8.00\%$$

and

$$i_{cp}(bey) = \frac{\$500,000 - \$495,000}{\$495,000} \cdot \frac{360}{45} = 8.19\%$$

PTS: 10

BNK: Chapter 05 – Money Markets, EOC

12. ANS:

a. Before the rate change, the CD holder will receive

$$FV = \$500,000 (1 + .055/3) = \$509,167$$

in for months in exchange for \$500,000 deposited in the bank today. Immediately after the market rate on the CD rises to 6 percent, the CD value decreases to

$$PV = 509,167 / (1 + .06/3) = \$499,183.33$$

b. Immediately after the market rate on the CD falls to 5.25 percent, the CD value decreases to

$$PV = 509,167 / (1 + .0525/3) = \$500,409.83$$

PTS: 10

BNK: Chapter 05 – Money Markets, EOC

SHORT ANSWER

13. ANS:

First, money market instruments are generally sold in large denominations (often in units of \$1 million to \$10 million). Most money market participants want or need to borrow large amounts of cash. So that transactions costs are low relative to the interest paid. The size of these initial transactions prohibits most individual investors from investing directly in money market securities. Rather, individuals generally only invest in money market securities indirectly with the help of financial institutions such as money market mutual funds.

Second, money market securities have low default risk; the risk of late or nonpayment of principal and/or interest is generally small. Since cash lent in the money markets must be available for a quick return to the lender, money market instruments can generally be issued only by high quality borrowers with little risk of default.

Finally, money market securities must have an original maturity of one year or less. Recall from Chapter 3 that the longer the maturity of a debt security, the greater is its interest rate risk and the higher its required rate of return (the higher its liquidity risk premium). Given that adverse price movements resulting from interest rate changes are smaller for short term securities, the short term maturity of money market instruments helps lower the risk that interest rate changes will significantly affect the security's market value and price.

PTS: 10

BNK: Chapter 05 – Money Markets, EOC

14. ANS:

The discount yield differs from a true rate of return (or bond equivalent yield) for two reasons: i) the base price used is the face value of the security and not the purchase price of the security and ii) a 360-day year is used. The bond equivalent yield uses a 365-day year and the purchase price, rather than the face value of the security, is used as the base price. Treasury bills are quoted on a discount yield basis.

PTS: 10

BNK: Chapter 05 – Money Markets, EOC

15. ANS:

There are several features of a discount yield that prohibit it from being compared to yields on other (nondiscount) securities. The nominal interest rate on nondiscount securities is referred to as the bond equivalent yield and is calculated as follows:

$$i_{bey} = [(P_f - P_o) / P_o](365/h)$$

Notice the discount yield uses the terminal price (or face value) as the base price in calculating a nominal interest rate. Typically, nominal rates are based on the purchase price of a security. Further, and as already mentioned, discount yields use a 360-day rather than a 365-day year. An appropriate comparison of nominal interest rates on discount securities versus nondiscount securities would require that the discount yield be converted to a bond equivalent yield in the following manner:

$$i_{bey} = i_{dy} (P_f/P_o)(365/360)$$

Finally, neither of these yields considers the compounding of interest rates during the (less than one year) investment horizon. The EAR on a discount security would be calculated by applying the bond equivalent yield for the discount security to the EAR equation.

PTS: 10 BNK: Chapter 05 – Money Markets, EOC

16. ANS:

The U.S. Treasury has a formal process by which it sells new issues of Treasury bills through its regular Treasury bill auctions. Every week (usually on a Thursday) the amount of new 91-day and 182-day T-bills the Treasury will offer for sale is announced. Bids may be submitted by government securities dealers, financial and nonfinancial corporations, and individuals and must be received by a Federal Reserve Bank by the 1 pm Monday following the auction announcement. Allocations and prices are announced the following morning (Tuesday). In addition auctions of 52-week (1-year) T-bills are conducted by the U.S. Treasury on a monthly basis.

PTS: 10 BNK: Chapter 05 – Money Markets, EOC

17. ANS:

Submitted bids can be either competitive bids or noncompetitive bids. Competitive bids specify the desired quantity of T-bills and the bid price. Any bidder can submit more than one bid and can bid on up to 35 percent of the issue size. The highest bidder receives the first allocation (or 'allotment') of T-bills and subsequent bids are filled in decreasing order of the bid until all T-bills auctioned that week are distributed. Thus, the auction takes the form of a 'discriminating' price auction in that different bidders pay different prices. Competitive bids are generally used by large investors and government securities dealers, and make up the majority of the auction market.

With noncompetitive bids, the bidder indicates the quantity of T-bills he or she wants to buy and agrees to pay the weighted average price of the winning competitive bids. Noncompetitive bidders get a preferential allocation, i.e., all these bids are met before the remaining T-bills are allocated to the competitive bidders. Noncompetitive bids are limited to \$1 million or less. Noncompetitive bids allow small investors to participate in the T-bill auction market without incurring large risks. That is, small investors who are unfamiliar with money market interest rate movements can use a noncompetitive bid to avoid bidding a price too low to receive any of the T-bills or bidding too high and paying more than the 'fair' market price.

PTS: 10

BNK: Chapter 05 – Money Markets, EOC

18. ANS:

Federal funds are not formal securities. Rather, fed funds are short term funds transferred between financial institutions, usually for a period of one day. The institution that borrows fed funds incurs a liability on its balance sheet, "federal funds purchased," while the institutions that lends the fed funds records an asset, "federal funds sold."

PTS: 10

BNK: Chapter 05 – Money Markets, EOC

19. ANS:

Two forms of federal funds transactions are commonly used: i) negotiations between two commercial banks often takes place directly over the telephone between the ‘money dealers’ of the banks involved or ii) the transaction may occur through a fed funds broker. Figure 5-3 illustrates the two methods through which a fed funds transaction can occur. For example, a bank that finds itself with \$75 million in excess reserves can call its correspondent banks to see if they need overnight reserves. The bank will then sell its excess reserves to those correspondent banks that offer the highest rates for these fed funds. When a transaction is agreed upon, the lending bank instructs its district Federal Reserve Bank to transfer the \$75 million in excess reserves to the borrowing bank’s reserve account at its Federal Reserve Bank. The Federal Reserve System’s wire transfer network, Fedwire, is used to complete the transfer of funds. The next day the funds are transferred back, via Fedwire, from the borrowing bank to the lending bank’s reserve account at the Federal Reserve Bank plus one day’s interest. Overnight fed fund loans will likely be based on an oral agreement between the two parties and are generally unsecured. Increasingly, participants in the fed funds markets do not hold balances at the Federal Reserve. In this case the fed funds transaction is settled in immediately available funds: fed funds on deposit at the lending bank that may be transferred or withdrawn with no delay. In this case a federal funds broker, typically a commercial bank, matches up institutions using a telecommunications network that links federal funds brokers with participating institutions. Upon maturity of the fed funds loan, the borrowing bank’s fed fund demand deposit account at the lending bank is debited for the total value of the loan and the lending bank pays the borrowing bank an interest payment for the use of the fed funds.

PTS: 10 BNK: Chapter 05 – Money Markets, EOC

20. ANS:

A repurchase agreement (repos or RPs) is an agreement involving the sale of securities by one party to another with a promise to repurchase the securities at a specified price and on a specified date in the future. Thus, a repurchase agreement is essentially a collateralized fed funds loan backed by the securities. The securities used most often in repos are U.S. Treasury securities (e.g., T-bills) and government agency securities (e.g., Fannie Mae). A reverse repurchase agreement (reverse repo) is an agreement involving the purchase of securities by one party from another with the promise to sell them back at a given date in the future.

PTS: 10 BNK: Chapter 05 – Money Markets, EOC

21. ANS:

This 270 day maximum is due to a Securities and Exchange Commission (SEC) rule that securities with a maturity of more than 270 days must go through the time consuming and costly registration process to become a public debt offering (i.e., a corporate bond).

PTS: 10 BNK: Chapter 05 – Money Markets, EOC

22. ANS:

Because commercial paper is not actively traded and because it is also unsecured debt, the credit rating of the issuing company is of particular importance in determining the marketability of a commercial paper issue. Credit ratings provide potential investors with information regarding the ability of the issuing firm to repay the borrowed funds, as promised, and to compare the commercial paper issues of different companies. Several credit rating firms rate commercial paper issues (e.g., Standard & Poor's, Moody's, and Fitch Investor Service). Virtually all companies that issue commercial paper obtain ratings from at least one rating services company and most obtain two rating evaluations. The better the credit rating on a commercial paper issue the lower the interest rate on the issue.

PTS: 10 BNK: Chapter 05 – Money Markets, EOC

23. ANS:

The bank and the CD investor directly negotiate a rate, the maturity and, the size of the CD. Once this is done, the issuing bank delivers the CD to a custodian bank specified by the investor. The custodian bank verifies the CD, debits the amount to the investor's account, and credits the amount to the issuing bank. This is done though the Fedwire system, i.e., by transferring fed funds from the custodian bank's reserve account at the Fed to the issuing bank's reserve account.

PTS: 10 BNK: Chapter 05 – Money Markets, EOC

24. ANS:

Most banker's acceptances arise from international trade transactions and are used to finance trade in goods that have yet to be shipped from a foreign exporter (seller) to a domestic importer (buyer). Foreign exporters often prefer that banks act as guarantors for payment before sending goods to domestic importers, particularly when the foreign supplier has not previously done business with the domestic importer on a regular basis. The U.S. bank ensures the international transaction by stamping "Accepted" on a trade draft between the exporter and the importer, signifying its obligation to pay the foreign exporter (or its bank) on a specified date should the importer fail to pay for the goods. Foreign exporters can then hold the banker's acceptance until the date specified on the trade draft or, if they have an immediate need for cash, can sell the acceptance before that date at a discount from the face value to a buyer in the money market (e.g., a bank). In this case, the ultimate bearer will receive the face value of the banker's acceptance on maturity.

PTS: 10 BNK: Chapter 05 – Money Markets, EOC

25. ANS:

The major money market participants are the U.S. Treasury, the Federal Reserve, commercial banks, money market brokers and dealers, corporations, and other financial institutions, such as mutual funds. The U.S. Treasury raises significant amounts of funds in the money market when it issues T-bills. T-bills are the most actively traded of the money market securities. T-bills allow the U.S. government to raise money to meet unavoidable expenditure needs prior to the receipt of tax revenues. Tax receipts are generally concentrated around quarterly dates, but government expenditures are more evenly distributed over the year.

The Federal Reserve is a key participant in the money markets. The Federal Reserve holds T-bills (as well as T-notes and T-bonds) to conduct open market transactions: purchasing T-bills when it wants to increase the money supply and selling T-bills when it wants to decrease the money supply. The Federal Reserve often uses repurchase agreements and reverse repos to temporarily smooth interest rates and the money supply. Moreover, the Fed targets the federal funds rate on interbank loans as part of its overall monetary policy strategy, which can in turn affect other money market rates. Finally, the Fed operates the discount window which it can use to influence the supply of bank reserves to commercial banks and ultimately the demand for and supply of fed funds and the fed funds rate.

Commercial banks are the most diverse group of participants in the money markets. Banks participate as issuers and/or investors of almost all money market instruments. For example, banks are the major issuers of negotiable CDs, banker's acceptances, federal funds, and repurchase agreements. The importance of banks in the money markets is driven in part by their need to meet regulatory imposed reserve requirements. For example, during periods of economic expansion, heavy loan demand can produce reserve deficiencies for banks (i.e., their actual reserve holdings are pushed below the minimums required by regulation). Additional reserves can be obtained by borrowing fed funds from other banks, engaging in a reverse repurchase agreement, selling negotiable CDs, or selling commercial paper. Conversely, during contractionary periods, many banks have excess reserves which they can use to purchase Treasury securities, trade fed funds, engage in a repo, etc.

Brokers and dealers services are important to the smooth functioning of money markets. We have alluded to various categories of brokers and dealers in the chapter. First, are the 30 primary government security dealers. This group of participants plays a key role in marketing new issues of Treasury bills (and other Treasury securities). Primary government securities dealers also make the market in Treasury bills; buying securities from the Federal Reserve when they are issued and selling them in the secondary market. Secondary market transactions in the T-bill markets are transacted in the trading rooms of these primary dealers. These dealers also assist the Federal Reserve when it uses the repo market to temporarily increase or decrease the supply of bank reserves available. The second group of brokers and dealers are money and security brokers. These brokers play a major role in linking buyers and sellers in the fed funds market and assist secondary trading in other money market securities as well. The third group of brokers and dealers are the thousands of brokers and dealers who act as intermediaries in the money markets by linking buyers and sellers of money market securities. This group of brokers and dealers often act as the intermediaries for smaller investors who do not have sufficient funds to invest in primary issues of money market securities or who simply want to invest in the money markets.

Nonfinancial and financial corporations raise large amounts of funds in the money markets, primarily in the form of commercial paper. The volume of commercial paper issued by corporations has been so large that there is now more commercial paper outstanding than any other type of money market security. Because corporate cash inflows rarely equal their cash outflows, they often invest their excess cash funds in money market securities, especially T-bills, repos, commercial paper, negotiable CDs, and bankers acceptances.

Because their liability payments are relatively unpredictable, property-casualty (PC) insurance companies, and to a lesser extent life insurance companies, must maintain large balances of liquid assets. To accomplish this insurance companies invest heavily in highly liquid money market securities, especially T-bills, repos, commercial paper and negotiable CDs. Since finance companies are not banks and cannot issue deposits, they raise large amounts of funds in the money markets, especially through the issuance of commercial paper. Finally money market mutual funds purchase large amounts of money market securities and sell shares in these pools based on the value of their underlying (money market) securities. In doing so, money market mutual funds allow small investors to invest in money market instruments.

PTS: 10 BNK: Chapter 05 – Money Markets, EOC

26. ANS:

Eurodollar certificates of deposits (CDs) are U.S. dollar denominated CDs in foreign banks. Maturities on Eurodollar CDs are less than one year and most have a maturity of one week to six months. Because these securities are deposited in non-U.S. banks, Eurodollar CDs are not subject to reserve requirements in the same manner as U.S. deposits. This allows the rate offered on Eurodollar CDs to be somewhat higher than on comparable U.S. bank issued CDs. However, U.S. deposits are insured up to certain amounts while Eurodollar CDs are not, which lowers the Eurodollar CD rate compared to U.S. bank issued CDs. Eurocommercial paper (Euro-CP) is issued by dealers of commercial paper without involving a bank. The Eurocommercial paper rate is generally about one-half to one percent above the LIBOR rate.

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