

# §4. FIXED INCOME AND RATES

FIN 366: INVESTMENTS  
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## FIXED INCOME SECURITIES

**Fixed income securities** are debt instruments where the borrower (issuer) pays fixed payments to the lender (holder).

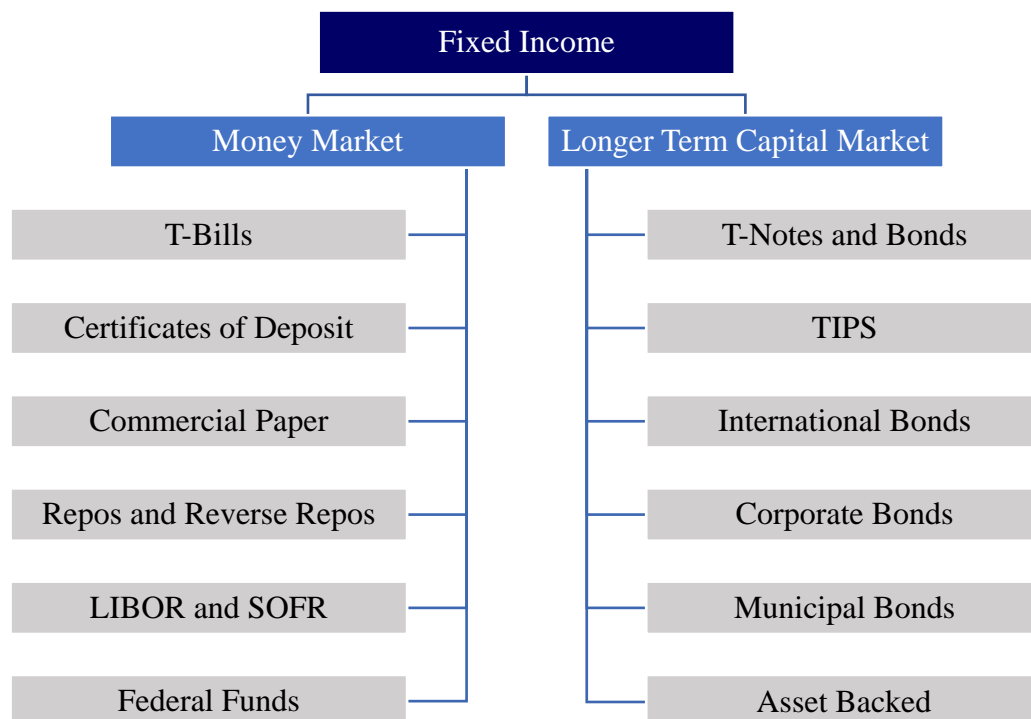


The key to understanding fixed income is understanding *yields*. Yields are the returns that a security pays you over time. The less you pay for a bond, the more it *yields* you (i.e., paying \$1 for a bond that gives you \$100 in one year is a 9,900% return, while paying \$99 for a bond that gives you \$100 in one year is a 1.01% return.)

*Prices and yields are therefore inversely related.*

**Money market** fixed income securities are short term, highly liquid, and low risk relative to longer term **capital market** debt instruments.

*Figure 1: Fixed Income Securities*





Why would shorter-term securities be relatively less risky than longer term debt? Why are fixed income securities relatively less risky than equity securities? Consider again the balance sheet.

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## MONEY MARKET FIXED INCOME SECURITIES AND RATES

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### T-BILLS

**Treasury-bills** (known as **T-bills**) are issued to finance government spending. They are **issued at a discount**, pay no coupon, and have maturities up to 52 weeks. The annualized return to holding a 90-day (13 week) T-bill is commonly referred to as the **risk-free rate** of return.



T-Bill (and as we'll see, T-Note and T-Bond) quotes are available on the WSJ website: <https://www.wsj.com/market-data/bonds/treasuries>. There's a small link on the top left of the table where you can toggle between Bills and Notes and Bonds.

Dealers (who have previously purchased government securities directly from the US in auctions) quote T-bills using the **bank discount method**.



T-Bills are quoted at *yields*, not as prices. The quotes tell you what return you would get if you buy now and collect the par at the end, *not* what you would pay.



How is it possible to quote fixed income securities at yields while common stock can only be quoted at prices?

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Figure 2: T-Bill Quotes

WSJ   MARKETS				
U.S. Treasury Quotes				
MATURITY	BID	ASKED	CHG	ASKED YIELD
4/23/2024	5.203	5.193	-0.005	5.365
4/25/2024	5.193	5.183	+0.023	5.356
4/30/2024	5.210	5.200	-0.008	5.378



**EXAMPLE:** From Figure 2, if you want to buy the T-bill maturing on 4/25/2024, you will have to pay some price such that its *yield to you* is *approximately* 5.183%. The dealer is willing to pay you some price such that its *yield to them* would be *approximately* 5.193% for the same T-bill.

We can determine what the *prices* are that investors could buy or sell these T-bills for.



**PRACTICE:** What is the dealer's profit on a T-bill given a BID = 0.905, ASKED = 0.895, CHG = -0.028, ASKED YIELD = 0.911? Assume a face value of \$10,000 and that there are 177 days to maturity.



**SOLUTION:** To find the dealer's profit, we need to find the bid-ask spread for this T-bill. That is, we need to calculate both the bid and ask *prices* from the bid and ask *yields* that

are provided. To convert the yields to prices by the bank discount method, we recognize that the bank discount method uses the following formula:

$$Quoted\ Yield = \frac{Face\ Value - Price}{Face\ Value} \times \frac{360}{Days\ to\ Maturity}$$

That is, the yield is the percent change in value, annualized assuming a 360-day year.

Solving for the *Price*, this formula becomes:

$$Price = Face\ Value \times \left[ 1 - \left( Quoted\ Yield \times \frac{Days\ to\ Maturity}{360} \right) \right]$$

To find the bid price, we plug in the values from the problem into the formula. Notice that we convert the given yields into decimals:

$$Bid\ Price = \quad \times \left[ 1 - \left( \quad \times \frac{\quad}{360} \right) \right] = \$9,955.50$$

To find the ask price:

$$Ask\ Price = \quad \times \left[ 1 - \left( \quad \times \frac{\quad}{360} \right) \right] = \$9,955.99$$

The dealer's profit is the bid-ask spread:

$$Bid\ Ask\ Spread = \quad - \quad =$$

**INTERPRETATION:** A dealer is willing to buy this bond at \$9955.50, then sell it at \$9955.99. Note however, that the bank discount method assumes the 360-day year, traditionally done to make computations simpler.

The value in the **asked yield** column of the quote table gives the annualized (365 day) rate of return if the T-bill is bought at the ask price and held until the maturity date. For this example, an investor who buys this bond at \$9955.99 from the dealer will receive \$10,000 in 177 days, realizing a 365-day annualized return of 0.911%.

Finally, the CHG tells us that today's BID value is 0.028 lower today than it was yesterday. The BID yesterday must have been  $0.905 + 0.028 = 0.933$ .



The Excel file [T-Bill Quotes](http://josephfarizo.com/fin366.html) available at [josephfarizo.com/fin366.html](http://josephfarizo.com/fin366.html) has additional practice problems using real quotes from the *WSJ*.

## CERTIFICATES OF DEPOSIT

**Certificates of Deposit (CD)** are time-deposits with a bank that cannot be withdrawn without penalty before a certain agreed upon date. In exchange for “locking up” investors' money, they offer a higher rate than savings or checking accounts. **Jumbo CDs** are in excess of \$100,000.

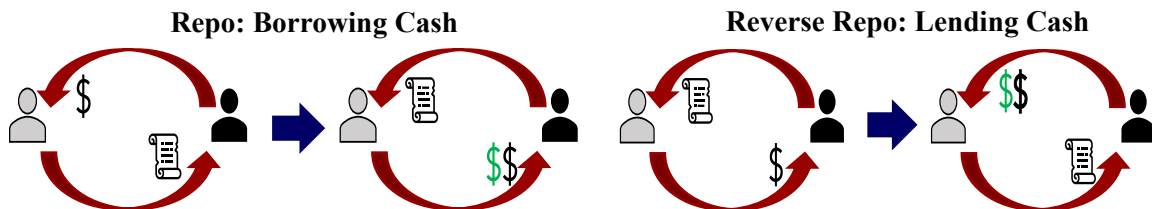
## COMMERCIAL PAPER

**Commercial paper** is unsecured (no collateral) short-term borrowings by large corporations, often in denominations of \$100,000 and maturing in less than 270 days. It may be used to pay for the firm's short-term liabilities, upcoming payroll obligations, or accounts payable.

## REPOS AND REVERSE REPOS

**Repurchase Agreements (Repos)** are short-term sale of securities to another party with the promise of buying them back for a higher amount later (borrowing). **Reverse Repos** are the short-term purchase of securities with an agreement to sell the securities back at a higher price (lending). The exchange often involves Treasury securities and cash.

*Figure 3: Repos and Reverse Repos*



## LIBOR AND SOFR

The **London Interbank Offer Rate (LIBOR)** was a short term interest rate that banks in London *claimed* they could borrow from each other. Many loans in the United States and worldwide were tied to this rate. For example, a credit card loan might require a borrower pay interest of LIBOR + 2 percentage points. The **Secured Overnight Financing Rate (SOFR)** is an *actual* rate on overnight repurchase agreements of Treasuries. SOFR, among other rates, has replaced LIBOR.

## FEDERAL FUNDS

The **federal funds rate** is the rate established by the Federal Reserve (FED) that banks borrow and lend to each other overnight to meet reserve requirements.



These money market rates and several other rates are available on the FED's Federal Reserve Economic Data (FRED) website: <https://fred.stlouisfed.org/>.

## CAPITAL MARKETS FIXED INCOME SECURITIES AND RATES

### T-NOTES AND T-BONDS

Like T-bills, **T-Notes** and **T-Bonds** are issued to finance government spending. These securities, however, make coupon payments and are longer term.

*Table 1: T-Bills, T-Notes, T-Bonds Government Securities*

	T-Bills	T-Notes	T-Bonds
Issuer	Federal Government		
Maturity	4, 13, 26 or 52 weeks	2, 3, 5, 7, and 10 years	20 and 30 years
Liquidity	High		
Default Risk	None – backed by the federal government		
Interest Type	Issued at a discount	Paid semiannually, with par paid at maturity	
Taxation	Owed: federal; exempt: state and local		

Unlike T-bills, T-Notes and T-Bonds *are* quoted at prices rather than at yields. This makes reading their quotes simpler.



Figure 4: T-Note and T-Bond Quotes

MATURITY	COUPON	BID	ASKED	CHG	ASKED YIELD
8/15/2052	3.000	88.0400	88.0500	0.8580	3.661
11/15/2052	4.000	106.1540	106.1740	0.9300	3.637
2/15/2053	3.625	99.1820	99.2020	0.8780	3.645

**EXAMPLE:** From Figure 4, let's assume the bond with the 8/15/2052 maturity has a \$10,000 par value. It pays a 3% *annual* coupon (or  $3\% \div 2 = 1.5\%$  every six months). This is a payment of  $0.015 \times \$10,000 = \$150$  every six months. The dealer will buy this bond from you if you have one to sell for 88.04% of its par value is (i.e., \$8,804). If you want to buy this bond, you'll pay 88.05% of par (i.e., \$8,805). Today's price is 0.8580% higher than yesterday (CHG), and your *annual* rate of return if you buy this bond at its ask price and hold it to maturity is 3.661% per year, the **asked yield**.



These bonds have maturity dates close to one another. Explain why their prices and coupons are different but their asked yields are similar. For example, why would an investor pay \$10,617.40 for a bond when another is available for \$8,805.00?

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The Excel file [T-Bond Quotes](http://josephfarizo.com/fin366.html) available at [josephfarizo.com/fin366.html](http://josephfarizo.com/fin366.html) has additional practice problems using real quotes from the *WSJ*.

## TREASURY INFLATION PROTECTED SECURITIES

**Treasury Inflation Protected Securities (TIPS)** are T-Notes and T-Bonds with the face value adjusted for changes to the Consumer Price Index inflation measure. The face value will increase with inflation, but not fall below the original face value if there is deflation. Although interest payments are fixed (i.e., 3% of par), the coupon payments change as the face value changes.

## INTERNATIONAL BONDS

**Eurobonds** are bonds denominated in a currency other than the denomination of the country in which it is issued, allowing flexibility to raise capital. For example, a Japanese yen-denominated bond issued in the United States may give a Japanese-based firm access to US investors.



This name can be confusing. Eurobonds *may be* denominated in Euros €, but don't have to be.

## CORPORATE BONDS

**Corporate bonds** are longer-term debt instruments issued by corporations to finance investments and projects. Corporate bond investors receive claims on a firm's assets before preferred and common stockholders.

## MUNICIPAL BONDS

**Municipal bonds (munis)** are issued by state and local government to finance projects like roads, hospitals, and stadiums. Two main types:

- **General Obligation Bonds**- paid by tax revenue
- **Revenue Bonds**- paid by project revenue (tolls, college tuition, college room and board)

Muni bond issuers *can* default, so these securities are not risk free. However, they offer an attractive feature: the bond investor doesn't need to pay federal income taxes and taxes of the issuing local government/municipality.

Investors should consider the after-tax returns when comparing muni yields to otherwise similar taxable instruments. We can convert a muni bond's yield to the **equivalent taxable yield**, or the rate of return it "actually" earns post tax. You should compare a muni's equivalent taxable yield to what a taxable bond yields to determine which is better (assuming *all else equal* and the other characteristics of the bonds are the same.)

$$r_{\text{equivalent taxable}} = \frac{r_{\text{muni}}}{(1 - t)}$$



**EXAMPLE:** Would an investor prefer a taxable corporate bond yielding 4.5% return, or a muni bond with a 4% tax-free yield? Assume the bonds are otherwise identical, and that the investor's combined federal and state marginal tax rate is 17.75% (or 12.0% federal + 5.75% state). The equivalent taxable yield is:

$$r_{\text{equivalent taxable}} = \frac{0.04}{(1 - 0.1775)} = 0.04863 = 4.863\%$$

That is, although the muni bond yields 4%, it is *as if* the bond yields 4.863% after the tax advantage. Because 4.865% > 4.5%, the investor should choose the muni.

If you have the taxable and muni yields, you can determine at which marginal tax rate you'd be indifferent between the two:

$$r_{\text{equivalent taxable}} = \frac{r_{\text{muni}}}{(1 - t)} = 0.045 = \frac{0.04}{(1 - t)} \rightarrow t = 11.11\%$$

If an investor's marginal tax rate is 11.11%, they are indifferent between these two bonds.

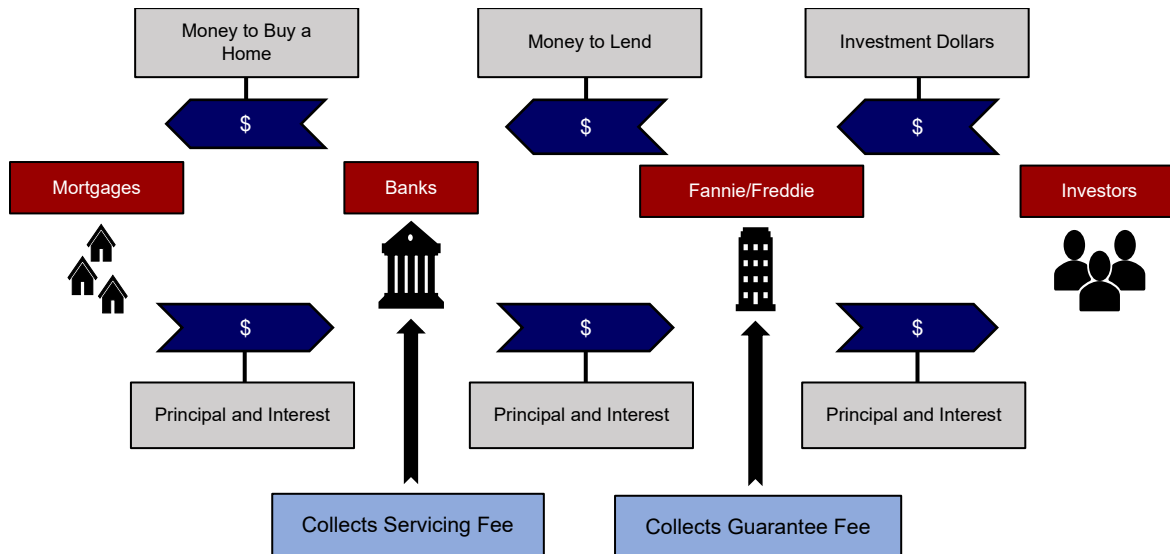


The Excel file [Muni Bonds](http://josephfarizo.com/fin366.html) available at [josephfarizo.com/fin366.html](http://josephfarizo.com/fin366.html) has additional muni bond practice problems.

## ASSET BACKED SECURITIES

**Asset Backed Securities** are instruments that are *collateralized* by a pool of underlying assets such as mortgages (**mortgage backed securities - MBS**), car loans, student loans, or credit cards. Creating a security through the pooling of assets is a process known as **securitization**.

Figure 5: Mortgage-Backed Securities



**The Global Financial Crisis** in 2008 (GFC) was the most severe economic crisis since the Great Depression of the 1930s. MBS played a large role. Predatory lending resulted in mortgages that borrowers couldn't afford. Some borrowers could obtain loans without verifying their income, jobs, or assets (**NINJA loans** – no income, no job or assets). Subprime, or low-quality mortgages were packaged up and securitized, guaranteed by government sponsored entities **Fannie Mae** and **Freddie Mac**. These MBS were considered safe by rating agencies. Then, housing prices dropped, defaults ensued, and losses rippled throughout the economy.



The [\*Financial Crisis Inquiry Report\*](#) authored by Congress-appointed academics, analysts, and attorneys, goes into the many details surrounding the crisis.

## CRITICAL THINKING QUESTIONS

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1. A very young and risky company wants to borrow money from you, promising to pay you back \$1,000 in exactly one year. A much safer and older firm with steady cash flows similarly want to borrow money from you, promising to pay you back exactly \$1,000 in one year. Which company would you require sell you a bond at a “deeper discount”, and why?
2. Regarding the question above, what can we conclude about yields and risk? Should higher risk securities yield more, and why?
3. Yields and prices are inversely related, yet you notice a bond with a lower price has a *lower* yield than a bond with a higher price. How might this be possible? (Hint: think about coupons.)
4. How are shorter term debt securities less risky than longer term debt securities?
5. Why are a firm’s debt instruments less risky than a firm’s equity instruments?
6. When you look up T-bill quotes online, are these dealers or the federal government posting bid and asks? Would this be a secondary or primary market transaction?
7. What does it mean when a debt instrument is “issued at a discount”?
8. How can you determine from the WSJ quotes pages what a T-bill, T-Note, or T-bond’s average annualized rate of return is?
9. Explain what the statement “T-bills are quoted at yields not at prices” means.
10. Dealers profit on the bid-ask spread. Why, then, is the value in the bid column greater than the value in the ask column for T-bill quotes?
11. How does the federal funds rate affect us as individuals and investors if it is the rate that banks borrow to and lend from each other?
12. Explain why an investor may be willing to purchase a T-bond at a price greater than the principal or face value of the bond.
13. What is the distinction between a *general obligation* muni bond and a *revenue* muni bond?
14. Given your answer in the question above, which type of bond do you think would be riskier and why?
15. What is an advantage of muni bonds, particularly as it pertains to investors in high tax brackets?
16. What is a disadvantage or risk associated with muni bonds relative to treasury securities?
17. Define the *equivalent taxable yield*.
18. All else equal, if a muni bond’s equivalent taxable yield is greater than a similar but taxable bond’s yield, which bond is preferred?
19. Why might wealthier investors be attracted to muni bonds?
20. What are the differences between corporate bonds and commercial paper?
21. Identify each of the following fixed income securities/transactions/rates. Which are *money market* securities/transactions/rates?
  - a. A securities dealer acquires additional T-bonds for their inventory by paying \$1.0 million to another party, agreeing to sell back the bonds to the same party for \$1.01 million.
  - b. You open an interest-bearing account at Iberia Bank, but the money cannot be withdrawn from your account until the end of the year.
  - c. To borrow cash, a dealer sells some of their T-bonds to another party, agreeing to buy them back at a higher price in the near future.

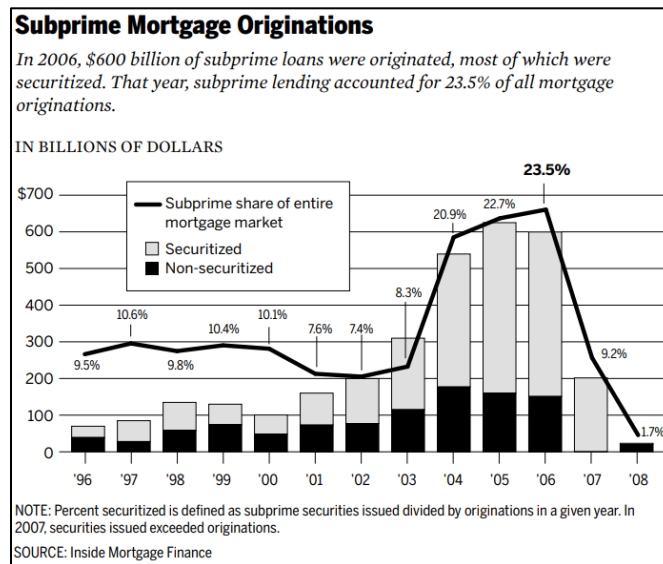
- d. FLFB Corp., a large chemical company, issues a promissory note to borrow \$300,000 for an upcoming expense. They will pay back the holder \$310,000 in 250 days.
  - e. To meet its reserve requirements, B&T bank borrows \$15,000,000 from American Bank Corp., and will pay back \$15,001,234 within 24 hours.
  - f. A large institutional investor holds a security that earns interest and principal payments from auto loans.
  - g. Your credit card loans were originally tied to a floating interest rate that is being phased out, and it will now be tied to a new rate. What was the likely name of the old rate and what is likely the name of the new rate?
22. Describe the process of securitization. What does collateralized mean?
23. **CHALLENGE The WSJ Prime Rate** is a rate that many credit card loans are tied to (like SOFR). The WSJ surveys large banks, asking them the rate they charge their best, most credit-worthy customers. Why might a credit card company have an interest rate of, for example, WSJ Prime + 2% instead of just offering some fixed rate of interest? What causes interest rates to change? If you have a poor credit history, do you think your loan is more likely to be WSJ Prime + 2% or WSJ Prime + 4%? Why?
24. **CHALLENGE** Describe how TIPS adjust for inflation. Given they offer this inflation protection benefit, why wouldn't everyone buy TIPS instead of regular treasuries (Hint: do they need to offer higher or lower yields than bonds that do not have inflation protection)?

## ANALYTICAL QUESTIONS

1. Use the table of T-Bond quotes below to answer the questions that follow.

WSJ   MARKETS					
U.S. Treasury Quotes					
MATURITY	COUPON	BID	ASKED	CHG	ASKED YIELD
8/15/2052	3.000	88.0400	88.0500	0.8580	3.661
11/15/2052	4.000	106.1540	106.1740	0.9300	3.637
2/15/2053	3.625	99.1820	99.2020	0.8780	3.645

- Explain how the bond with the lowest coupon rate has the highest asked yield.
  - What does the bond maturing on 11/15/2052 pay every 6 months to the investor? How much do you pay for this bond? Assume the par value is \$10,000.
  - Explain how investors buying and selling these bonds changes the prices, and how changing prices changes their asked yields.
2. Below is a figure from the [Financial Crisis Inquiry Report](#)<sup>1</sup>. Answer the questions that follow:



- Explain the two disturbing trends that are revealed from this figure prior to the crisis.
- What do you think caused the sizable drop in the two trends from (a)?
- How might securitization make banks less likely to care about whether the mortgages they originate can make their payments?

## CFA QUESTIONS

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Answers are in the *Notes & References* section below.<sup>2</sup>

1. Calculate the coupon payment on a 2.5% coupon bond with \$100,000 par value and a semiannual payment frequency.
  - a. \$1,250
  - b. \$250
  - c. \$2,500
2. The source of repayment for asset-backed securities are
  - a. Cash flows from the securitized group of loans
  - b. Mortgages
  - c. NINJA loans and subprime loans
3. Orleans Parish, the regional government of New Orleans in Louisiana, issued a green bond, the proceeds of which are to be used for investments including ecofriendly construction and renovation of buildings, public transport to support sustainable mobility, and renewable energy projects. The bond is backed by the tax and other revenue of Orleans Parish. This bond is an example of:
  - a. A general obligation bond
  - b. A revenue bond
  - c. A T-bill
4. Ahbaling Industries (Ahbaling), a manufacturer of industrial machine tools, has \$500 million of corporate bonds outstanding. Ahbaling has \$400 million of receivables on its balance sheet that it would like to securitize. The receivables represent payments Ahbaling expects to receive for machine tools it has sold to various customers in Europe. Ahbaling issues ABS, backed by the pool of receivables. Investors considering the purchase of the ABS bonds will rely most on:
  - a. Whether Ahbaling can pay its \$500 million in debt
  - b. The default risk associated with collecting payments from Ahbaling customers
  - c. The financial health of Ahbaling



## NOTES & REFERENCES

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<sup>1</sup> This is Figure 5.2 from the report, on page 70. Available at <https://www.govinfo.gov/content/pkg/GPO-FCIC/pdf/GPO-FCIC.pdf>.

<sup>2</sup> CFA Question answers: 1) A, 2) A, 3) A, 4) B

