Corporate Finance: IOE 452/MFG 455
University of Michigan
Winter 2026
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1/20/26

Contents

1 Review

Example

Suppose bank **A** pays interest monthly with the interest rate quoted as an effective annual rate (**EAR**) of 5%.

1. What amount of interest will you earn each month?
2. Suppose you have no money in the bank today, how much will you need to save at the end of each month to accumulate $\$80,000$ in 10 years?

   Solution

   - A 5% **EAR** is equivalent to earning $(1+.05)^{\frac{1}{12}}-1=.4074\%$ per month.
   - We can model this saving plan as a monthly annuity with 10×12 monthly deposits. The future value of the annuity is $\$80,000$. Therefore, solve for C in

   $$C=\$80,000\times 0.004074\left((1.004074)^{120}-1\right)^{-1}=\$518.26$$

   We can also compute this result using the annuity spreadsheet:

   $$C=\mathbf{PMT}(0.004074,120,0,-80000)$$

Example[1]

Your firm is purchasing a new telephone system, which will last for four years. You can purchase the system for an up–front cost of $\$150,000$, or you can lease the system from the manufacturer for $4000 paid at the end of each month. Your firm can borrow at an interest rate of 5% **APR** with semiannual compounding. Should you purchase the system outright or pay $4000 per month?

Solution

First, convert the borrowing cost of 5% **APR** with semiannual compounding to a monthly discount rate. Monthly rate is:

$$(1.025)^{\frac{1}{6}}-1=.4124\%$$

Alternatively, we could use formula (Lecture 2, 12) we had for converting **APR** to bf EA:

$$1+\text{EAR}=\left(1+\frac{.05}{2}\right)^2=1.050625$$

[1] Text. Example 5.2

Then, convert the semiannual rate to a monthly rate using

$$(1.050625)^{\frac{1}{12}} - 1 = 0.4124\%$$

In either case, we must use 0.4124% in the annuity formula to compute the present value

$$\text{PV} = \frac{4000}{0.004124}\left(1 - (1.004124)^{-48}\right) = \$173,867.22$$

Thus, paying \$4000 per month for 48 months is equivalent to paying a present value of \$173,867.22 today. This cost is higher than the cost of purchasing the system, so it is better to pay \$150,000 for the system rather than lease it. We can interpret this result as meaning that at a 5% APR with semiannual compounding, by promising to repay \$4000 per month, your firm can borrow \$173,86 today. With this loan it could purchase the phone system and have an additional \$23,867 to use for other purposes.

2 Bonds: Continued

3 Quality Ratings

- Most bonds are exposed to **default risk**, which arises when the issuer experiences financial distress or enters bankruptcy and is unable to meet its promised interest or principal payments.
- To help investors assess this risk, specialized **credit rating agencies** evaluate and rate corporate bonds based on their credit quality. Two of the most prominent agencies are Moody's and Standard & Poor's.
- Credit ratings are determined using a combination of **quantitative analysis** (such as financial ratios, cash flow projections, and leverage) and **qualitative judgment** (including industry outlook, management quality, and economic conditions). These ratings reflect the likelihood that bond payments will be made fully and on time.
- While rating agencies use different letter-based classification systems, their ratings are broadly comparable and are designed to convey similar levels of credit risk.
- Bonds with lower credit ratings typically trade at **lower prices and higher yields** than otherwise comparable bonds with higher ratings, compensating investors for the additional default risk.

3.1 Credit Rating Agencies

Credit rating agencies are specialized financial service firms that assess the *credit risk* of a security or an issuer. Their role is to provide investors with an informed estimate of the likelihood that promised interest and principal payments will be made in full and on time.

In practice, credit risk is summarized through the assignment of a **credit rating**, a standardized mark or grade, reflecting the issuer's financial strength, cash flow stability, leverage, and overall economic outlook. These ratings help investors compare securities across issuers and markets and play a central role in pricing bonds and determining required yields.

Prominent agencies such as Moody's and S&P use broadly similar frameworks, though their specific rating symbols differ. Despite these differences, ratings across agencies are generally comparable in terms of the level of default risk they represent.

The importance of credit ratings is underscored by developments in the corporate bond market. In 2021, issuance of low-rated, **speculative-grade** (or "high-yield") debt reached approximately $650 billion by September, surpassing previous annual records with several months remaining in the year.

This surge followed historically high levels of corporate borrowing in 2020, as firms across industries raised large amounts of debt to withstand the economic disruptions caused by the COVID-19 pandemic. These episodes highlight how credit ratings influence access to capital, borrowing costs, and investor risk-taking, especially during periods of economic stress.

Credit Rating Scales by Agency, Long-Term

Moody's	S&P	Fitch	
Aaa	AAA	AAA	Prime
Aa1	AA+	AA+	High grade
Aa2	AA	AA	
Aa3	AA-	AA-	
A1	A+	A+	Upper medium grade
A2	A	A	
A3	A-	A-	
Baa1	BBB+	BBB+	Lower medium grade
Baa2	BBB	BBB	
Baa3	BBB-	BBB-	
Ba1	BB+	BB+	Non-investment grade speculative
Ba2	BB	BB	
Ba3	BB-	BB-	
B1	B+	B+	Highly speculative
B2	B	B	
B3	B-	B-	
Caa1	CCC+	CCC	Substantial risk
Caa2	CCC		Extremely speculative
Caa3	CCC-		Default imminent with little prospect for recovery
Ca	CC		
	C		
C	D	DDD	In default
/		DD	
/		D	

"Junk"

WOLFSTREET.com

4 Pricing a Bond: Valuation

The value of a bond is determined by the present value of its expected future cash flows, discounted at a rate that reflects prevailing market interest rates and the bond's risk characteristics.

A standard coupon bond generates cash flows at regular intervals over its life. These cash flows consist of periodic coupon payments and a final repayment of principal at maturity.

- The **traditional valuation approach** discounts every promised cash flow of a fixed-income security using the *same* discount rate, known as the bond's yield to maturity.

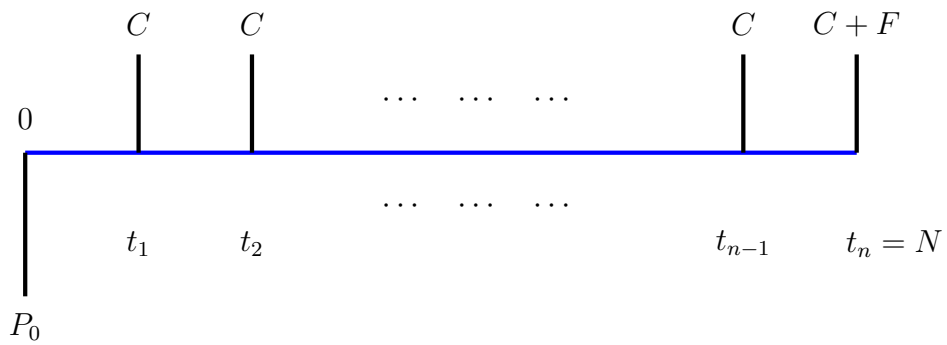
- Bond cash flows take two forms:

  1. **Coupon payments** C, paid periodically. When expressed as a rate,

  $$C = r \times F$$

  where r is the coupon rate.
  2. **Principal repayment** F, paid at **maturity.**

- **Notation:**
  - F: face (par) value of the bond
  - r: coupon rate per payment period
  - y: yield to maturity (uniform discount rate)
  - N: total number of coupon payment periods
  - P: price of the bond, typically quoted as a percentage of face value



Example–Bond Price Quotation

Suppose a bond with face value $F = \$1{,}000$ is quoted at a price of 98. This implies a market value of

$$P = \frac{98}{100} \times \$1{,}000 = \$980.$$

Example–Annual Coupon Bond

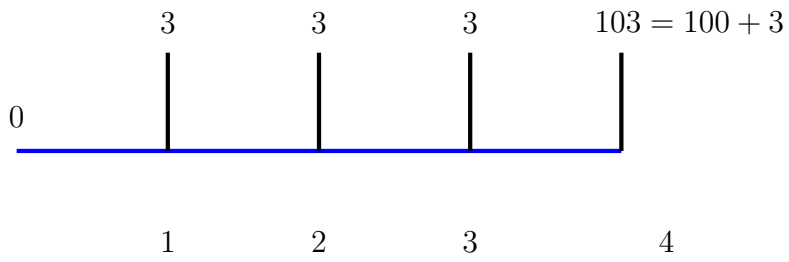
Consider a bond with face value \$100 that pays annual coupons for four years at a coupon rate of 3%. Assume investors require a yield of 6%.

Solution

The annual coupon payment is

$$C = 0.03 \times 100 = \$3.$$

The bond's cash–flow diagram is as follows:



The bond price equals the present value of all future cash flows:

$$\begin{aligned} P_0 &= \frac{3}{(1.06)^1} + \frac{3}{(1.06)^2} + \frac{3}{(1.06)^3} + \frac{103}{(1.06)^4} \\ &= \$89.60. \end{aligned}$$

Therefore, the price of this bond P_0, which is just the sum of the present values of all the cash flows is \$89.60.

Since $P_0 < F$ and $y > r$, this bond trades *below par* and is classified as a **discount bond**.

Example–Semiannual Coupon Bond

Determine the price of a 3-year bond with face value \$1,000, a coupon rate of 3% paid semiannually, and a required yield of 6%.

Solution

Each semiannual coupon payment equals

$$\frac{0.03 \times 1000}{2} = \$15,$$

and the yield per period is 3% over 6 periods.

Using Excel:

$$\text{PV}(\mathbf{0.03, 6, 15, 1000, 0})$$

5 Bond Types

Bonds can be classified based on their market price relative to face value:

1. **Premium bond:** $P > F$
2. **Discount bond:** $P < F$
3. **Par bond:** $P = F$

- Regardless of type, all bonds trade at par at maturity, this is known as the **pull-to-par effect**.
- The bond's classification depends on the relationship between the coupon rate r and the yield to maturity y:
  - If $r > y$, the bond trades at a premium.
  - If $r < y$, the bond trades at a discount.
  - If $r = y$, the bond trades at par.

Example–Bond Type Determination

Consider a 10-year bond with face value \$1,000 and a coupon rate of 4% paid semiannually. The market yield is 5%.

Solution

Each semiannual coupon equals

$$\frac{0.04 \times 1000}{2} = \$20,$$

and there are 20 payment periods.

The present value of coupon payments is (remember the annuity formula!)

$$\frac{20}{0.025}\left(1 - (1.025)^{-20}\right) = \$311.78$$

and the present value of the principal is

$$\frac{1000}{(1.025)^{20}} = \$610.27$$

Thus, the bond price is

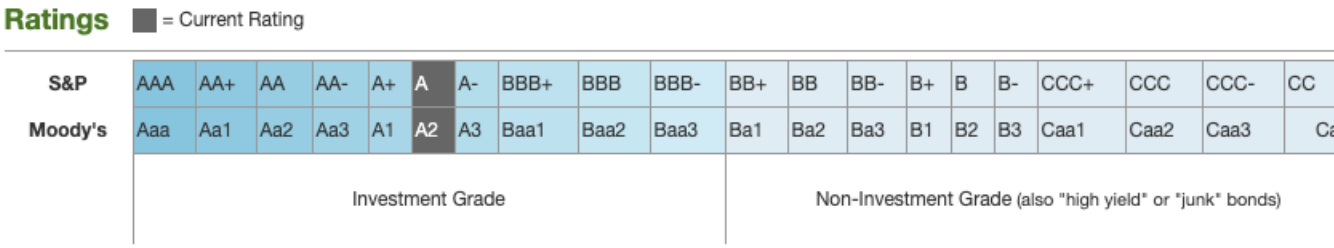
$$P = 311.78 + 610.27 = \$922.05$$

Because the price is below face value, this bond is a **discount bond**.

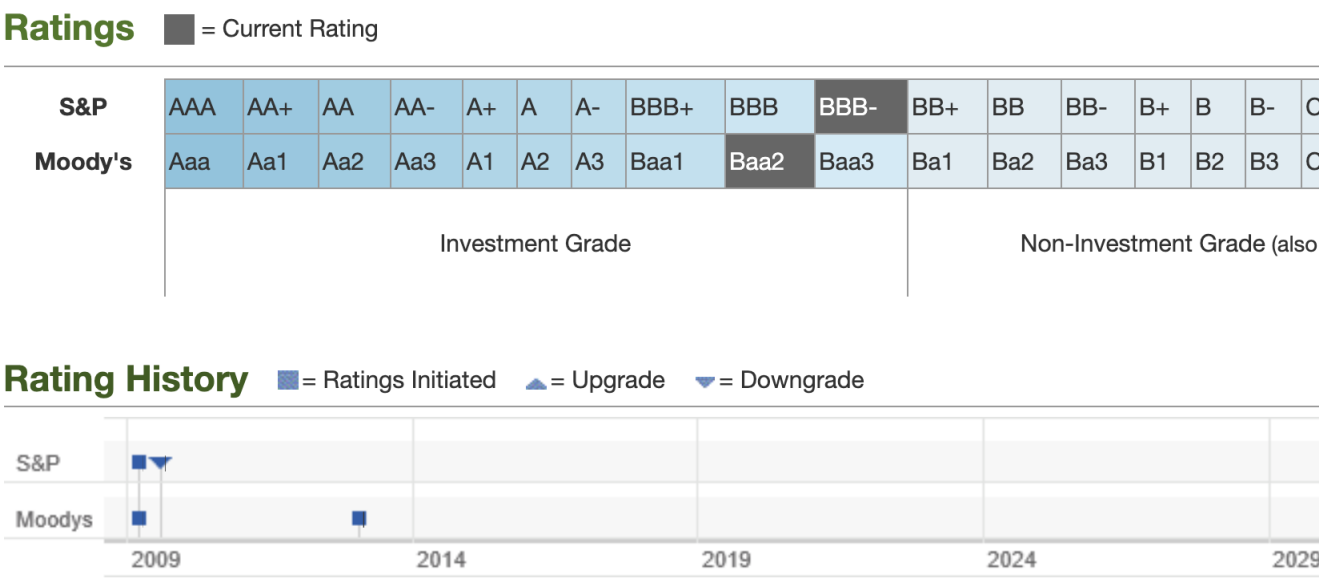
6 A Corporate Bond over Time: Example

- **Example of a Corporate Bond over time:**

- Consider the following bond issued by Boeing Corporation:
- **CUSIP**: 097023AX3
- Bond issued on 03/13/2009 with the maturity date of 03/15/2039. (30 year bond)
- Face $100.
- On 9/9/19 Here are some characteristics:
- Price: $151.110
- Rating: **A S&P**, **A2 Moody's**
- Coupon 6.875% paid semi–annually.
- Non–callable.



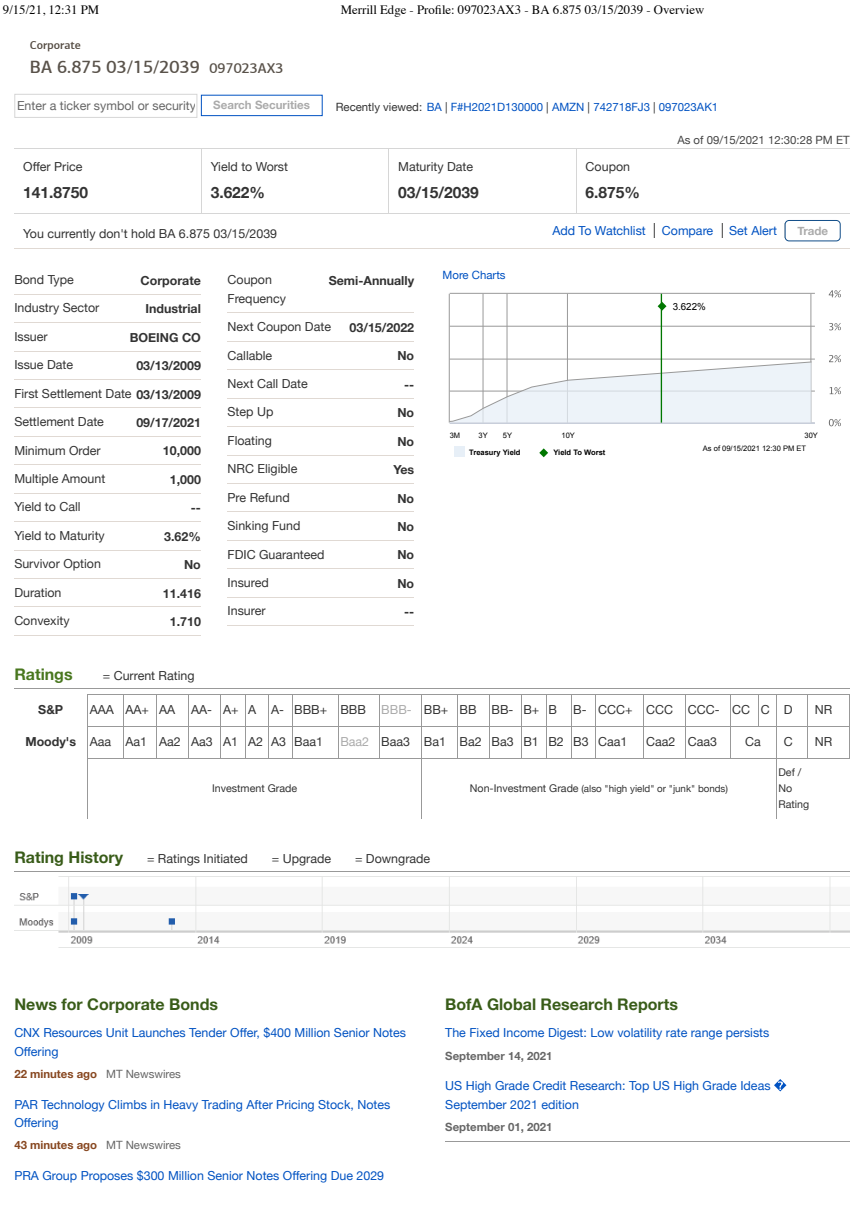
- Same bond on 9/16/20
- Price: $129.22
- Rating: **BBB- S&P**, **Baa2 Moody's**



- Rating: **BBB- S&P**, **Baa2 Moody's**

- Same bond on 9/15/21 (Two years after)

  Price: $141.8750



9/15/21, 12:31 PM Merrill Edge - Profile: 097023AX3 - BA 6.875 03/15/2039 - Overview

Corporate

BA 6.875 03/15/2039 097023AX3

Enter a ticker symbol or security | Search Securities | Recently viewed: BA | F#H2021D130000 | AMZN | 742718FJ3 | 097023AK1

As of 09/15/2021 12:30:28 PM ET

Offer Price	Yield to Worst	Maturity Date	Coupon
141.8750	3.622%	03/15/2039	6.875%

You currently don't hold BA 6.875 03/15/2039 Add To Watchlist | Compare | Set Alert | Trade

Bond Type	Corporate	Coupon Frequency	Semi-Annually
Industry Sector	Industrial	Next Coupon Date	03/15/2022
Issuer	BOEING CO	Callable	No
Issue Date	03/13/2009	Next Call Date	--
First Settlement Date	03/13/2009	Step Up	No
Settlement Date	09/17/2021	Floating	No
Minimum Order	10,000	NRC Eligible	Yes
Multiple Amount	1,000	Pre Refund	No
Yield to Call	--	Sinking Fund	No
Yield to Maturity	3.62%	FDIC Guaranteed	No
Survivor Option	No	Insured	No
Duration	11.416	Insurer	--
Convexity	1.710		

More Charts

Ratings = Current Rating

S&P	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC+	CCC	CCC-	CC	C	D	NR
Moody's	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa1	Caa2	Caa3	Ca		C	NR
	Investment Grade										Non-Investment Grade (also "high yield" or "junk" bonds)											Def / No Rating	

Rating History = Ratings Initiated = Upgrade = Downgrade

News for Corporate Bonds

CNX Resources Unit Launches Tender Offer, $400 Million Senior Notes Offering

22 minutes ago MT Newswires

PAR Technology Climbs in Heavy Trading After Pricing Stock, Notes Offering

43 minutes ago MT Newswires

PRA Group Proposes $300 Million Senior Notes Offering Due 2029

BofA Global Research Reports

The Fixed Income Digest: Low volatility rate range persists

September 14, 2021

US High Grade Credit Research: Top US High Grade Ideas September 2021 edition

September 01, 2021

1/3

- Same bond on 9/9/22
- Price $107.5190
- Rating: **BBB- S&P**, **Baa2 Moody's**

Corporate

BA 6.875 03/15/2039 097023AX3

As of 09/09/2022 01:15:03 PM ET

Offer Price	Yield to Worst	Maturity Date	Coupon
107.5190	**6.144%**	**03/15/2039**	**6.875%**

You currently don't hold BA 6.875 03/15/2039

Bond Type	**Corporate**
Industry Sector	**Industrial**
Issuer	**BOEING CO**
Issue Date	**03/13/2009**
First Settlement Date	**03/13/2009**
Settlement Date	**09/13/2022**
Minimum Order	**10,000**
Multiple Amount	**1,000**
Yield to Call	**--**
Yield to Maturity	**6.14%**
Survivor Option	**No**
Duration	**9.740**
Convexity	**1.335**

Coupon Frequency	**Semi-Annually**
Next Coupon Date	**09/15/2022**
Callable	**No**
Next Call Date	**--**
Step Up	**No**
Floating	**No**
NRC Eligible	**Yes**
Pre Refund	**No**
Sinking Fund	**No**
FDIC Guaranteed	**No**
Insured	**No**
Insurer	**--**

More Charts

chart not available

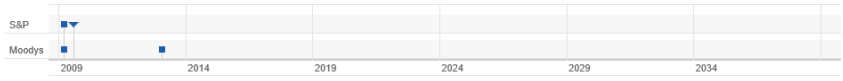
Ratings

= Current Rating

S&P	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC+	CCC	CCC-	CC	C	D	NR
Moody's	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa1	Caa2	Caa3	Ca		C	NR
	Investment Grade										Non-Investment Grade (also "high yield" or "junk" bonds)											Def / No Rating	

Rating History

= Ratings Initiated = Upgrade = Downgrade



News for Corporate Bonds

Air Liquide Successfully Launches a 600 Million Euros Long Term Bond Issuance

September 09, 2022 11:45 AM ET Business Wire

Telus Prices $2.0 Billion Three-tranche Senior Note Offering

September 09, 2022 06:43 AM ET MT Newswires

TELUS Prices $2 Billion Senior Notes Offering

September 09, 2022 03:10 AM ET MT Newswires

BofA Global Research Reports

The Fixed Income Digest: Higher hard landing probability = good news for duration

August 10, 2022

- Same bond on 1/24/24
- Price $112.1280
- Rating: **BBB- S&P**, **Baa2 Moody's**

Offer Price	Yield to Worst	Maturity Date	Coupon
112.1280	**5.67%**	**03/15/2039**	**6.875%**

You currently don't hold BA 6.875 03/15/2039 Add To Wa

Bond Type	**Corporate**	Coupon Frequency	**Semi-Annually**
Industry Sector	**Industrial**	Next Coupon Date	**03/15/2024**
Issuer	**BOEING CO**	Callable	**No**
Issue Date	**03/13/2009**	Next Call Date	**--**
First Settlement Date	**03/13/2009**	Step Up	**No**
Settlement Date	**01/26/2024**	Floating	**No**
Minimum Order	**10,000**	NRC Eligible	**Yes**
Multiple Amount	**1,000**	Pre Refund	**No**
Yield to Call	**--**	Sinking Fund	**No**
Yield to Maturity	**5.67%**	FDIC Guaranteed	**No**
Survivor Option	**No**	Insured	**No**
Duration	**9.483**	Insurer	**--**
Convexity	**1.223**		

More Charts

Ratings = Current Rating

S&P	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC+
Moody's	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa1
	Investment Grade										Non-Investment Grade (also "high						

- Same bond on 1/17/25
- Price $106.1750
- Rating: **BBB– S&P**, **Baa3 Moody's**

Corporate

BA 6.875 03/15/2039 097023AX3

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As of 01/17/2025 10:13:25 AM ET

Offer Price	Yield to Worst	Maturity Date	Coupon
106.1750	6.212%	03/15/2039	6.875%

You currently don't hold BA 6.875 03/15/2039 | Add To Watchlist | Compare | Set Alert | Trade

Bond Type	Corporate	Coupon Frequency	Semi-Annually
Industry Sector	Industrial	Next Coupon Date	03/17/2025
Issuer	BOEING CO	Callable	No
Issue Date	03/13/2009	Next Call Date	--
First Settlement Date	03/13/2009	Step Up	No
Settlement Date	01/21/2025	Floating	No
Minimum Order	5,000	NRC Eligible	Yes
Multiple Amount	1,000	Pre Refund	No
Yield to Call	--	Sinking Fund	No
Yield to Maturity	6.21%	FDIC Guaranteed	No
Survivor Option	No	Insured	No
Duration	8.938	Insurer	--
Convexity	--		

More Charts

Ratings

= Current Rating

S&P	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC+	CCC	CCC-	CC	C	D	NR
Moody's	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa1	Caa2	Caa3	Ca		C	NR
	Investment Grade										Non-Investment Grade (also "high yield" or "junk" bonds)											Def / No Rating	

- Same bond on 1/20/26
- Price $113.8840
- Rating: **BBB– S&P**, **Baa3 Moody's**