



IBS

INTERNATIONAL
BUSINESS SCHOOL

Valuing Bonds

Principles and Practices of
Business Finance

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Agenda

1. What is a Bond
2. Bond Pricing
3. Premium and Discount Bonds
4. Bond pricing with annuity
5. Bond Yields
6. Bond Rates of Return
7. Special Types of Corporate Bonds

What is a Bond

Bond - Security that **obligates** the issuer to make regular interest payments ('coupon') until the end of the loan ('maturity'), and to repay the amount borrowed (the 'principal') payment to the bondholder upon maturity.

- A **security** is a tradable financial asset.
- Bond is basically a loan:
 - Borrower: **bond issuer** (*the one who sells the bond*)
 - Lender: **bondholder** (*the one who buys the bond*)
 - Interest payment: **coupon** (special name of interest in case of bonds)

Companies and governments are typical bond issuers (borrowers).

Terminology:

- Face Value (Par Value or Principal Value) - Payment at the maturity of the bond
- Coupon - The interest payments made to the bondholder
- Coupon Rate - Annual interest payment, as a percentage of face value

UNITED STATES OF AMERICA + STATE OF ILLINOIS

1000

No. 12882



1000

No. 12882

Issuing
Company
(The Borrower)

Maturity Date
January 1, 2019

SMART TOUCH LEARNING, INC.

SMART TOUCH LEARNING, INC., a corporation of the State of Illinois (hereinafter called the "Company"), for value received, hereby promise to pay to the bearer, or, if this bond be registered as to principal to the registered owner, here of,

ON THE FIRST DAY OF JANUARY

2019

the sum of

ONE THOUSAND DOLLARS (\$1,000),

Annual Stated
Interest Rate
9%

and to pay interest on such principal sum from the date hereof at the rate of
NINE PER CENT

per annum, payable January 1, 1977, and semi-annually thereafter on the first day of January and the first day of July in each year until the maturity of this bond, or, if default should be made in payment of the principal hereof or when the same shall become due and payable, at the legal rate of interest until the present in full of such principal sum, but, in the case of the interest due on or before maturity, paid upon the presentation and surrender of the respective interest coupons representing such interest bonds attached, at their several rates.

Principal of and interest and premium, if any, on this bond are payable solely out of the special fund of the System known as the "Washington Public Power Supply System Nuclear Project No. 1 Bond Fund" (hereinafter referred to as the "Bond Fund"). Payment of such principal, interest and premium will be made at the principal office of SEATTLE-FIRST NATIONAL BANK, in the City of Seattle, Washington, or, at the option of the holder hereof, or of such successor, as the case may be, at the principal office of THE FIRST NATIONAL BANK OF CHICAGO, in the City of Chicago, Illinois, or at the principal office of MANUFACTURERS HANOVER TRUST COMPANY, in the City of New York, New York, or Paying Agents of the System, in such sum or currency of the United States of America which at the time of payment is legal tender for public and private debts.

This bond is one of a duly authorized series of bonds of like designation herewith, aggregating One Hundred Eighty Million Dollars (\$180,000,000) in principal amount. This bond and the bonds of the series of which it is one are issued under the authority of and in full compliance with the Constitution and Statutes of the State of Washington, including Title 43 and 54 of the "Revised Code of Washington," and under and pursuant to Resolution No. 769 of the System adopted by the Board of Directors of the System on the 10th day of September 1970. There-

sufficient for the fixed amounts which the System is obligated to set aside in the Bond Fund to pay the principal of and interest and premium, if any, on this Bond and the issue of Bonds of which this Bond is a part, and for the proper operation and maintenance of the Project, and of necessary repairs thereto and replacements and renewals thereof.

The Bonds of the series of Bonds of which this Bond is a part are subject to redemption prior to maturity, at the option of the System, on and after September 1, 1985, or in whole at any time, or in part from time to time on any interest payment date in the inverse order of their maturities and by lot within a maturity, at the redemption prices with respect to each Bond, expressed as a percentage of the principal amount of the Bond to be redeemed, set forth below, together with the interest accrued thereon to the date fixed for redemption:

Period During Which Redeemed (Bonds Due Dates Included)	Redemption Price
Jan 1, 2014 thru Oct 31, 2014	103%
Jan 1, 2015 thru Dec 31, 2015	102%
Jan 1, 2016 thru Dec 31, 2016	101%
Jan 1, 2017 thru Oct 31, 2017	100%

provided, however, that the System further reserves the right to redeem prior to maturity the Bonds of the series of Bonds of which this Bond is a part maturing (i) on July 1, 2010, and (ii) on July 1, 2017, in part from time to time on any interest payment date on and after January 1, 1988, and on and after January 1, 2011, respectively, but only upon payment of the principal amount thereof from the amounts credited to the Bond Retirement Account in the Bond Fund pursuant to paragraph C of Section 7.9 of the Bond Resolution. (d) On July 1,

Face Value

Bond Term	Meaning
Issuer	Borrower
Investor	Lender or Creditor
Principal, Face Value, Par Value	Amount Borrowed
Coupon Rate	Interest Rate
Coupon	Interest Payment
Maturity	Due Date
Term	Time until Maturity
Yield to Maturity	Annualized Return on Bond Investment
Market Value	Current Price

Bonds

WARNING

The coupon rate IS NOT the discount rate used in the Present Value calculations

- The coupon rate merely tells us what cash flow the bond will produce
- Since the coupon rate is listed as a %, this misconception is quite common

Bond Pricing

The price of a bond is the present value of all cash flows generated by the bond (i.e. coupons and face value) discounted at the required rate of return

$$PV = \frac{cpn}{(1+r)^1} + \frac{cpn}{(1+r)^2} + \dots + \frac{(cpn + par)}{(1+r)^t}$$

cpn is commonly used as an abbreviation for *coupon*

Bond Pricing

Example

What is the price of a 7.25 % annual coupon bond, with a \$1,000 face value, which matures in 3 years? Assume a required return of 0.35%.



$$PV = \frac{72.50}{(1.0035)^1} + \frac{72.50}{(1.0035)^2} + \frac{1,072.50}{(1.0035)^3}$$

$$PV = \$1,205.56$$

Bond Pricing

Example (continued)

What is the price of a 7.25 % annual coupon bond, with a \$1,000 face value, which matures in 3 years? Assume a required return of 0.35%, 7.25% and 10%.

$$PV = \frac{72.50}{(1.0035)^1} + \frac{72.50}{(1.0035)^2} + \frac{1,072.50}{(1.0035)^3} = \$1,205.56$$

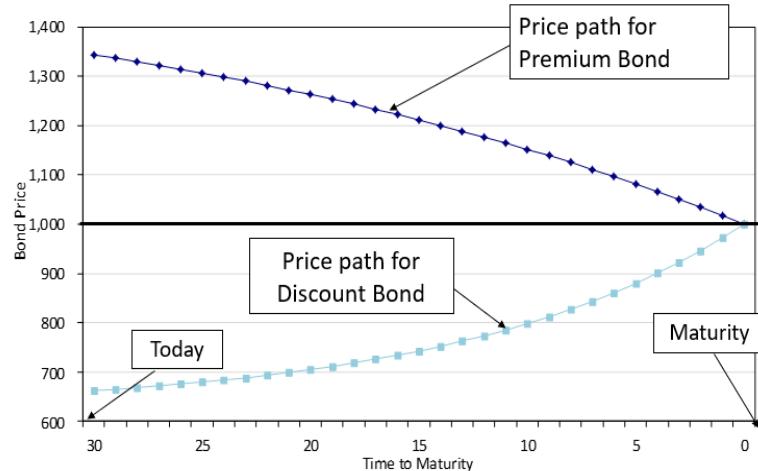
$$PV = \frac{72.50}{(1.0725)^1} + \frac{72.50}{(1.0725)^2} + \frac{1,072.50}{(1.0725)^3} = \$1,000$$

$$PV = \frac{72.50}{(1.10)^1} + \frac{72.50}{(1.10)^2} + \frac{1,072.50}{(1.10)^3} = \$931.61$$

The upper mentioned required return is used as a discount rate in the calculation of the bond price, it is called **Yield To Maturity** (we also call it the **Market rate**) defined as the Interest rate for which the present value of the bond's payments equals the price.

Premium and Discount Bonds

- Premium Bond
 - Coupon rate exceeds yield to maturity
 - Bond price will decline to par over its maturity
- Discount Bond
 - Yield to maturity exceeds coupon rate
 - Bond price will increase to par over its maturity



Three options

The price is at Face value: coupon rate = market rate

The price is at Discount: coupon rate < market rate

The price is at Premium: coupon rate > market rate

Bond pricing with annuity

$$Price = PV \text{ of coupons} + PV \text{ of FaceValue}$$

The coupons behave like an annuity.

$$Price = \left[cpn \times \left(\frac{1}{r} - \frac{1}{r(1+r)^t} \right) \right] + \frac{FaceValue}{(1+r)^t}$$

Problem:

- ❖ Why is it not possible to discount face value on annuity basis?

Bond pricing with annuity

- What is the price of a 5% coupon bond , \$1000 Face Value that has 20 years until maturity if the yield to maturity is equal to 3%?

$$PV_{Cpn} = 50 \times \left(\frac{1}{0,03} - \frac{1}{0,03 \times (1 + 0,03)^{20}} \right) = 50 \times 14,877 = 743,87$$

$$P = 743,87 + \frac{1000}{(1 + 0,03)^{20}} = 743,87 + 553,67 = \$1297,54$$

$$P = 50 \times \left(\frac{1}{0,03} - \frac{1}{0,03 \times (1 + 0,03)^{20}} \right) + \frac{1000}{(1 + 0,03)^{20}} = \$1297,54$$

Bond Yields

Yield To Maturity - Interest rate for which the present value of the bond's payments equals the price.

(The calculation of YTM is not required in this module - a *financial calculator or excel is needed to calculate it.*)

Current Yield - Annual coupon payments divided by bond price.

Example

What is the current yield of a 10.0 % annual coupon bond, with a \$1,000 face value, which matures in 3 years? The market price of the bond is \$1,136.16.

$$\text{Current yield} = \frac{100}{\$1,136.16} = .088 \text{ or } 8.8\%$$

Bond Rates of Return

Rate of Return – Total income per period per dollar invested

$$\text{Rate of return} = \frac{\text{total income}}{\text{investment}}$$

$$\text{Rate of return} = \frac{\text{coupon income} + \text{price change}}{\text{investment}}$$

Bond Rates of Return

Example

A bond increases in price from \$963.80 to \$1,380.50 and pays a coupon of \$21.875 during the same period. What is the rate of return?

$$\text{Rate of return} = \frac{21.875 + (1380.50 - 963.80)}{963.80} = .455$$

$$\text{ROR} = 45.5\%$$

Special Types of Corporate Bonds

- Zero coupon
 - No coupon
 - Price is below face value, return: face value paid at maturity - purchase price
- Floating rate bonds
 - Coupon periodically adjusted
 - Coupon rate: reset once year to current short-term Treasury rate + 2%
- Convertible bonds
 - Can be exchanged against other financial securities (shares)