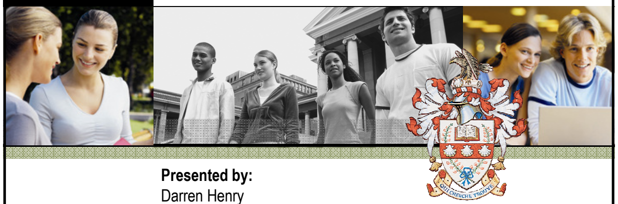
DEBT SECURITIES

Topic 1: Features of debt securities

LA TROBE UNIVERSITY — Faculty of Business, Economics and Law



Presented by:
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Subject Coordinator and Lecturer

- Name: Darren Henry
- Room location: DWB 420
- Telephone: 94791730
- E-mail: d.henry@latrobe.edu.au
- Consultation time: Wednesday 12.00noon – 2.00pm
- My background:
  - Teaching interests: Finance, Corporate Finance / Financial Management, Mergers and Acquisitions, Financial Markets and Instruments, Security Valuation
  - Research interests: Empirical corporate finance, corporate governance, mergers and acquisitions, corporate ownership structure and control
- I have also recently taken over the role of Director of the Master of Financial Analysis (MFA) and related programs

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Teaching arrangements

- Lecture class
  - Held weekly on Wednesday 9.00am - 11.00am in the Hooper Lecture Theatre from weeks 1 to 13 (excluding the Anzac Day Public Holiday on April 25th 2012)
- Tutorial classes
  - Held weekly on Wednesday or Thursday commencing in Week 2 of Semester
  - Students are required to enrol in a tutorial class using the Oasis on-line enrolment system, which opened on Thursday 23rd February at 6.00pm. The available tutorial times currently are:
  - Wednesday 11.00am – 12.00noon (ED1 219)
  - Wednesday 12.00noon – 1.00pm (ED1 219)
  - Wednesday 2.00pm – 3.00pm (MAR 442)
  - Thursday 10.00am – 11.00am (ED1 501)
  - Thursday 11.00am – 12.00noon (ED1 402)

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Textbook and teaching resources

- Textbook and ancillary resources required for successful completion of this subject:
  - *Fixed Income Analysis, Second Edition* by F.J. Fabozzi (2007), John Wiley & Sons: New Jersey.
  - *Fixed Income Analysis Workbook, Second Edition* by F.J. Fabozzi (2007), John Wiley & Sons: New Jersey.
  - The textbook and workbook are available for purchase from the University Bookshop, and are also available on Closed Reserve in the University Library
  - The textbook provides full coverage of the subject curriculum, and access to the workbook is also required as this contains the tutorial problem set. Additional tutorial questions may be set occasionally for specific topics, if it is felt that there are not available tutorial questions which address particular topic areas. These will be provided on the subject LMS site.
  - Tutorial questions will also be provided on the subject LMS site

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Subject assessment components

- There will be three assessment components in this subject:
- Tutorial assessment tasks (20%)
  - This will involve the completion of five assessment tasks in tutorials throughout the semester. Each will effectively represent 5% of total assessment, with the best four assessment task results determining your mark out of 20%.
  - The structure of these will either be a set of multiple-choice or short answer questions, a practical (calculation-based) exercise or an analytical exercise.
- Group assignment (20%)
  - This will encompass various content of the subject syllabus, and relate specifically to conducting a credit analysis of a listed company and writing a credit report.
- Final examination (60%)
  - Three-hour duration including a mix of multiple-choice, calculation and analytical questions covering the entire subject syllabus.
  - Note that there is a 50% grade hurdle requirement associated with the final examination

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About Debt Securities

- This subject will provide a comprehensive evaluation of the nature of debt securities, the markets in which they are traded, and their use by Governments, companies and investors for fund-raising, investment and risk management activities
- They are often considered to be of lesser relevance and interest in comparison to equities, but:
  - They are actually much more interesting from structural, issuing and valuation perspectives
  - Significantly more debt securities (debt funding) are issued compared to equity securities (funding)
  - The recent global financial crisis (including sub-prime mortgage effects, freezing up of worldwide debt markets, focus on the LIBOR rate, TED spread) and European sovereign problems (eg. Greece, Spain, Ireland, Italy etc.) demonstrates the importance of debt markets and debt as a financing source in the global economy

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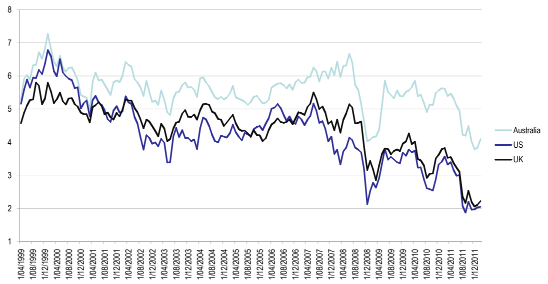
10-Year Government bond yields from 1999 to 2012



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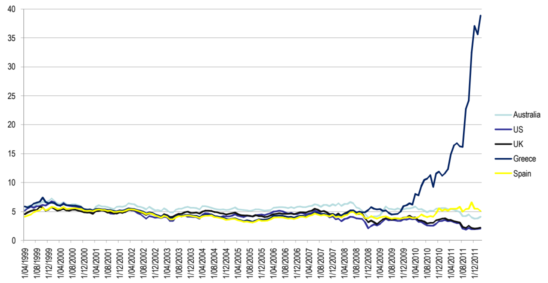
10-Year Government Bond yields from 1999 to 2012



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An example of interest rates on different debt securities

	CDS (CBIL)			Bonc 2 Yr			Int Rate ST			Bond 10 Yr		
Country	5 Yr	Time	Chg	Yld	Time	Chg	Rate	Time	Chg	Yld	Time	Chg
1) Australia	62.62	7:53	+.76	4.477	8:34	-.024	4.88	7/11	-.01	4.956	8:35	-005
2) Austria	77.12	8:33	-.05	1.612	8:34	+.045	1.55	7:52	+.10	3.309	8:35	-010
3) Belgium	197.06	8:33	+.06	2.597	8:33	+.078	1.55	7:52	+.10	4.257	8:35	-007
4) Canada				1.421	4:59	-.073	1.17	7/11	-.01	2.868	5:00	-068
5) Denmark	55.60	8:33	-.42	1.467	7/11	-.157	1.66	7/11	+.01	2.904	7/11	-137
6) Finland	42.83	8:33	unch	1.429	8:33	+.034	1.55	7:52	+.10	3.051	8:35	-002
7) France	105.14	8:33	+.14	1.580	8:33	+.013	1.55	7:52	+.10	3.342	8:35	-012
8) Germany	54.38	8:33	+.05	1.246	8:33	-.003	1.55	7:52	+.10	2.664	8:35	-005
9) Greece	2337.23	8:33	+.23	28.362	7/11	+.783	1.55	7:52	+.10	16.101	7/11	+144
10) Hong Kong	53.23	4:57	+.03	.183	08:33	-.002	.26	7/11	+.00	2.203	8:34	-018
11) Iceland							3.75	7/11	+.00			
12) Ireland	1007.64	8:33	+2.23	16.899	8:34	+.703	1.55	7:52	+.10	12.654	7/11	+275
13) Italy	295.66	8:33	-.34	4.151	8:34	-.009	1.55	7:52	+.10	5.677	8:35	+003
14) Japan	91.15	4:57	+.05	.150	8:34	N.A.	.34	7/11	+.00	1.108	8:35	-032
15) Netherland	45.17	8:33	-.16	1.404	8:34	+.006	1.55	7:52	+.10	3.109	8:35	-003
16) New Zeala	72.60	7:53	+1.19				2.67	8:34	+.01	5.028	8:35	N.A.
17) Norway	22.46	8:33	-.12				2.90	7/11	+.02	3.167	8:30	N.A.
18) Portugal	1133.63	8:33	-.85	16.215	7/11	+1.13	1.55	7:52	+.10	12.512	7/11	+420
19) Singapore				.350	8:33	-.002	.44	7/11	+.00	2.114	8:35	-012
20) Spain	333.84	8:33	+9.67	4.071	8:34	+.039	1.55	7:52	+.10	6.001	8:35	+017
21) Sweden	31.83	8:33	unch	2.093	7/11	-.126	2.51	21:36	+.01	2.638	23:18	-153
22) Switzerlar				.126	23:50	-.021	.17	7/11	+.00	1.521	23:50	-075
23) United Kir	74.84	8:33	-.06	.709	7/11	-.041	.83	7/11	+.00	3.064	7/11	-106
24) United Sta	50.83	8:33	-1.01	.363	8:34	+.008	.25	7/11	+.00	2.932	8:35	+013

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Student learning objectives

1.1 Describe the basic features of a bond;
1.2 Identify the various coupon rate structures;
1.3 Define accrued interest, full price and clean price;
1.4 Describe the provisions for redeeming bonds;
1.5 Identify embedded options in a bond;
1.6 Explain the various risks associated with investing in bonds;
1.7 Explain how features of a bond affect its interest rate risk.

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References

> **Fabozzi F. J. (2007).** *Fixed Income Analysis*. John Wiley & Sons Inc. New Jersey. Chapter 1 and 2.

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Objective 1.1

Indenture

> A bond's **indenture** is a legal document that sets down in detail the obligations, or promises, of the issuer and the rights of the bondholder

> In order to make it easier for bondholders to check whether the issuer is complying with the promises laid down in the indenture, the indenture usually provides for the appointment of a trustee who will act on behalf of bondholders in ensuring compliance by the issuer

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Objective 1.1

Covenants

- The indenture will contain a number of affirmative and negative covenants
- **Affirmative covenants** are things that the issuer is required to do under the indenture, such as:
  - Paying interest and principal on a timely basis
  - Paying all taxes and other claims when due
  - Maintaining all property in good condition and working order
  - Submitting periodic reports to the trustee
- **Negative covenants** place limits on what the issuer can do; the most common negative covenant is a restriction on the amount of additional debt that can be incurred unless certain tests are satisfied

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Objective 1.1

Maturity

- The **maturity date** is the date on which the debt will cease to exist, and the date on which the issuer must repay the principal
- The **term to maturity** (often referred to as the *maturity* or the *term*) of a bond is the time remaining between now and the maturity date
- The maturity of a bond is important because:
  - It specifies the period over which interest payments will be made
  - It impacts upon the interest rate that will be offered; depending on the **yield curve**
  - It determines the sensitivity of the bond to changes in interest rates (known as interest rate risk)

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Objective 1.1

Par value

- The **par value** of a bond (also referred to as the *face value*) is the amount that the issuer agrees to repay on or by the maturity date
- Due to fluctuations in interest rates, a bond will not trade at par
  - If it is trading below its par value, we say that it is **trading at a discount**
  - If it is trading above its par value we say that it is **trading at a premium**
- The convention in the U.S. is to quote the price as a % of its par value
  - If the par value is $100 and the bond is trading at a price of $90, the quote would be 90, and if it is trading at a price of $105, the quote would be 105
  - Until relatively recently bond prices were quoted in tick levels (such as ¾ or ⅛), but are now provided in decimal price form (such as $100.75)
- The quote can then be divided by 100 and multiplied by par value to find the actual dollar price of the bond

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Example 1.1.2

Par value

?

A bond's quoted price is 102.75 and its par value is $5,000, what is its dollar value?

A. $5,000
B. $102.75
C. $513,750.00
D. $5,137.50

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Objective 1.1

Coupon rate

- A bond's **coupon rate** is the rate of interest (as a percentage of the par value) that the issuer promises to pay the bond holder
- The **coupon** is the annual dollar amount of interest to be paid
- Coupon payments can be made annually, semi-annually, quarterly or monthly; in Australia and the U.S. coupon payments are usually semi-annual
- When describing a bond, it is usually sufficient to specify the maturity date and the coupon rate
  - For example, in the U.S. a bond might be described as "6s of 12/1/2020", which means a bond paying a 6% coupon series expiring on 1 December 2020
- It is important to remember the distinction between the coupon rate and the yield (required return) of a bond

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Example 1.1.3

Coupon rate

?

A bond has a par value of $5,000 and a coupon rate of 8.5% payable semi-annually. What is the dollar amount of the semi-annual coupon?

A. $212.50
B. $238.33
C. $425.00
D. $476.66

Features of debt securities

Objective 1.2

Coupon rate structures

- A **zero-coupon bond** does not pay any interest over the life of the bond (in other words, it has a coupon rate of zero)
- The purchaser of a zero-coupon bond receives a return by buying the bond at a price well below the par value (i.e. by buying the bond at a discount); the discounted price reflects the time value of money
- A **step-up note** is a bond where the coupon rate *steps up*, or increases, over the life of the bond
  - If the coupon only increases once, it is called a **single step-up note**
  - If there are two or more increases in coupon rate, it is referred to as a **multiple step-up note**

Features of debt securities

Objective 1.2

Coupon rate structures

- A **deferred coupon bond** is a bond where there are no coupon payments for a period of time (the coupon rate is zero), after which the issuer makes periodic coupon payments in the normal way
- A **floating rate security (or floater)** is a security where the coupon rate, instead of being a fixed percentage of the par value, varies over the life of the security
  - The coupon is reset periodically in accordance with a *reference rate* that is in turn a variable interest rate, such as LIBOR (the London Interbank Offered Rate), which is the interest rate that banks in London quote to each other on Eurodollar Certificates of Deposit
  - Corporate bonds typically offer floating rates, whereas most Government bonds still carry fixed coupon rates

Features of debt securities

Objective 1.2

Floating rate securities

- A floating rate security is reset according to the **coupon formula**:

  coupon rate = reference rate + quoted margin
- The **quoted margin** is the additional amount over and above the reference rate that the issuer agrees to pay the security holder
- The quoted margin is typically quoted as a number of *basis points* where a basis point is 0.0001 or 0.01%; hence, 1% is 100 basis points
- Note that the quoted margin can be a negative amount, in which case the coupon rate is less than the reference rate (known as an inverse floater)
- On each reset date (say, at 6-monthly intervals) the current reference rate is used to establish the coupon rate payable in six months' time

Features of debt securities

Objective 1.2

Floating rate securities

- Sometimes there is a maximum and/or minimum coupon rate payable
  - A maximum rate is called a **cap**; if the reference rate is such that the coupon rate would otherwise exceed the cap, the coupon rate is set equal to the cap
  - A minimum rate is called a **floor**; if the reference rate is such that the coupon rate would otherwise be below the floor, the coupon rate is set equal to the floor
- A cap is an unattractive feature from the point of view of the holder of a floating rate security, because it limits the coupon rate that is payable, while a floor is an attractive feature for the security holder
- The opposite interpretation apply from the perspective of the issuer
- Caps and floors are examples of **embedded options**

Features of debt securities

Objective 1.3

Accrued interest, clean price and dirty price

- The coupon payment is made to the *bondholder of record*, who is the person owning the bond on a particular date just before payment is due
- If the bond is sold between coupon payments, the person selling the bond would miss out on interest earned between the previous coupon payment and the date on which the bond is sold
- To prevent this, the buyer of a bond pays the seller the quoted price of the bond (the **clean price**) plus **accrued interest** earned by the seller since the previous coupon payment
- The total amount paid is known as the **full price** (or **dirty price**)

Features of debt securities

Example 1.3.1

Accrued interest, clean price and dirty price

An investor paid a full price of $1,059.04 each for 100 bonds. The purchase was between coupon dates and accrued interest was $23.54 per bond. What is each bond's clean price?

A. $1,000.00
B. $1,059.04
C. $1,035.50
D. $1,082.58

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Objective 1.4

Redemption of bonds

- **Redemption** of a bond means paying back the principal; when the debt is repaid, the bond is said to be *redeemed*
- Most bonds don't require the issuer to repay any of the principal until the maturity date; this is referred to as a **bullet maturity**
- Mortgage-backed securities and asset-backed securities usually provide for each repayment to consist of both interest and principal; this is called an **amortising security**, because the amount owed is *amortising* or reducing over the life of the security
- This is similar to the repayment of a mortgage loan from a bank
- Hence, a bond with a bullet maturity can also be referred to as a non-amortising bond

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Objective 1.4

Non-callable and non-refundable bonds

- A bond may be non-callable or non-refundable
- Both of these provisions provide protection to the bondholder against the early retirement of debt, but there is a subtle difference
- Although there may be some exceptions, a **non-callable** bond provides robust protection, in most circumstances, against a bond being called
- A **non-refundable** bond merely protects the bondholder against early retirement that is funded by the issuer re-borrowing the necessary funds at a lower interest rate; the debt could still be retired early if the issuer is able to fund the retirement in some other way

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Objective 1.4

Early retirement of debt

- There are various arrangements that sometimes make it possible for the issuer to repay the principal and **retire the debt early**
- The option to do this will be attractive to the issuer because there is always the possibility that interest rates will fall, allowing the issuer to borrow at a lower rate of interest in order to retire the debt
- Such an option will make the bond less attractive for the purchaser, because the repaid principal will then have to be invested at a lower interest rate, reducing the realised return on the investment
- If any of these provisions are included in a bond's indenture, the bond issuer will typically offer a higher rate of return in order to compensate the purchaser and induce him to invest in the bond

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Objective 1.4

Prepayment options and sinking funds

- In the case of an amortising security (a security where there is a schedule of principal repayments), a **prepayment option** gives the borrower the right to repay some or all of the principal prior to the scheduled repayment date
- This is effectively the same as a call option, but the call price does not depend on when the early repayment occurs – debt is retired at par value
- Rather than a call provision, giving the issuer the *option* of retiring debt early, there may be a **sinking fund** provision in the indenture that *requires* some or all of the debt to be retired prior to maturity
- The original purpose of a sinking fund was to reduce credit risk

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Objective 1.4

Callable bonds

- The right to retire debt early is referred to as a **call provision**, and a bond that has a call provision is referred to as a **callable bond**
- If the issuer exercises the right, he is said to *call the bond*
- The price that the issuer must pay is referred to as the **call price** or **redemption price**
- The indenture may state that the issuer cannot call the bond until a specified period has elapsed; this is referred to as a **deferred call**
- The call price may be a single set price regardless of the call date, be based on a call schedule (where the call prices are typically higher at earlier call dates), or be derived based on a make-whole premium (which represents a premium which if invested at current interest rates will provide the same overall yield that would have been earned if the bond had not been called)

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Objective 1.5

Embedded options

- A bond issue will often include provisions that allow the issuer and/or the bondholder to take some action against the other party
- These provisions are referred to as **embedded options** to distinguish them from stand-alone options that can be purchased on an exchange or over-the-counter
- Embedded options make it very difficult to estimate the cash flows from the security: it is necessary not only to model the cash flows under different scenarios but also to estimate the probability of different events occurring
- There are two types of embedded options: those that are granted to the issuer and those that are granted to the bondholder

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Objective 1.5

Embedded options granted to the issuer

- The most common embedded options granted to the issuer are:
  - **The right to call the issue:** This gives the issuer the right to retire the debt early, and is particularly valuable if interest rates fall and the issuer can refinance the debt at a lower interest rate
  - **The right to make prepayments:** This gives the issuer the right to make repayments of principal earlier than scheduled
  - **Accelerated sinking fund provisions:** If there is a sinking fund (a requirement to progressively pay off part of the debt over the life of the bond) the issuer may have the right to accelerate those payments
  - **The cap on a floating rate security:** This puts a maximum on the interest rate payable by the issuer: i.e. gives the issuer an option not to pay any more than a maximum coupon rate, independent of how higher variable interest rates are

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Objective 1.5

Embedded options granted to the bondholder

- The most common embedded options granted to the bondholder are:
  - **A conversion privilege:** A **convertible bond** gives the bondholder the right to convert the bond to a fixed number of ordinary shares
  - **The right to put the issue:** This is the reverse of a call option: it gives the bondholder the right to sell the bond back to the issuer (i.e. redeem it early)
  - **The floor on a floating rate security:** This puts a minimum on the interest rate payable by the issuer: i.e. gives the bondholder the right to enforce this floor if interest rates fall below the floor

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LA TROBE UNIVERSITY Features of debt securities

Objective 1.6

Risks associated with investing in bonds

- Interest rate risk
- Yield curve risk
- Call and prepayment risk
- Reinvestment risk
- Credit risk
- Liquidity risk
- Exchange rate risk
- Inflation and purchasing power risk
- Volatility risk
- Event risk
- Sovereign risk

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LA TROBE UNIVERSITY Features of debt securities

Objective 1.6

Risks associated with investing in bonds

Interest rate risk

- As we shall see in Lecture 4, the price of a typical bond will change in the opposite direction to the change in interest rates
- Interest rate risk is the risk that the value of a bond held in a portfolio will decline as a result of an increase in interest rates

Yield curve risk

- The yield curve depicts the interest rates applicable to bonds with differing maturities
- If interest rates change by different amounts, the yield curve shifts
- Yield curve risk is the exposure of a bond portfolio to how the yield curve shifts

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Objective 1.6

Risks associated with investing in bonds

Call and prepayment risk

- The risk that a bond issuer will exercise an embedded option to call the bond, or make prepayments of the principal prior to maturity
- Since this usually happens after a fall in interest rates, the investor is forced to reinvest the funds at a lower rate of return
- This is one element of reinvestment risk

Reinvestment risk

- Another element is the risk that the proceeds from a bond (interest and principal) may have to be reinvested at a lower interest rate
- If this occurs the investor will not be able to achieve the yield that was implicit in the price that was paid for the bond (discussed in Lecture 5)

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LA TROBE UNIVERSITY Features of debt securities

Objective 1.6

Risks associated with investing in bonds

Credit risk

- There are three components of credit risk (discussed in Lecture 6):
  - Default risk – the risk that the borrower will fail to fulfil its obligations
  - Credit spread risk – the risk that bond yields will increase (and hence bond prices fall) because of an increase in the risk premium, for all risky investments or for particular sectors or bond issuers
  - Downgrade risk – the risk that ratings agencies will downgrade the rating of a bond issue, causing an increase in the credit spread

Liquidity risk

- The risk that an investor will be forced to sell a bond below its indicated value (such as the most recent sale price)

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Objective 1.6

Risks associated with investing in bonds

Exchange rate risk

> Variability in returns to the investor caused by the bond payments being in a different currency from the investor's domestic currency

> When cash flows are converted to the domestic currency, exchange rate variability changes the domestic value of the cash flows

Inflation and purchasing power risk

> The risk that the value of a security's cash flows will decline as a result of inflation

> Although the nominal or dollar value of the cash flows is often fixed, the "real" value of cash flows is typically expressed in terms of purchasing power, which declines as a result of inflation

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Objective 1.6

Risks associated with investing in bonds

Volatility risk

> Options, including a bond's embedded options, are valuable to the person who has the option

> For example, stand-alone options to buy or sell an asset become more valuable the more volatile the price of the underlying asset

> If an embedded option may or may not be exercised depending on bond yields, the greater the volatility of bond yields the greater the value of the option

> Volatility risk is the variability in the value of a bond caused by variability in the value of embedded options caused by volatility in bond yields

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Objective 1.6

Risks associated with investing in bonds

Event risk

> The risk that a bond issuer's ability to pay interest and principal will be affected by a major event, such as:
  - A natural disaster
  - A takeover or corporate restructuring
  - A regulatory change

Sovereign risk

> This is faced when an investor acquires a bond issued by a foreign entity

> Sovereign risk is the risk that there will be a default or an adverse price change as a result of actions by the foreign government

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Example 1.6.1

Risks associated with investing in bonds

?

Which of the following does a 2-year, zero-coupon US Treasury note NOT have?

A. Inflation risk.
B. Interest rate risk.
C. Exchange rate risk.
D. Volatility risk.

LA TROBE UNIVERSITY — Features of debt securities

Objective 1.7

Features of a bond and interest rate risk

> When interest rates rise a bond's price will fall, and when interest rates fall a bond's price will rise

> The strength of this inverse relationship is referred to as the **sensitivity** of the bond price to changes in market interest rates

> A number of factors influence a bond's sensitivity to interest rate changes, such as:
  - Maturity – the longer the bond's maturity (or **duration**), the greater the bond's sensitivity to changes in interest rates
  - Coupon rate – the lower the coupon rate, the greater the bond's price sensitivity to changes in interest rates
  - Bond yield – the higher the bond's yield the lower its price sensitivity to a change in interest rates

LA TROBE UNIVERSITY — Features of debt securities

Objective 1.7

Features of a bond and interest rate risk

> The value of embedded options can also impact on interest rate sensitivity

> Because a call option is valuable to a bond issuer, it reduces the value of the bond to the investor

Price of callable bond = price of option-free bond – value of embedded call option

> If interest rates decline, the price of an option-free bond increases but the value of an embedded call option increases, partially offsetting the price increase, and vice versa

> In a similar fashion, the change in the value of an embedded put option partially offsets the change in value of a putable bond

> Embedded options, therefore, reduce interest rate sensitivity