

## **Learning Module 2: Fixed Income Cash Flows and Types**

### **LOS 2a: describe common cash flow structures of fixed-income instruments and contrast cash flow contingency provisions that benefit issuers and investors**

Fixed income instruments have different cash flow structures that provide investors and issuers with various options to meet their specific financial goals, manage risks, and tailor their investments to suit their particular circumstances.

#### **Standard, Fixed-Rate Bond (“Bullet Bond”)**

A standard fixed-rate bond, often termed a “Bullet Bond”, is a widely utilized debt instrument wherein the issuer receives the principal amount when the bond is issued and commits to repay that principal when the bond reaches its maturity. Throughout the bond's duration, the issuer makes regular, fixed coupon payments to the bondholder. When the final payment consists of a lumpsum combined with the interest of the last period, it's called a **balloon payment**.

One of the primary appeals of a bullet bond for both issuers, such as governments and corporations, and investors is its straightforward cash flow structure. For issuers, this bond provides a consistent and predictable financing mechanism. Investors, on the other hand, favor bullet bonds because of the guaranteed income stream via fixed coupon payments and the certainty of receiving the principal back at a set date, which can be useful for funding specific future cash flow needs.

#### **Example: Bullet Bond**

Consider a \$2,000 face value 7-year bond with an annual coupon rate of 4%. With a bullet structure, the bond's promised payments at the end of each year would be as follows.

Year	1	2	3	4	5	6	7
PMT	\$80	\$80	\$80	\$80	\$80	\$80	\$2,080
Principal remaining	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$0

In the example above, every year for 6 years, the bondholder receives an interest payment of \$80 (which is 4% of \$2,000). At the end of the 7<sup>th</sup> year, the bondholder receives the final interest payment along with the face value of the bond, totaling \$2,080.

## Amortizing Principal

This structure is commonly seen in bonds, where the principal amount is gradually paid off over time through a series of periodic payments. The coupon payments, representing the interest, are made regularly throughout the life of the bond. At maturity, the final principal payment is made, completing the amortization process. This structure is frequently used in corporate and government bonds to manage repayment obligations.

## Fully Amortized Loan

In the case of loans, such as mortgage loans, the cash flows consist of both interest and principal portions. Borrowers make regular payments that include both the interest accrued and a portion that reduces the principal balance. Over the life of the loan, the principal is gradually paid down until the entire debt is repaid. This structure allows borrowers to build equity while repaying the loan.

The periodic payment is calculated as follows:

$$PMT = \frac{i \times \text{Principal}}{1 - (1 + i)^{-n}}$$

Where:

PMT = Periodic payment amount

i = Interest rate

Principal = Principal amount of loan or bond

n = Number of payment periods

### Example: Fully Amortizing Bond

Consider a \$2,000 face value 7-year bond with an annual coupon rate of 4%. With a fully amortizing structure, the bond's promised payments at the end of each year would be as follows.

Year	1	2	3	4	5	6	7
PMT	333.22	333.22	333.22	333.22	333.22	333.22	333.22
Interest	80.00	69.87	59.34	48.38	36.99	25.14	12.82
Principal payment	253.22	263.35	273.88	284.84	296.23	308.08	320.40
Principal Remaining	1,746.78	1,483.43	1,209.55	924.71	628.48	320.40	-0.01

Formula:

$$\text{PMT} = \frac{i \times \text{Principal}}{1 - (1 + i)^{-n}}$$
$$\text{PMT} = \frac{4\% \times 2,000}{1 - (1 + 4\%)^{-7}} = 333.22$$

### Partially Amortizing Bond

A partially amortizing bond is a unique financial instrument where not all the principal amount borrowed is paid off over the bond's life. Unlike the standard bullet bond, where the full principal is repaid at maturity, in a partially amortizing bond, periodic payments are made that cover both interest and a portion of the principal. However, there remains a certain portion of the principal, referred to as the “balloon payment,” that is paid off only at the bond's maturity.

In our previous example, if the final payment includes \$800 to repay the remaining principal outstanding, the principal outstanding at the end of every year is indicated in the following table:

Year	1	2	3	4	5	6	7
PMT	231.93	231.93	231.93	231.93	231.93	231.93	231.93
Principal Remaining	1,848.07	1,690.06	1,525.74	1,354.83	1,177.10	992.25	0.01

Subtracting the present value of the balloon payment from the \$2,000 price of the bond gives us \$1392.07 in principal repayment to amortize over 7 years to leave a remaining principal of \$800 at maturity. Using this \$1392.07 principal amount, we can compute the periodic payment amount as:

$$\text{PMT} = \frac{4\% \times 1392.07}{1 - (1 + 4\%)^{-7}} = 231.93$$

### Year 1:

$$\text{PMT} = 231.93$$

$$\text{Interest paid: } 4\% \times 2000 = \$80$$

$$\text{Principal payment} = 231.93 - 80 = 151.93$$

$$\text{Principal remaining} = 2000 - 151.93 = 1848.07$$

The last payment of \$992.25 consists of the regular \$231.93 payment combined with the remaining principal of \$800.

## Sinking Funds

A sinking fund is an arrangement predominantly used by bond issuers, including governments and select corporate entities. In this setup, issuers systematically allocate funds into a special escrow or sinking fund account. This proactive strategy is deployed to ensure they can meet their repayment obligations, thereby reducing the inherent credit risk of default. Through the sinking fund, issuers retire a predetermined amount of the bond's principal over its lifetime. This retirement can either be executed by redeeming bonds chosen at random or by exercising the option to repurchase bonds prior to maturity at a specified price, as outlined during the bond issuance. While this strategy undeniably minimizes credit risk by ensuring funds are set aside for

repayment, it introduces a layer of reinvestment risk for bondholders. This stems from the potential early retirement of bonds, compelling bondholders to possibly reinvest in securities with lower returns.

## **Waterfall Structures**

Waterfall structures are integral to the functioning of asset-backed securities (ABS) and mortgage-backed securities (MBS). Within a waterfall structure, the distribution of cash flows is organized in a hierarchical manner among various tranches or investor classes. While interest or coupon payments are generally disbursed to all tranches without any specific order, the repayment of the principal observes a defined pecking order. The tranche designated as the most senior receives its principal payment first. Upon its complete repayment, the next tranche in line begins receiving its principal, and this sequence persists until the most junior tranche is addressed.

## **Variable Interest Debt**

Variable interest debt instruments, such as certain bonds and loans, adjust their interest payments based on a market reference rate (MRR) coupled with a credit spread. This dynamic structure makes them favorable for various stakeholders. For instance, financial intermediaries, especially banks, show a predilection for these assets because they conveniently align with their variable-rate liabilities. Moreover, floating-rate notes (FRN), another form of this debt, are especially attractive to investors keen on capitalizing on rising interest rates. A simple mathematical representation to determine the FRN coupon is:

$$\text{FRN coupon} = \text{MRR} + \text{Credit spread}.$$

## **Interest Rate and Credit Risks**

While these variable-rate instruments have been designed to reduce interest rate risk—given that their coupon payments are modulated with fluctuating interest rates—they are not free of risks. Credit risk remains a concern. If there's a perceived decline in an issuer's credit quality, irrespective of the MRR's status, the instrument's price may plummet.

## **Mechanisms of Rate Adjustments**

Beyond the regular adjustments based on MRR, these instruments come with various innovative features:

- **Step-up Bonds:** These bonds have an in-built mechanism where the coupon rates ascend at predetermined intervals.
- **Event-based Adjustments:** These are contingent on specific events, like a drop in an issuer's creditworthiness. Sometimes, these adjustments might even be tethered to certain financial covenants or credit ratings.

## **Leveraged Loans**

Leveraged loans, typically extended to issuers perceived as lower credit quality, have their own set of dynamics. The coupon rate, for example, may surge if the issuer's credit quality takes a hit. This surge ensures that investors are compensated with a higher yield. A case in point is the Antelas AG scenario, where a loan's credit spread might be recalibrated based on specific financial ratios.

## **Payment-in-Kind (PIK) Bond**

Certain issuers, wary of future cash flow challenges, might opt for the PIK feature in their loans or bonds. This unique feature allows these issuers to pay interest by augmenting the bond or loan principal instead of traditional cash payments. Notably, this arrangement is more prevalent among firms that are heavily reliant on debt.

## **Sustainability and ESG-linked Bonds**

The financial world is becoming increasingly conscious of environmental, social, and governance (ESG) factors. Responding to this trend, bonds with provisions related to ESG have emerged. A prominent example is the sustainability-linked bond issued by the Public Power Corporation. Here, bonds might undergo step-up margins if they don't meet certain ESG benchmarks.

## Index-Linked Bonds

Index-linked bonds offer another layer of sophistication. Their payments are tethered to specific indices. The most prevalent among these are the inflation-linked bonds, colloquially known as 'linkers'. Their primary function is to act as a shield against inflation, offering stakeholders inflation-adjusted cash flows. A widely recognized example is the U.S.'s Treasury Inflation-Protected Securities (TIPS), which modulate their cash flows based on inflation metrics like the Consumer Price Index.

## Classifications of Index-linked Bonds

- **Capital-indexed Bonds:** These types, exemplified by TIPS, adjust their principal in line with inflation metrics, safeguarding the real value of the debt principal against inflation.
- **Interest-indexed Bonds:** These bonds keep the maturity amount constant, adjusting only the coupon against an index. They are essentially variations of FRNs where inflation acts as the MRR. Significantly, they find more favor with private entities than with governments.

## Zero-Coupon Bonds

These fixed-income instruments do not make regular interest payments like traditional bonds. Instead, they are sold at a discount to their face value and do not provide periodic income. Investors earn their return by purchasing the bonds at a discount and receiving the full face value at maturity. Zero-coupon bonds are often used in situations where investors are seeking a predictable lump sum payout in the future.

## Deferred Coupon Bonds

This structure includes bonds that have a deferred coupon payment, meaning they do not pay

interest for a specified initial period. After the deferral period, the bond starts making regular coupon payments that are typically higher than the market rate to compensate for the earlier period without interest. This structure is commonly utilized in projects or financial instruments where cash flows are expected to be limited in the early stages, such as infrastructure projects or issuances from entities with lower credit quality.

## **Fixed-Income Contingency Provisions**

Bonds often come with certain conditional provisions known as contingency provisions. These provisions dictate actions that may be taken contingent upon specific events. They embed within the bond contract the rights but not obligations to undertake certain actions. Depending on their nature, these provisions can either add value to the issuer or the bondholder. Among the numerous types of bonds with such embedded options are callable, putable, and convertible bonds.

## **Callable Bonds**

These bonds predominantly favor the issuer, as they provide the issuer the right to redeem or “call” the bond before its maturity. The underlying motivation is protection against falling interest rates. By doing so, the issuer can replace an old bond with a higher interest rate with a new bond with a potentially lower interest rate, thus reducing its borrowing cost. This presents reinvestment risks for the investor since if interest rates fall, the issuer is more likely to call the bond, meaning the investor may then have to reinvest in a lower-yielding environment. To compensate for this risk, callable bonds generally offer a higher yield.

A call premium is the amount over the par value that the issuer pays if they decide to redeem the bond before maturity. The call protection period also referred to as the lockout period or cushion, represents the initial period during which the issuer cannot call the bond. This protection incentivizes investors by offering them some security against early redemption.

There's also a unique callable bond variant called a make-whole call. Instead of a fixed call



premium, the issuer makes a payment determined by the present value of future coupons, making early redemption significantly more expensive.

## **Puttable Bonds**

While callable bonds cater to issuers, puttable bonds cater to bondholders. These bonds grant bondholders the right to “put” or sell the bond back to the issuer at predetermined prices on specified dates. This is particularly advantageous if interest rates spike, as bondholders can then liquidate the bond and reinvest the proceeds at higher yields. Consequently, puttable bonds often fetch a higher price compared to regular bonds. Like their callable counterparts, puttable bonds also have the European and Bermuda styles based on the frequency and timing of the put option.

## **Convertible Bonds**

Blurring the lines between debt and equity, convertible bonds offer bondholders a choice: they can either hold onto the bond or convert it into a predetermined number of common shares of the issuing company. This dual feature—bond downside protection and potential equity upside—makes convertibles relatively attractive, thus often garnering a higher price.

An alternative to convertibility is the inclusion of warrants. Unlike the embedded nature of the convertible option, a warrant is an additional, separable option that grants the holder the right to purchase shares at a given price within a set timeframe. Often considered a “sweetener”, warrants can make bonds more appealing, especially for younger firms. They offer the potential for additional returns if the company's shares are appreciated.

Lastly, there's a unique bond variant known as Contingent Convertible Bonds or CoCos. Primarily issued by some European banks, these bonds automatically convert from debt to equity upon the occurrence of specific events, as the issuer's equity drops below a particular level.

## Question #1

Calculate the periodic payment and the interest and principal components of the first payment for a fully amortizing bond based on the following:

- A. Loan amount: \$15 million
- B. Annual interest rate: 3.5%
- C. Loan term: 8 semiannual periods (4 years)

### Solution:

Formula:

$$PMT = \frac{i \times \text{Principal}}{1 - (1 + i)^{-n}}$$

Where

- $i = \frac{(3.5\%)}{2} = 1.75\%$
- Principal = \$15 million
- $n=8$

Solve for the periodic payment as follows:

$$PMT = \frac{0.0175 \times 15}{1 - (1.0175)^{-8}} = \$2.026 \text{ Million}$$

The initial \$2.026 Million periodic payment comprises the following:

- Initial interest payment:  $\$15 \times 1.75\% = \$0.2625 \text{ million}$
- Initial principal repayment:  $= \$2.026 \text{ Million} - \$0.2625 \text{ million} = \$1.7635 \text{ million}$

## Question #2

Which bond structure involves periodic payments that cover both interest and a portion of the principal, but not all of the principal amount is paid off over the bond's life?

- A. Bullet Bond
- B. Fully Amortizing Bond
- C. Partially Amortizing Bond

### Solution

The correct Answer is **C**.

A partially amortizing bond includes periodic payments that cover both interest and some of the principal, leaving a portion of the principal, known as a “balloon payment,” to be paid off at maturity.

**A is incorrect:** A bullet bond involves only interest payments throughout its life with the full principal returned at maturity.

**B is incorrect:** A fully amortizing bond involves periodic payments that cover both interest and principal such that the entire principal is paid off by maturity.

## Question #3

For which bond structure are funds allocated into a special account to ensure repayment obligations and reduce credit risk?

- A. Amortizing Principal
- B. Sinking funds
- C. Waterfall Structures

### Solution

The correct answer is **B**.

Sinking funds are provisions used by bond issuers to systematically allocate money into a special account. This strategy is used to ensure that they can meet their repayment obligations, reducing the credit risk of default.

**A is incorrect:** Amortizing principal's structure involves the gradual repayment of principal over the bond's life.

**C is incorrect:** Waterfall Structures relate to the hierarchical distribution of cash flows among various tranches or investor classes in asset-backed securities.

## **LOS 2b: describe how legal, regulatory, and tax considerations affect the issuance and trading of fixed-income securities**

Fixed-income securities depend on laws and regulations of the place of issuance, where bonds are traded, and the holders of bonds.

### **Classification of Bonds by Jurisdiction**

#### **1. Domestic Bonds**

These are bonds issued by entities incorporated within a country and traded within that country. For example, when a US company like Apple issues bonds in the US, these are domestic bonds.

#### **2. Foreign Bonds**

Foreign bonds are issued by entities that are not native to the country in which they're traded. The classic examples are the Yankee bonds (issued by foreign entities in the US) and Samurai bonds (issued by non-Japanese firms in Japan). For instance, if a French company like Renault issues bonds in the United States, these are foreign bonds.

#### **3. Eurobonds**

These bonds are issued outside the jurisdiction of any single country and can be denominated in any currency. They were primarily introduced in the 1960s to sidestep certain regulations and are often named based on the currency they are denominated in. For instance, a Eurobond issued in US dollars is called a Eurodollar bond.

#### **4. Global Bonds**

Global bonds are a type of bond that are issued simultaneously in multiple markets, typically in the Eurobond market and at least one domestic bond market. They allow issuers to access a broader investor base and increase liquidity.

### **Emerging and Frontier Markets**

Bonds from emerging and frontier markets can differ in characteristics and risk factors. In frontier markets, which are typically smaller and less mature than emerging markets, bond issuances are dominated by domestic sovereign bonds or bonds from local banks. Corporate financing in these markets is generally through bank loans. In contrast, larger emerging markets might have a mix of state-owned enterprises, private corporations, and sovereign entities issuing bonds.

## **The Role of Currency in Bond Markets**

The currency in which a bond is denominated can significantly influence its price. This is because the currency will dictate the interest rate environment to which the bond is tied. For instance, a bond denominated in a high-inflation currency might have a much higher interest rate than a similar bond in a stable, low-inflation currency.

## **Tax Considerations for Bonds**

### **Interest Taxation**

Bond interest might be taxed at ordinary income rates. This tax treatment varies by country and can depend on the type of bond. For instance, municipal bonds in the US can provide tax-free interest income.

### **Capital Gains**

If bonds are sold before maturity at a price different than the purchase price, they may generate capital gains or losses. These, too, can have specific tax treatments depending on the holding period.

### **Original Issue Discount (OID)**

Bonds like zero-coupons are issued at a discount to their par value. This discount can be treated as interest, and the taxation of this interest can vary by country.

## Question

PT Indonesia Infrastructure Finance (IIF) decided to issue a bond denominated in US dollars with terms that it would be available to a broader set of international investors and would be traded in the Eurobond market. This bond can best be described as:

- A. Eurobond
- B. Foreign bond
- C. Global bond

## Solution

**The correct answer is A.** Eurobonds are bonds issued outside the jurisdiction of any single country and can be denominated in any currency, including the issuer's domestic currency. They are underwritten by a group of financial intermediaries from different jurisdictions and are typically sold to investors in Europe, the Middle East, and Asia. In the given scenario, IIF's bond fits this description, given its US dollar denomination and its listing for broader international trading.

**B is incorrect:** A foreign bond is a bond issued in a domestic market by a foreign entity, denominated in the domestic market's currency. Since the IIF bond is not necessarily issued in a foreign domestic market and is denominated in US dollars, it does not fit the description of a foreign bond.

**C is incorrect:** A global bond is a bond issued simultaneously in the Eurobond market and in at least one domestic bond market. While the IIF bond is issued in the Eurobond market, there's no indication in the provided notes that it's simultaneously issued in any domestic bond market.

This question encapsulates the understanding of different bond types and their respective markets, and it requires the respondent to differentiate between bonds based on issuance location, trading location, and currency denomination.