ÁREA TEMÁTICA: Finanças

AN OVERVIEW OF DEBT AND FIXED INCOME PORTFOLIOS USING FIGURES

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Abstract

The aim of this work is to present a new approach of using figures designed to convey key concepts regarding corporate debt usage and fixed-income portfolio management. While corporate finance executives make decisions regarding the suitability and structure of debt, investors and portfolio managers evaluate how the interaction of different types of debt affects the risk and return of capital allocated to a fixed-income portfolio. Such an integrated, concise, and intertwined presentation of debt and fixed-income portfolio, which also highlights both their complementary nature and their differences, seems to rarely be available in standard finance literature. Written in English, this work can assist in developing technical vocabulary in the field, noting that many terms and expressions are not even translated into other languages. The ideas presented here stem from teaching experience with professionals and students in advanced finance courses and certification exam preparation. In these contexts, learning and knowledge retention are enhanced using tables, sketches, and images rather than lengthy texts. The originality of the various figures and tables inserted in this work serves as evidence that artificial intelligence (A.I.) played no role in the conception or creation of this work, which should stimulate critical-analytical thinking and, consequently, develop skills through the use of unique human intelligence.

Keywords: Corporate Debt; Debt Structure; Corporate Finance; Fixed-Income Portfolio Management; Teaching of Finance and Business

Resumo

O objetivo deste trabalho é apresentar uma nova abordagem usando figuras para transmitir conceitos importantes sobre o uso de dívida por empresas e a gestão de portfólio com títulos de dívida. Enquanto os executivos de finanças corporativas analisam alternativas e tomam decisões quanto à conveniência e ao formato do endividamento, os investidores e gestores de portfólios de investimentos avaliam como a interação de diversos tipos de dívida afeta o retorno e o risco esperado do capital alocado em um portfólio de renda fixa. Esta forma de apresentação integrada, concisa e entrelaçada sobre dívida e portfólio de renda fixa, ressaltando complementariedade e diferenças, não costuma estar em publicações de finanças. Este trabalho em inglês pode contribuir para o desenvolvimento do vocabulário técnico na área, observando que diversos termos e expressões sequer são traduzidos para outros idiomas. As ideias expostas neste trabalho resultam de experiência com atividades de docência envolvendo profissionais e estudantes em cursos avançados de finanças e em estudos para provas de certificação em finanças. Nestes contextos, o aprendizado e a retenção do conhecimento são aprimorados usando tabelas, esquemas e imagens ao invés de textos longos. A originalidade das diversas figuras e tabelas inseridas neste trabalho é uma evidência de que não houve participação de inteligência artificial (I.A.) na concepção e elaboração deste trabalho, o qual deve estimular o pensamento crítico-analítico e, consequentemente, desenvolver habilidades por meio do uso da diferenciada inteligência humana.

Palavras-chave: Dívida Corporativa; Estrutura de Dívida; Finanças Corporativas; Gestão de Carteiras de Renda Fixa; Ensino de Finanças e Administração

JEL Classification Codes: G32; G31; G12; G11; A23

1 Motivation for the conception and production of this work

The goal of this work is to present in an original way with images rather than with texts key concepts regarding corporate debt usage and fixed-income portfolio management. There is no intent to exhaust the subject of corporate debt and fixed-income portfolio management, but rather to present an overview of key topics, given the empirical observation that courses and publications in finance tend to focus more on equity, although fixed-income is the largest asset class in financial markets. Thus, a sequence of figures was developed for this work to spur interest on fixed income, showing how key concepts intertwine, which should motivate further learning and enhance knowledge retention.

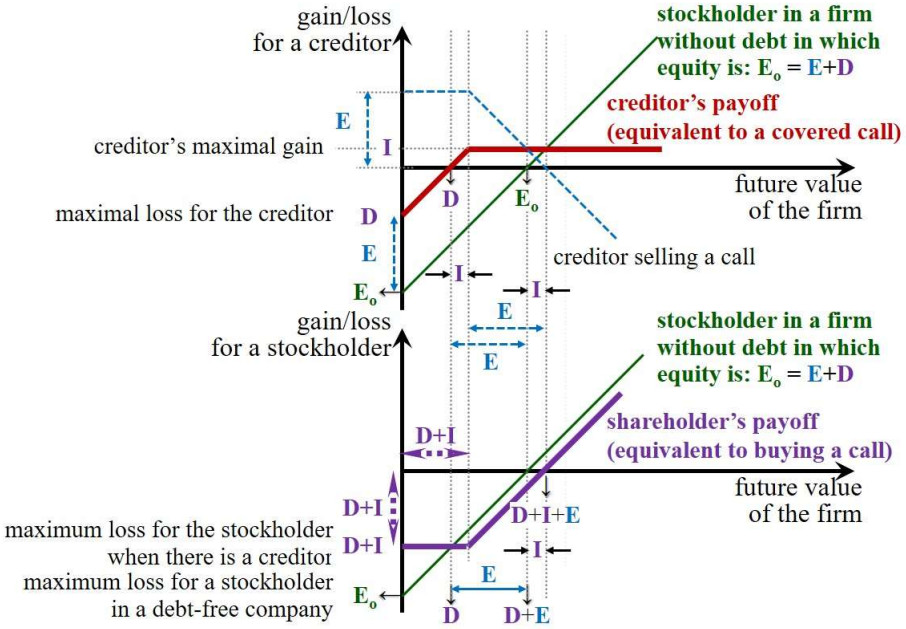
This work begins by showing the relevance and use of corporate bonds, whose features also rely on the prevailing market circumstances and yield curve movements. This work ends with discussion on how corporate bonds are inserted in a fixed-income portfolio with the following structure. Section 2 provides a discussion on corporate leverage: contrasting the use of debt and equity. Section 3 brings comments on circumstances affecting features of bonds. Section 4 presents main topics on fixed income portfolio management, given that different bonds may be bundled in different manners. The last section of this article lists conclusions, scope of this article, final thoughts, and suggestions. At the end, there is a list of references, which can be used to gather more information, concepts, and explanations. All notations used in the figures are explained in the body of the text.

2 Corporate leverage: contrasting the use of debt and equity

This section addresses questions usually explained in corporate finance publications (such as Aggarwal et al. (2010), while employing other ways of exposing the same content.

2.1 Why would a shareholder accept the substitution of equity with debt?

An entrepreneur may face the decision of whether to replace equity with debt and wonder about the implications of such a decision. Figure 1 expands upon a concept presented in general terms in Janjigian (2022), displaying a graph of outcomes for a creditor (debt holder) and for a stockholder (equity holder). The charts in this work significantly improve the geometry (especially considering that straight lines are either horizontal or slanted with a slope of 45°), contrast both situations, and add more details, as shown in Figure 1.



Developed for this work

Figure 1 Contrasting profit and loss profiles for shareholders and creditors

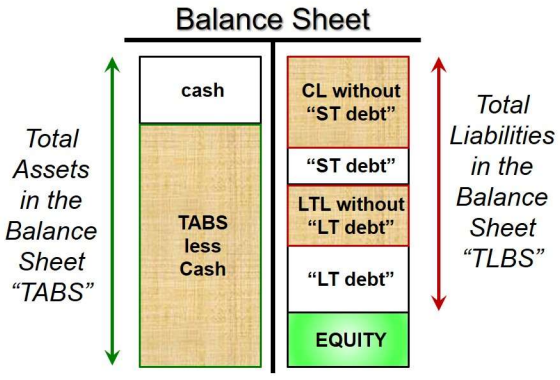
Being a stockholder in a debt-free firm implies that equity capital is E_o. The gain for a stockholder will begin when the firm's future value exceeds that amount (E_o). If the stockholder decides to replace a part of the equity with debt (D), knowing that debt entails interest payment (I), the shareholder's maximum potential loss will be reduced to (D+I) instead of (E_o). However, leverage postpones the point at which the stockholder can expect a return on invested capital to (E_o+I or D+I+E).

Figure 1 may also be understood by identifying derivatives concepts, namely option strategies. Being a shareholder of a firm with debt is equivalent to buying a call option with a premium equal to D+I. On the other hand, being a creditor of a company is equivalent to holding a covered call, which requires being a shareholder of a debt-free company, where equity is E_o (= E + D), and simultaneously selling a call with a premium equal to the equity portion "E" of the company with debt "D". Given that a creditor can be viewed as holding a covered call position or writing a put option, since both option strategies exhibit a similar return profile, such a creditor does not, in fact, believe that the firm value will plummet or that it will go bankrupt and, therefore, expects to receive the contractual cash flows (I) as the firm succeeds. Although it may seem strange to say so, a creditor remains, in a sense, potential owner of a firm until the bond investment matures. Moreover, they can even become more powerful than a majority shareholder, as recounted by Michael Lewis in a famous memoir about his work at one of the leading investment banks of the 1980s:

> *"Holding debt in a fragile company equates to control, because when the company fails to pay interest, the debt holder can seize the assets and liquidate the firm. Michael Milken explained this most succinctly to Meshulam Riklis—the de facto owner of Rapid-American Corporation—during a breakfast meeting in the late 1970s. Milken argued that Drexel [the investment bank where Milken worked] and its clients, not Riklis, controlled Rapid-American Corporation. "How can that be when I own 40% of the stock?" Riklis asked. "We hold one hundred million dollars of your debt," Milken said, "and if you miss a payment, we will take the company."" (Lewis, 1989, page 256)*

2.2 Is there an optimal level of indebtedness?

The actual value of a firm results from adding its market value to its net debt, which highlights the portion (and/or weight) of indebtedness minus cash. Although accounting amounts are not necessarily equal to amounts traded in the markets, an accounting approach may evidence the role of debt (i.e., short term debt - ST debt and long-term debt - LT debt) within current liabilities (CL) and long-term liabilities (LTL), as shown in Figure 2.

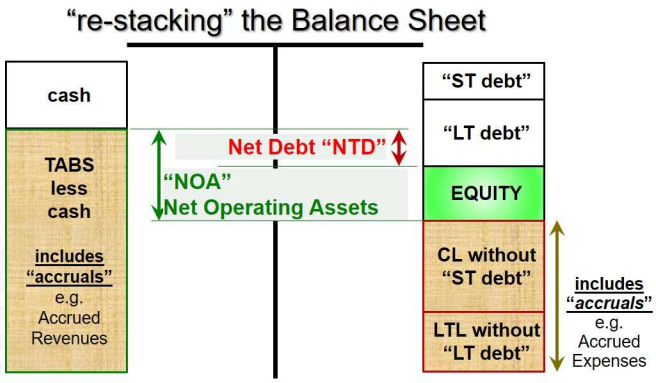


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Figure 2 A balance sheet highlighting debt separately from other liabilities

Figure 3 presents a transformed version of the balance sheet to illustrate the relevance of net operating assets (NOA) and their relationship to indebtedness. Shareholders hold a limited portion of the assets. Incurring debt is a way to increase NOA, which can improve operations, revenue, and profits, and ultimately boost wealth (i.e., equity). Changes in NOA

do not involve cash, which is not always affected by accrual-based adjustments. Moreover, accruals appear as assets and liabilities, and these amounts may partially offset each other over time, without effectively contributing to value creation through an increase in NOA.

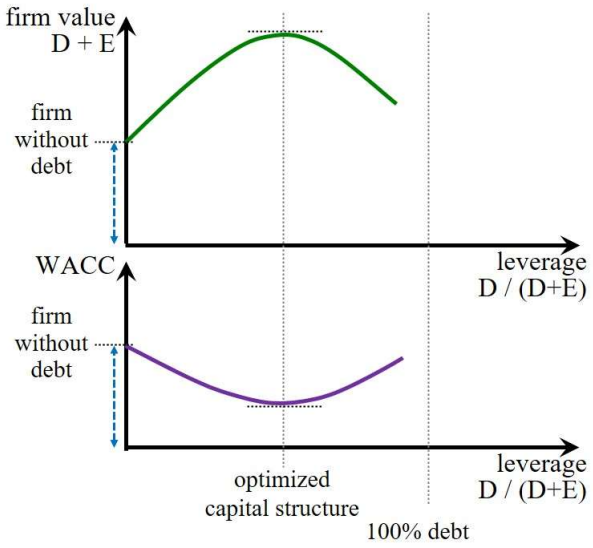


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Figure 3 "Re-stacking" the balance sheet components

The capital structure of a firm refers to the ratio of debt to equity. This ratio affects the calculation of the weighted average cost of capital (WACC). The cost of equity (r_e) and the cost of debt (r_d) are weighed using the market value of debt (D) and the market value of equity (E) (such that the firm's value is V = D + E). The tax rate ("t") reduces the impact of the cost of debt because financial expenses lower the taxable income base. Moreover, both the tax rate and the ratio of debt to equity affect the beta used to calculate the cost of equity (r_e). WACC is used to discount the FCFF (i.e., Free Cash Flow to the Firm), which is a valuation methodology to determine the firm's value. It is beyond the scope of this work to describe calculations for determining cost of equity, cost of debt, WACC and the FCFF.

Modigliani e Miller set two Propositions. Both MM Propositions exclude the impact of taxation and WACC is unaffected by capital structure. MM Propositions refers to a theoretical scenario because taxation affects the results of both MM Propositions, since financial expenses arising from indebtedness reduce the tax base for profit taxation. More information about the MM Propositions is available in finance textbooks and in Aggarwal et al. (2010), being a controversial theoretical issue whether a firm's value remains stable when debt replaces equity. Figure 4 illustrates how WACC and firm value may vary in practice.



Developed for this work

Figure 4 Sketch of the impact of leverage on firm value

As shown on the left side of Figure 4, when a company's leverage increases (raising the D/E ratio), the WACC used to discount the FCFF decreases, which consequently contributes to increasing the company's value. There are limits to increasing leverage, making it possible to identify an optimal capital structure, because: (a) financial distress makes increasing debt more difficult, expensive, and restricted; (b) creditors may impose restrictions on company management, regarding debt growth and dividend payments (affecting the cost of equity, r_e). Additionally, WACC changes beacuse: (i) agency costs arise to ensure executives make the best decisions for shareholders (e.g., decision monitoring), which contributes to increasing the cost of equity (r_e); (ii) information asymmetry between corporate managers and the market also tends to contribute to higher agency costs; (iii) companies incur fees and charges when issuing securities ("flotation costs").

Figure 4 shows that an increase in debt reduces the WACC, but the growing threat of financial distress reverses this downward trend. The firm's value changes inversely (though not linearly) with the WACC, based on the valuation model employing the FCFF methodology. However, it is not easy to identify, implement, and maintain an optimal capital structure, given fluctuations and unpredictable events in the capital markets, along with unexpected behaviors and unbridled attitudes on the part of a firm's stakeholders.

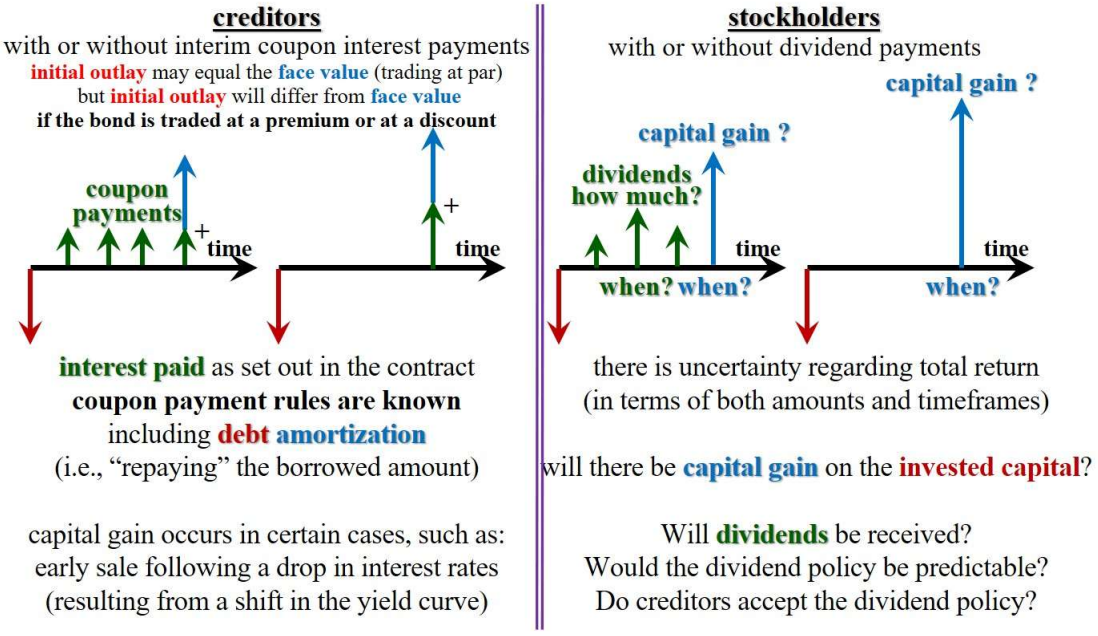
2.3 What are the implications of the increasing use of debt to replace equity?

Shareholders and creditors are investors with differing interests and expectations, as shown in Table 1, which can indeed give rise to conflicts of interest. The different expectations between debt and equity investors can be visualized with Figure 5.

Table 1 Investors with different interests and expectations

debt investor (creditors)	equity investor (shareholders)
contractually established obligations generally, there are interim coupon payments tax relief for companies reduces the debt burden monitors debt repayment and sets covenants	expectation of capital gain upon divestment dividends are distribution (possibly partial) of profits new share issuance may cause stockholder dilution demands total return & "corporate governance"

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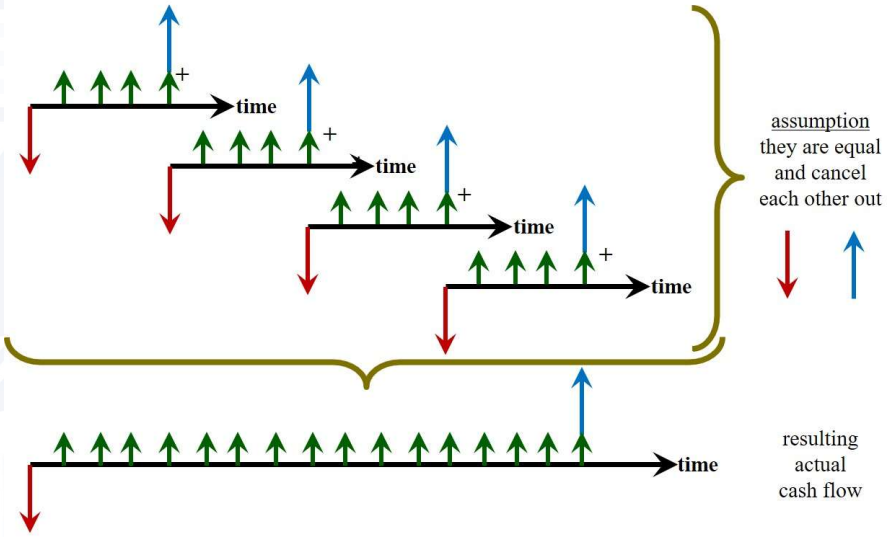


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Figure 5 Cash flows expected by creditors and shareholders

Creditors invest under “fixed pre-established rules” until maturity “at most”, whereas shareholders invest in “variable-income” assets with an indefinite term. Moreover, the tax rates applied to dividends and interest payments differ. Therefore, while creditors tend to focus (though not exclusively) on the analysis of retained earnings (cash preservation); market value relative to debt; liquidity and the level of indebtedness; over a predetermined investment period, shareholders’ focus centers on dividend payment; intrinsic value versus market value; activity level and profitability; and capital gain prospects.

Corporate financial managers (with the support of the controlling shareholders) are aware of the higher risk for the debt issuer due to contractual obligations and legal threats. Therefore, they will increase debt issuance when it is possible to correctly predict future cash flows, ensure interest and principal payments with a low risk of facing bankruptcy proceedings. Another key objective of borrowing is to only pay interest during a long period and to postpone debt amortization. This strategy is illustrated in Figure 6. However, there is a risk of facing difficulties in taking on new debt, specifically with rising interest rates or creditors’ perceptions of higher credit risk.



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Figure 6 Debt rollover strategy

Corporate financial managers will favor equity expansion when access to credit is difficult and there are significant prospects for capital gains (with unlimited “upside”), albeit such expectations are uncertain and even unpredictable. Equity issuance entails higher risk for the equity investor due to uncertain and discretionary gains. Furthermore, equity investors are entitled only to the company’s residual profits, and there is always a risk that the company may face temporary liquidity constraints, regardless of whether it has a solid business. This challenge can be illustrated with the real situation that occurred with Enron:

> “Scott Gieselman, a Goldman Sachs energy banker in Houston, was still in his office when the phone rang. ... Jeff McMahon, who had replaced Andy Fastow as Enron CFO that morning, was on the other end of the phone. "What can you monetize for me in the next 24 hours?" asked McMahon. He sounded frantic. ...
>
> With Enron's stock continuing to sink, panic was taking hold. The immediate problem was that Enron had been unable to roll its commercial paper - the portfolio of unsecured short-term loans that all big companies use to fund their day-to-day needs. Renewing such debt was normally a routine matter. Though the amounts involved were huge (for Enron, about $2 billion), the exposure was so brief (as little as 24 hours) that, for lenders, it was really nothing to worry about - unless they had reason to wonder if the company would survive long enough to pay it back.
>
> And in Enron's case, that's just what was happening. McMahon was shocked to hear this. ‘If we can't roll commercial paper, we can't pay the janitor,’ he told Whalley. ‘We have no cash!’ ”
>
> McLEAN, Bethany and Peter ELKIND (2004, chapter 22, page 378).

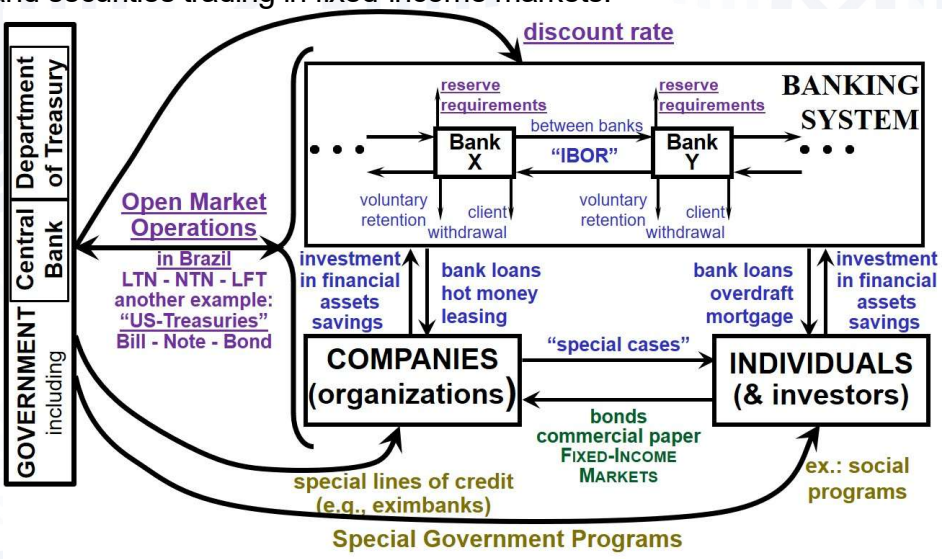
3 Features of bonds

When granting a loan and placing trust in the borrower, a lender transfers financial resources to the debtor, who provides some form of guarantee and a promise regarding the future timely repayment, including the payment of compensation (interest) or late payment subject to additional penalties and default interest. Debt amortization refers to how principal repayment will take place, being beyond the scope of this work discuss the several amortization schedules, referring to how payments are divided between principal and interest. One of the several methodologies for loan repayment is the "Price System" (also known as the French amortization method), featuring constant periodic payments, increasing principal amortization, and decreasing interest charges. However, it can be established that there will be a regular cash flow of interest payments and principal repayment will be only at maturity. This is the case of bonds with the strategy in Figure 6.

Bonds belong to the category of debt instruments. Obtain financing through bonds requires specifying the amount, the size of coupon payments with principal repayment at maturity, other contractual requirements stipulated in the bond indenture (including embedded options), the maturity date, and the implied yield or implicit interest rate.

3.1 How do private debt securities (bonds) relate to public debt?

Figure 7 schematically shows how monetary policy instruments (i.e., open market operations, the discount rate, and reserve requirements) are interconnected with bank lending, and securities trading in fixed-income markets.



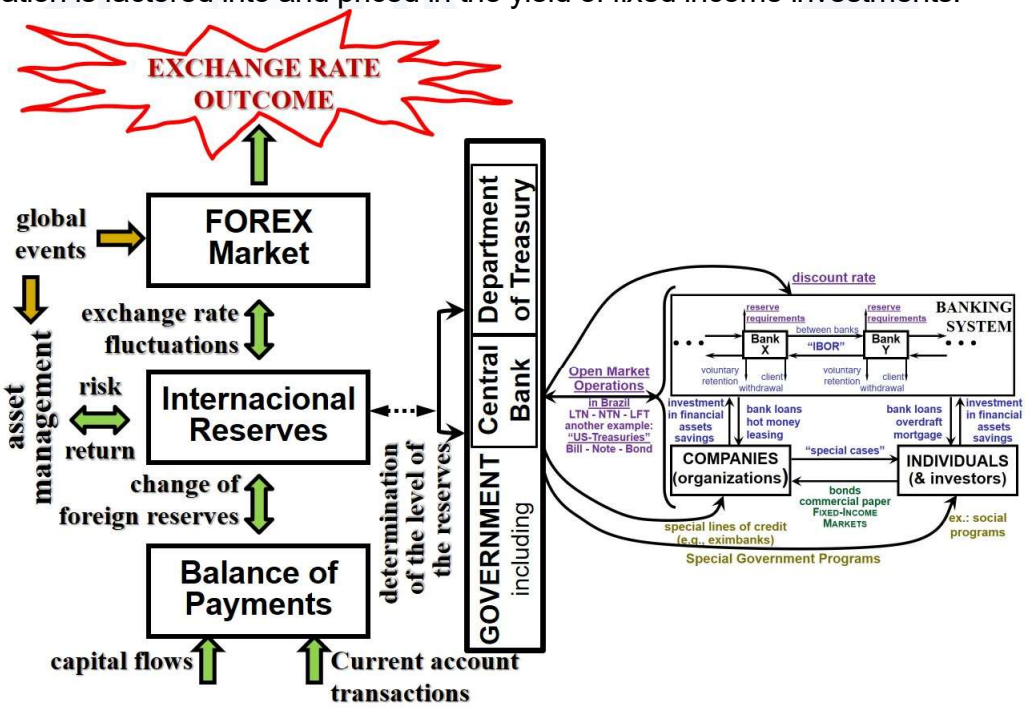
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Figure 7 Intertwining monetary policy with different types of debt

With the exception of the issuer of the primary currency used in international transactions (currently the United Sates), all other countries will closely monitor and manage: (a) the impact of exchange rate fluctuations in foreign exchange market transactions (FOREX); (b) the volume of their international reserves; and (c) their balance of payments, as shown in Figure 8, which adds to Figure 7 the international context that also affects the attitudes of a government. The impact of exchange rate fluctuations is particularly significant upon domestic transactions and investment decisions related to equity and fixed-income securities in Brazil, as discussed in Henriques-de-Brito (2009) with data.

When factors arise that drive the depreciation of the Brazilian real (BRL) against the US dollar (USD), the Central Bank of Brazil may intervene in the foreign exchange market to curb (or even reverse) this depreciation of the BRL, eventually reducing Brazilian's foreign

reserves. One alternative is to raise the benchmark interest rate in Brazil (Selic). A higher (and, crucially, rising) benchmark interest rate retains and even attracts new capital inflows into fixed-income instruments, specifically those offering higher yields and lower unit prices (which are expected to increase later when interest rates fall). These allocations into higher-yielding fixed-income assets occur at the expense of equity investments (stocks) on the B3 exchange, because corporate borrowing costs rise, consumer spending propensity declines, and transactions involving goods and services slow down, thereby constraining corporate profits and expansion prospects of listed companies in Brazil. Conversely, when the benchmark interest rate falls, markets for goods and services heat up, making equity investments attractive (driven by expectations of rising corporate earnings and stock prices). Such scenario stimulates the inflow of foreign capital into stocks traded at B3, favoring the appreciation of the BRL. This appreciation of the BRL against major currencies yields a currency gain for foreign-based investors, supplementing the expected total return (capital gains and income) from equity investments. In contrast, the probability of currency depreciation is factored into and priced in the yield of fixed income investments.



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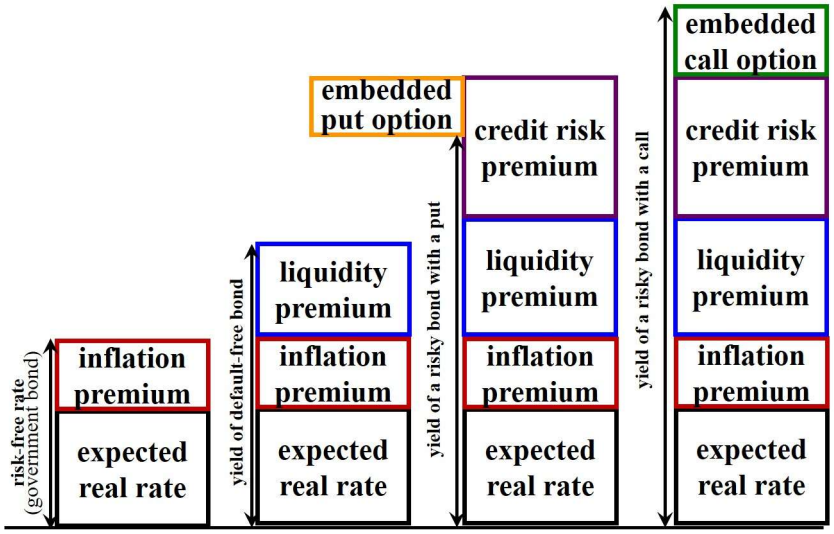
Figure 8 How central bank activities are affected by the international context

The comment above may prompt reflection on why bonds with the same characteristics in different parts of the world would not trade at the same price in a given currency and, hence, do not offer the same yield in that currency. For bond yields to be equal globally, the following conditions would have to be met: (a) governments providing the same macroeconomic scenario; (b) identical financial and contractual aspects; (c) free capital flow; (d) absence of transaction costs; and (e) investors with concrete and feasible expectations, rational behavior, and risk neutrality. Under these circumstances, gains or losses from "carry trades" would not be possible because of arbitrage, which would ensure a direct, predictable relationship between interest rates and exchange rate fluctuations. Nevertheless, the above conditions are not held up in practice, since term structures of interest rates (i.e., yield curves and their movements) differ among countries with their corresponding currency, and fixed-income security yields incorporate various risk premiums.

3.2 What are the components that make up a bond's yield?

The term yield refers to the total return on an investment. A bond's yield results from several components taken into account when evaluating the bond's cash flow: (a) the bond's purchase price; (b) periodic coupon payments received until maturity; (c) how the bond price varies over time, as it approaches maturity and as the discount rate changes; (d) investor's expectations of yields and yield spreads; (e) expected credit losses; (f) gains or losses related to exchange rate fluctuations. Details are available in Kopprasch and Mann (2018), and Adams and Smith (2019).

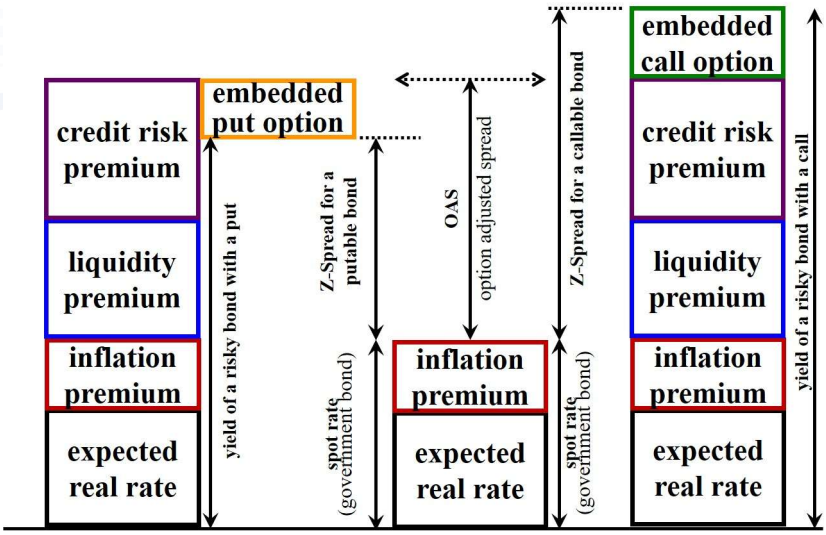
The yield to maturity (YTM) is a metric that takes into account features of a bond, which can be compared to those of a government bond. Since a government bond is considered risk-free in the country's currency, all other bonds denominated in the same currency will offer a higher yield, depending on their specific features. Figure 9 was developed for this work to facilitate understanding of the factors contributing to an increase in a bond's yield.



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Figure 9 Components of return on bond issues

Figure 10 presents several yield definitions, taking into account added premiums and the presence of embedded options in a bond.

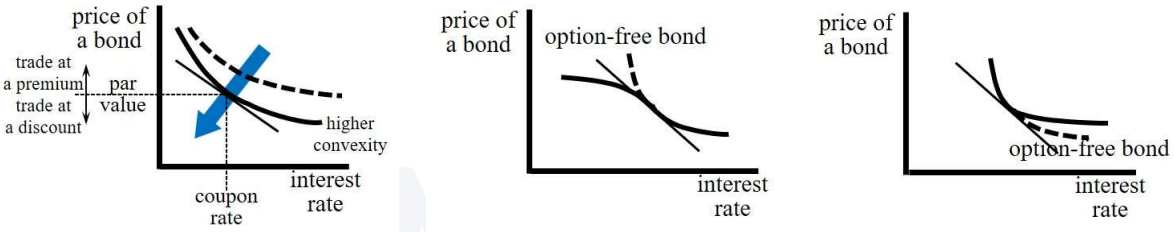


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Figure 10 Spot rate, Z-spread & OAS

3.3 How does the current market interest rate affect the price of a bond?

A bond's price varies inversely with the interest rate, depending on the curvature of this relationship and the existence of embedded options. When the market interest rate equals the coupon rate, the bond trades at par (i.e., bond's market value equals its face value).

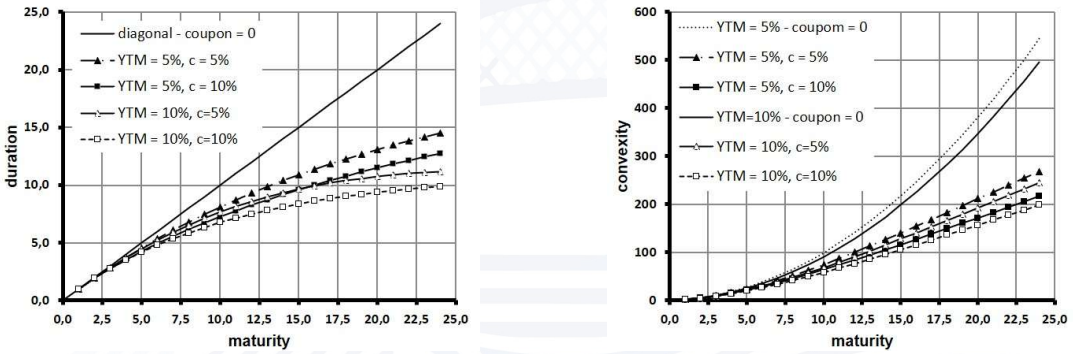


straight bond (option-free bond) | callable bond has an embedded call option | puttable bond has an embedded put option

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Figure 11 Price-yield curve of a bond without and with embedded options

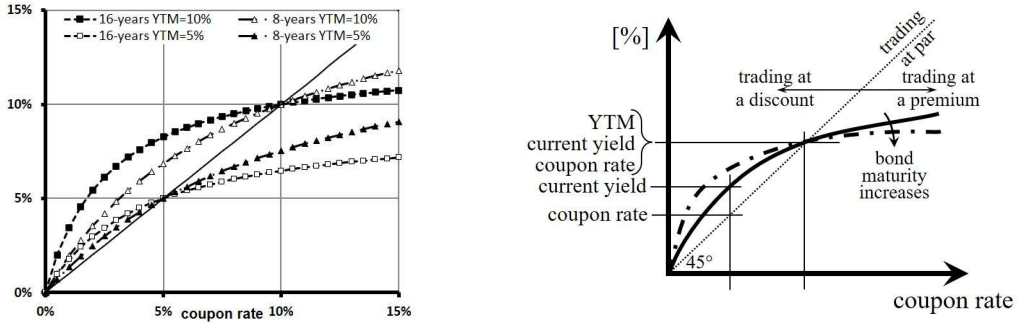
The curvature of the price-yield curve of a bond affects its duration and convexity. Both are derived from the YTM, the coupon rate and the time to maturity, as demonstrated in Figure 12. Duration measures how much the price of a bond will change due to an interest rate shock. Convexity provides a necessary quantitative adjustment when the magnitude of that rate shock is larger. Therefore, duration is a measure of interest rate risk that does not correspond to a specific time period, particularly as the coupon rate and YTM increase, as can be observed in the data in Figure 12.



Developed for this work

Figure 12 Bond duration and convexity as a function of time to maturity

Current yield is defined as the annual coupon payment divided by the bond's current market price. While the coupon rate remains constant until maturity, the current yield fluctuates inversely with the bond's current market price and differs from the yield to maturity (YTM), except when the bond trades at par, as shown by data and explanation in Figure 13, which illustrates the visual relationships between relevant bond's metrics and maturity.



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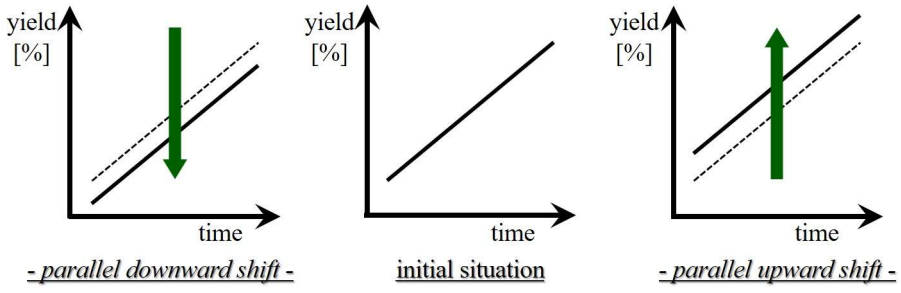
Figure 13 Visual relationships between bond metrics and maturity

The comments above do not consider the possibility of improvement or deterioration in a bond's credit condition, which directly affects the bond's price and its liquidity. Credit events tend to be more frequent and surprising than expected or desired.

3.4 What are the typical movements of the yield curve and why is this important?

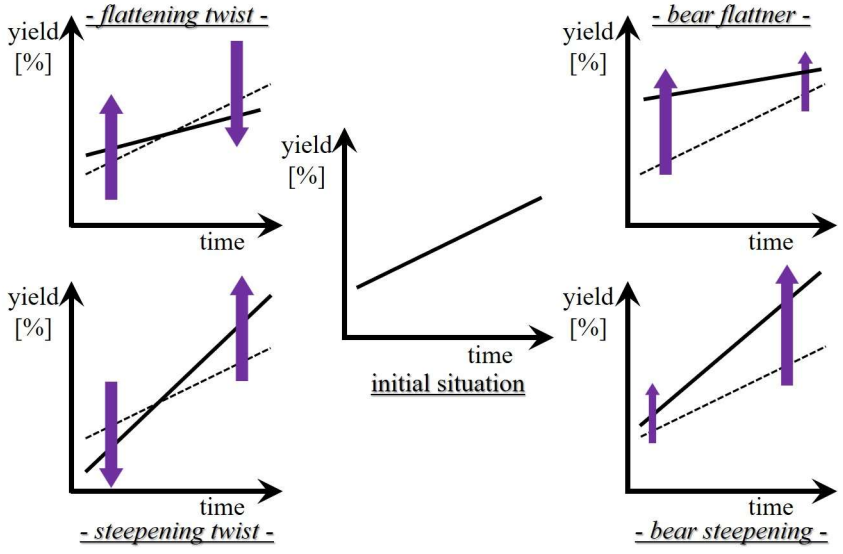
The yield curve (also known as the term structure of interest rates) shows how a specific yield, used as a benchmark for fixed income investment, varies across different maturities, ranging from the short term (months) to the long term (many years or even decades). The current shape of the yield curve and its expected movements reflect market perceptions regarding the projected trajectory of bond yields and future monetary policy decisions, which will influence other macroeconomic conditions and signal economic expansion or recession. Therefore, a yield curve is a useful tool for forecasting and making investment decisions.

Usually, the yield curve slopes upward with lower yields for shorter-term bonds, and rising yields for bonds with longer maturity, indicating economic expansion. In a stable rate environment, as the bond's yield falls and its price rises, some bond investors sell the bond as it approaches maturity, employing a strategy known as "riding the yield curve". However, the shape of the yield curve varies over time, and typical movements of the yield curve include changes in level (involving vertical shifts as in Figure 14), slope (i.e. steepening and flattening as in Figure 15), and curvature (when middle maturities move differently relative to those in the short and long ends), in addition to the possibility of an inverted yield curve (Figure 16). The dashed line relates to the initial situation preceding the movement.



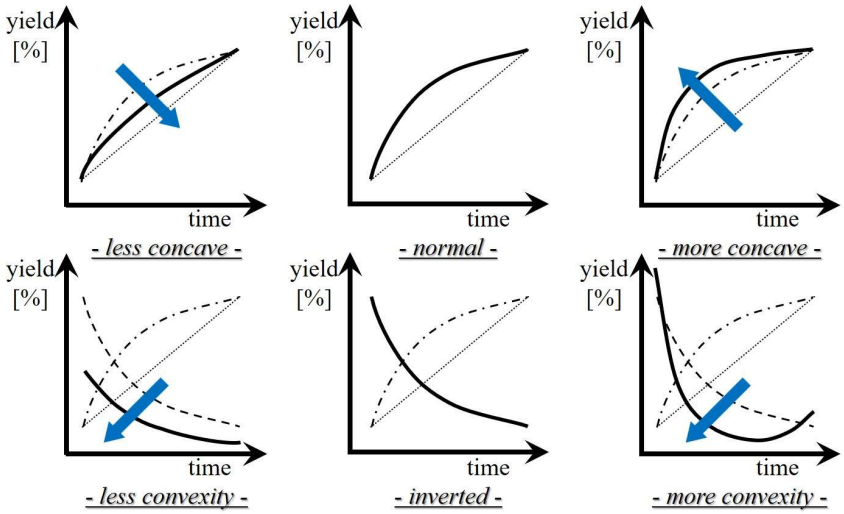
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Figure 14 Yield curve movements – vertical shifts



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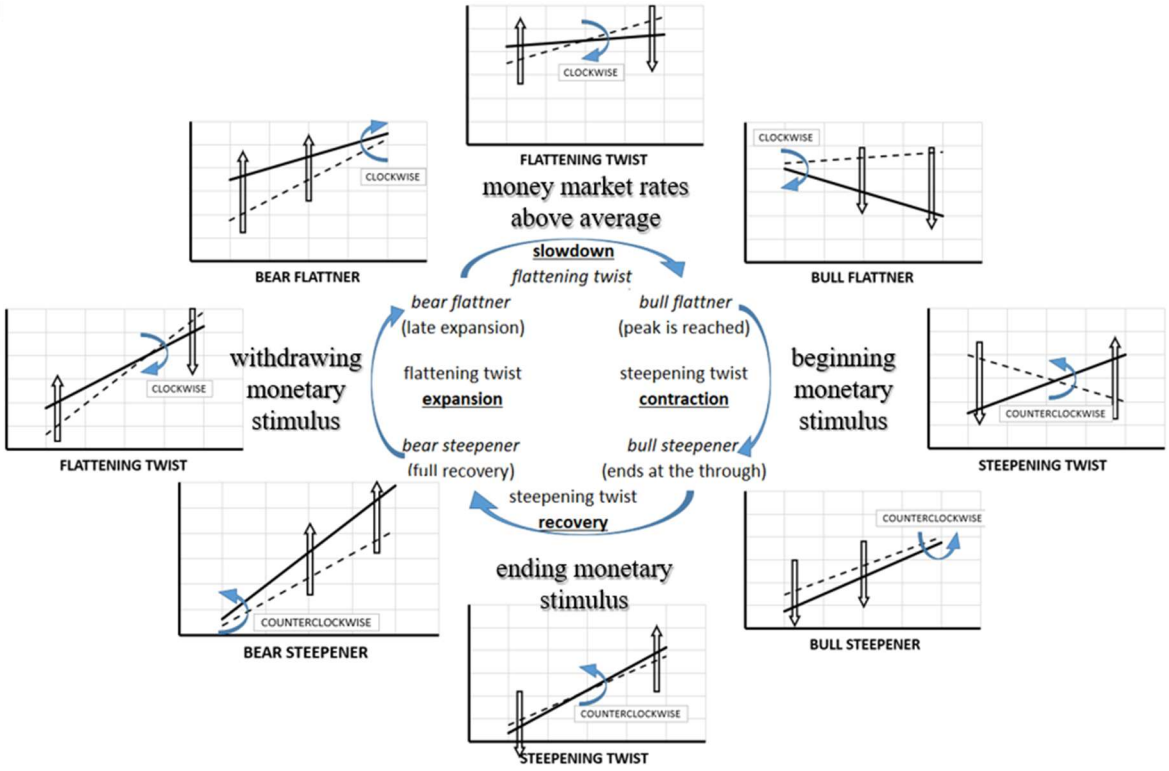
Figure 15 Yield curve movements – changes in slope



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Figure 16 Yield curve movements – changes in curvature (including inversion)

A steep yield curve signals strong economic growth, a scenario often accompanied by higher inflation and higher interest rates. However, an upcoming economic recession causes short-term interest rates to rise above long-term rates, resulting in a downward-sloping yield curve. This inverted yield curve emerges during recessions, when investors expect long-term bond yields to fall. During periods of economic uncertainty, short-term and long-term yields become quite similar. The yield curve flattens, eventually appears a slight hump associated with medium-term maturities that offer slightly higher yields. Figure 17 was developed for this work to illustrate how yield curve dynamics relate to macroeconomic conditions and affect investment portfolio strategies, as presented in section 4.



Developed for this work

Figure 17 A complete cycle of yield curve movements

3.5 How is it possible to compare bonds with different currencies?

The steps to compare bonds with different currencies are: (1) Identify cash flows in the respective currencies; (2) Estimate the series of foreign currency exchange rates against the “reference currency” over the cash flow period; (3) Convert all foreign currency inflows/outflows into values in the “reference currency”; (4) Calculate the net present value of both cash flows with the discount rate in the “reference currency”; (5) Choose the highest NPV. It is incorrect to calculate NPV of the cash flows in the foreign currency with the corresponding discount rate to subsequently convert that value to the “reference currency” using the initial exchange rate. This procedure would only be possible in a very specific case described in depth in Henriques de Brito (2003) and Henriques de Brito (2005), in which an alternative method is proposed.

4 Fixed income portfolio management

The focus of this section is on how fixed income is employed by investors and portfolio managers, considering that an investment portfolio does not comprise a single bond only.

4.1 How are strategies for fixed income portfolio management selected?

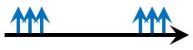
Just as with equity investment, fixed-income investors or portfolio managers can choose between passive and active management. The former involves adopting a passive strategy based on fixed-income indices (such as fixed-income index replication), whereas active fixed-income management aims to generate excess returns and, hence, outperform a benchmark, either by selecting high-yielding securities (including debt instruments, such as bonds) or by taking profitable credit positions (i.e. anticipating movements in credit spreads, Goodman and Melentyev, 2017). Both approaches may involve anticipating yield curve movements, their implications for economic activity, and the yield curve cycle (Figure 17).

The previously described yield curve movements will affect risk and return expectations, portfolio’s performance, and cash flows (Hanke and Henderson, 2017). Assets-liability mismatches resulting from non-parallel yield curve movements (i.e., changes in slope, twists in Figure 15) are particularly detrimental and pose a structural risk to liability-based mandates (cash flow matching, duration matching or a combination of both). While a cash flow matching mandate aims to ensure that expected cash inflows from fixed-income assets meet the cash outflows requirements or demands arising from future obligations on specific payment dates, duration matching seeks to align the duration of assets and liabilities with respect to interest rate shifts, without requiring the temporal alignment of cash flows (Adams and Smith, 2017). Thus, a key decision regarding fixed income portfolios is precisely deciding whether to buy, sell or hold bonds with shorter, medium, or longer maturities, as well as varying coupon rates and credit risk ratings, considering probability and severity of losses. Beyond affecting portfolio returns and both the amount and timing of cash flows, the inclusion of new bonds in a portfolio will likely change both portfolio’s duration and convexity, being even possible to buy or sell convexity to adjust these metrics to portfolio’s target level.

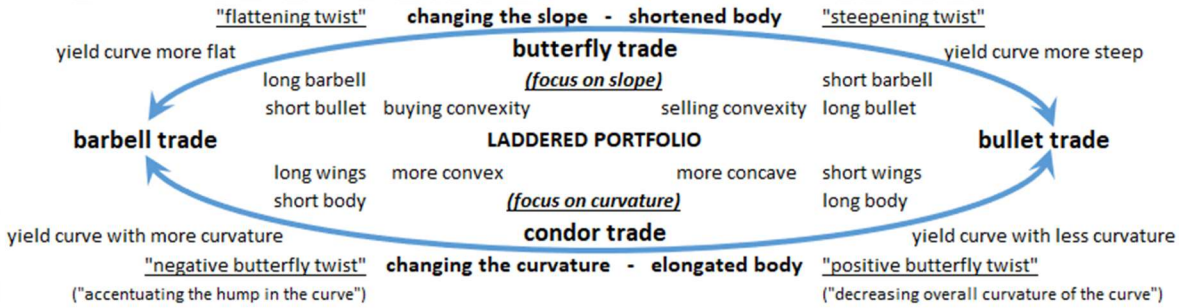
Table 2 lists three fixed-income portfolio structures for addressing yield curve vertical shifts and changes in slope. Figure 18 relates portfolio structures and trading strategies in response to expected or projected yield curve movements. In the middle lies the laddered portfolio with bonds distributed evenly along the yield curve, which maintains the duration of the overall portfolio, resulting in a balanced position and the most conservative portfolio structure. Conversely, while a barbell portfolio is better suited for a flattening yield curve, for a yield curve with more curvature, and when volatility increases, a bullet portfolio is more appropriate for a steepening yield curve, with less curvature, and when volatility reduces. Figure 18 also draws a distinction between butterfly trade and condor trade strategies, which focus on both the body (inner yields) and the wings (outer yields) of the portfolio structure.

While the butterfly trade strategy with a portfolio structure focusing on the slope of the yield curve is suitable for its rotating or pivoting, the condor trade strategy refers to a portfolio structure positioned to a yield curve changing its curvature by either crooking or bending.

Table 2 Fixed-income portfolio structures for managing yield curve moments

BARBELL PORTFOLIO	LADDERED PORTFOLIO	BULLET PORTFOLIO
bonds with short- and long-term maturities are placed at the ends of the yield curve	bonds with different maturities are spread more or less evenly along the yield curve.	bonds are concentrated at a particular point of the yield curve targeting a given duration
		
highest portfolio convexity	diversified maturities offer better protection from shifts and twists	lowest portfolio convexity

Developed for this work



Developed for this work

Figure 18 Portfolio structures and trading strategies facing yield curve movements

4.2 Is there any topic related to debt accounting that should not be neglected?

Accounting standards require a distinction between bonds held to maturity (measured at cost) and those held for trading (fair market value). Such distinction affects profit determination, as thoroughly explained in Gordon and Henry (2019).

4.3 Why combine fixed-income investments with other types of investments?

The benefits of fixed-income investments in a multi-asset portfolio are diversification, inflation hedging potential, and obtaining periodic and quite predictable cash flows. There are however challenges of dealing with specific types of risk exposures, such as interest rate risk (yield curve shifts & twists), inflation rate risk; liquidity risk (low trading volumes), risk with embedded options, credit risk (default risk) and credit spread risk. Global bonds are also subjected to currency risk (overshooting); country default risk (current account imbalances); and political risk (capital restrictions). Diversification across multiple asset classes is an effective long-term strategy for dealing with financial risk exposures, as Henriques-de-Brito (2022) demonstrates through conceptual arguments and data.

In addition to adhering to the portfolio mandate, which reflects an investment portfolio statement (IPS), all investors and portfolio managers must consider how taxes, fees, transaction costs, and regulations specific to various jurisdictions worldwide affect the performance of a portfolio with all its asset classes and investment vehicles. Thus, diversification among different asset classes and within each distinct asset class plays a relevant role to boost earnings and income, requiring suitable valuation techniques of the assets and efficient and effective trading procedures, without neglecting behavioral biases as well as ethical and legal constraints.

5 Conclusions, final thoughts, and suggestions

This work about bonds and fixed-income portfolios is based on the idea that "*a picture is worth a thousand words*", which refers to using an image to convey more quickly and clearly multiple pieces of information, an intricated idea or a complex set of facts rather than through lengthy text. This approach is particularly relevant in today's multimedia era. Analyzing a sequence of images and discussing the connections within and between them can spark curiosity for more information and stimulate critical-analytical thinking more effectively than reading a long, well-written text. The knowledge and information in this work should be useful for investors, portfolio managers, finance executives and professors, and students willing to learn and review information about the largest asset class in financial markets.

The equations to compute duration, convexity, and the price of a bond (including valuation of bonds with embedded options and a discussion about the difference between dirty price and clean price) are not in this work, which additionally does not discuss how trading procedures affect the performance of a portfolio nor how should fixed-income portfolio performance be evaluated. Nevertheless, there are several publications that tackle these issues clearly and effectively, among them are Stafford Johnson (2013), combining conceptual and practical approaches, and readings of the CFA Program curriculum.

The originality of conveying information through a sequence of figures within a narrative context serves as evidence that artificial intelligence (AI) played no role in the conception or creation of this work. Artificial intelligence (A.I.) advances especially by favoring text, and it remains to be seen to what extent A.I. tools are actually able to propose convincingly useful images with symbols, complex sketches, and technical drawings for assimilating new content and fully extract useful information from such figures and pictures. The way this work is designed with its figures should also motivate readers to develop the skills of both creating figures to synthesize explanations and interweaving those images with texts.

References

ADAMS, James and Donald J. SMITH (2017). Liability-Driven and Index-Based Strategies. In: CFA Program Curriculum 2020, Level III, Volume 4, Reading 19. CFA Institute, 2019.

ADAMS, James and Donald J. SMITH (2019). Introduction to Fixed-Income Valuation. In: CFA Program Curriculum 2020, Level I, Volume 5, Reading 44. CFA Institute, 2019.

AGGARWAL, Raj: DRAKE, Pamela Peterson; KOBOR, Adam; and Gregory NORONHA (2010). Capital Structure. In: CFA Program Curriculum 2020, Level II, Volume 3, Reading 20. CFA Institute, 2019.

GOODMAN, Campe and Oleg MELENTYEV (2017). Fixed-Income Active Management: Credit Strategies. In: CFA Program Curriculum 2020, Level III, Volume 4, Reading 21. CFA Institute, 2019.

GORDON, Elizabeth A. and Elaine HENRY (2019). Non-Current (Long-Term) Liabilities. In: CFA Program Curriculum 2020, Level I, Volume 3, Reading 28. CFA Institute, 2019.

HANKE, Bernd and Brian J. HENDERSON (2017). Overview of Fixed-Income Portfolio Management. In: CFA Program Curriculum 2020, Level III, Volume 4, Reading 18. CFA Institute, 2019.

HENRIQUES DE BRITO, Marcelo (2003). Crise e Prosperidade Comercial, Financeira e Política, Probatus.

HENRIQUES DE BRITO, Marcelo (2005). Comparando fluxos de caixa em moedas diferentes. Resende: II Simpósio de Excelência em Gestão e Tecnologia, 2005.

HENRIQUES DE BRITO, Marcelo (2009). The Interaction of the Exchange Rate Variation with Decisions Regarding Monetary Policy and Investments in Brazil. RBRS International, v. 3, p. 151-172.

HENRIQUES-DE-BRITO, Marcelo (2022). Short-term and Long-term Strategies for Dealing with Financial Risk Exposures. In: XLVI Encontro da ANPAD - EnANPAD, retrieved at: http://dx.doi.org/10.2139/ssrn.4227074

JANJIGIAN, Vahan (2022). Corporate Structures and Ownership. In: Corporate Finance: A Practical Approach. CFA Institute, 2022.

KOPPRASCH, Robert W. and Steven V. MANN (2018). Yield Curve Strategies. In: CFA Program Curriculum 2020, Level III, Volume 4, Reading 20. CFA Institute, 2019.

LEWIS, Michael (1989). Liar's Poker, Hodder, 2006.

McLEAN, Bethany and Peter ELKIND (2004). The Smartest Guys In The Room: The Amazing Rise And Scandalous Fall Of Enron. Penguin Books, 2004.

STAFFORD JOHNSON, R. (2013). Debt Markets and Analysis. Bloomberg Press, 2013.

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