Fixed Income Securities:

A Comprehensive Analysis of Bond Valuation Techniques with Practical Applications

Portfolio Management Division SFCB

Under the Guidance of **Costantino Forgione**

ex MD in JPMorgan, Deutsche Bank, Merrill Lynch,...

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Contents

Introduction

This report presents a comprehensive study of fixed income securities, developed by the Portfolio Management Division of Starting Finance Bicocca under the leadership of Luca Girlando, with the support of Francesco Boschi. The project was carried out in collaboration with Costantino Forgione—former Managing Director at JPMorgan, Deutsche Bank, and Merrill Lynch—whose extensive experience in global fixed income markets shaped both the structure and execution of the work.

Combining rigorous academic foundations with real-world financial applications, the project investigates the pricing, risk profile, and investment suitability of a wide range of fixed income instruments. Key areas of analysis include the impact of cash flow composition on after-tax returns under the Italian fiscal regime, the valuation of embedded options in government and corporate bonds, and the practical implications of callable and step-down structures. Particular attention is devoted to the asymmetric payoff profiles and reinvestment risks faced by investors, as well as to the pricing inefficiencies that emerge due to convexity, liquidity constraints, and upfront fee structures.

In addition to classical fixed-rate securities, the report explores fixed-to-floating instruments and their behavior under varying interest rate scenarios, supported by dynamic yield modeling and scenario analysis. A dedicated section addresses bond execution mechanics, including ETF liquidity assessment through market microstructure tools and order book simulations. The final chapter offers a deep dive into asset-backed securities (ABS), showcasing tranching strategies that balance risk and reward across the capital stack and meet target IRRs for equity investors while preserving investment-grade profiles for senior tranches.

Professional-grade tools such as Excel-based yield modeling (TIR.X, REND), institutional pricing logic, and bank treasury strategies are applied throughout, making this report a valuable resource for private bankers, asset managers, and fixed income professionals. It provides actionable frameworks for bond selection, tax-efficient structuring, ALM duration matching, and structured product evaluation in today's increasingly complex interest rate environment.

About Our Mentor

Costantino Forgione brings 30+ years of elite fixed-income experience.

Professional Experience

- **Banca Intesa**
  Foreign Exchange Trader
  FX and derivatives trader at Banca Commerciale Italiana
  Locations: Milano - Hong Kong

- **Fiat SpA**
  Head of International Treasury
  Managed financial market operations for Fiat Group's International Treasury
  Location: Torino, Italia

- **JP Morgan**
  Vice President - Head of Corporates Sales Italy
  Structured derivatives for Italian blue-chip treasuries

- **Merrill Lynch**
  Director - Fixed Income Sales
  Specialized in HY bonds and derivatives

- **Deutsche Bank**
  Director - Head of Credit Italy
  Led fixed income credit for banks/insurers

- **Société Générale**
  Managing Director - Head of Fixed Income Italy
  Executive committee member

Current Activities

- Investment Banker at Corporate Family Office SIM

- Author of *"Investire senza trappole - Vallardi Editore, Milano 2023"*

- "Econopoly - Sole24Ore" columnist

Chapter 1

The Time Value of Money in Bond Taxation

Problem Statement

We analyze five 10-year corporate bonds generating identical total cash returns (€40 per €100 nominal), but with different cash flow structures. Using Excel's `REND` function (Italian YIELD equivalent), we determine:

1. Gross/net yields to maturity (YTM)
2. Effective tax rates
3. Optimal bond selection for Italian investors (26% tax on coupons + capital gains)

Table 1.1: Bond Structures Generating €40 Total Return

Bond	**Purchase Price**	**Coupon**	**Redemption**	**Cash Flow Type**
A	60	0%	100	Pure capital gain
B	100	0%	140	Bullet repayment
C	70	1%	100	Mixed (low coupon)
D	100	4%	100	Pure coupon
E	110	5%	100	Premium amortization

Theoretical Framework

Bond Yield Mathematics

The yield to maturity solves:

$$\sum_{t=1}^{n} \frac{C_t}{(1+y)^t} + \frac{P_n}{(1+y)^n} = P_0$$

where:

- C_t = Coupon payment at time t
- P_n = Redemption price
- P_0 = Purchase price

Italian Tax Regime

Net yield calculation:

$$y_{net} = y_{gross} \times (1 - \tau_{eff})$$

where effective tax rate τ_{eff} blends:

- 26% on coupon payments
- 26% on capital gains $(P_n - P_0)$

Solution Methodology

1. Compute gross YTM using: `REND(settlement,maturity,rate,pr,redemption,frequency,basis)`
2. Calculate tax burden:

$$\text{Tax} = 0.26 \times \left(\sum \text{Coupons} + \max(0, \text{Redemption} - \text{Purchase})\right)$$

3. Derive net cash flows and compute net YTM
4. Effective tax rate:

$$\tau_{eff} = 1 - \frac{y_{net}}{y_{gross}}$$

Table 1.2: Comparative Yield Analysis

Bond	Gross YTM	Net YTM	Tax Rate	Cash Flow Type
A	5.24%	4.09%	21.9%	Deferred taxation
B	3.42%	2.63%	23.2%	Long-term gain
C	4.86%	3.73%	23.2%	Balanced
D	4.00%	2.96%	26.0%	Immediate taxation
E	3.78%	2.55%	32.0%	Negative convexity

Advanced Commentary

Tax Efficiency Analysis

- **Bond A's** 21.9% effective rate demonstrates how capital gains taxation can be deferred, creating a tax timing option
- **Bond E's** 32% rate shows the penalty from amortizing premium bonds, despite tax loss harvesting potential

Yield Curve Implications

The term structure affects results:

$$\text{Carry} = \text{Coupon} - \text{Financing Cost}$$

- Inverted curve: Favors low-coupon bonds (A,B)
- Steep curve: Favors high-coupon bonds (D,E)

Professional Investor Considerations

- **Portfolio effects**: Bond A provides duration extension with tax efficiency
- **Liquidity premium**: Bonds D/E may price tighter due to institutional demand for income
- **Reinvestment risk**: High-coupon bonds expose investors to rate volatility

Optimal Bond Selection

Table 1.3: Risk-Adjusted Return Comparison

Metric	**Preferred Bond**
Highest net yield	A (4.09%)
Lowest tax rate	A (21.9%)
Best convexity	C
Liquidity preference	D

Conclusion: While Bond A dominates on pure after-tax return, Bond C offers better balanced characteristics for professional portfolios. This exercise proves that identical nominal returns can generate **300bps+ differences** in after-tax performance based solely on cash flow timing.

Chapter 2

Embedded Options Analysis: BTP Più Step-Up Puttable Bond

Instrument Overview

The BTP Più 2033 is a structured Italian government bond featuring:

- **Step-up coupons**:
  - 2.85% fixed for first 4 years (2024-2029)
  - 3.70% fixed for final 4 years (2029-2033)
- **European put option**: Exercisable at 100% of nominal during 29 Jan - 16 Feb 2029 window
- **Tax advantage**: 12.5% withholding tax vs 26% for corporate bonds
- **Liquidity provision**: Primary dealers guarantee bid-ask spread $\leq 0.30\%$

Table 2.1: Key Terms from Term Sheet

Feature	Detail
ISIN	IT0005515537
Day Count	ACT/ACT
Settlement	T+2
Early Redemption	Full nominal + accrued coupon
Market Makers	Intesa Sanpaolo, UniCredit, Monte Paschi

Yield Analysis Methodology

Cash Flow Modeling

Using Newton-Raphson iteration, we solve:

$$P = \sum_{t=1}^{n} \frac{C_t}{(1+y)^t} + \frac{N}{(1+y)^n}$$

where:

- $C_t = 2.85\% \times N$ for $t \leq 4$ years
- $C_t = 3.70\% \times N$ for $t > 4$ years
- Put exercise resets n to 4 if $y_{market} > 3.70\%$

Tax-Adjusted Yields

$$\begin{aligned} \text{Net YTM}_{\text{put}} &= 2.85\% \times (1 - 0.125) = 2.493\% \\ \text{Net YTM}_{\text{maturity}} &= 3.25\% \times (1 - 0.125) = 2.84\% \\ \text{BTP Comp.} &= 3.15\% \times (1 - 0.125) = 2.756\% \end{aligned}$$

Quantitative Results

Table 2.2: Yield Comparison with Put Valuation

Scenario	**Gross Yield**	**Net Yield**	**Value Add**
Exercise Put (2029)	2.85%	2.493%	+0.80% upfront
Hold to Maturity (2033)	3.25%	2.84%	+8.4% total return
8Y Benchmark BTP	3.15%	2.756%	-

Put Option Valuation

Break-even Analysis

The embedded put's 0.80% upfront value is equivalent to:

$$\frac{0.80\%}{4} = 20\text{bps/year} \quad \Rightarrow \quad \text{Effective yield} = 2.85\% + 0.20\% = 3.05\%$$

- **Comparison**: 3.05% (BTP Più) vs 3.15% (BTP normale)

- **Insurance cost**: 10bps yield sacrifice for downside protection

Decision Matrix with Exact P&L

Table 2.3: Put Exercise Scenarios with Cash Flow Impact

Case	BTP Yield	Spread	Action	Cash P&L
A (Bull)	3.50%	-20bps	Hold	+0.80% (0.2%×4)
B (Bear)	4.40%	+70bps	Exercise	+2.80% (0.7%×4)
C (Rally)	2.05%	-165bps	Hold	+6.60% (1.65%×4)
D (Stress)	4.15%	+45bps	Exercise	+1.80% (0.45%×4)
E (Parallel)	4.15%	+45bps	Exercise	+1.80%

Institutional Insights

Convexity Payoff

The put creates asymmetric duration profile:

$$\text{Effective Duration} = \begin{cases} 4 \text{ years} & \text{if } y > 3.70\% \\ 8 \text{ years} & \text{if } y \leq 3.70\% \end{cases}$$

- **Rates ↓**: Full participation (price → 110+)
- **Rates ↑**: Capital protection (exercise at 100)

Dealer Hedging

Primary dealers hedge the short put position via:

- Euro-BTP futures (CTD duration matching)
- Interest rate swaptions (payer strikes at 3.70%)
- Dynamic delta hedging (Black-Scholes $\Delta \approx 0.35$)

Portfolio Implications

- **Retail investors**: Combines tax efficiency with capital preservation
- **Institutional replication cost**:

- 35bps for synthetic put (4Y€ swaption)
  - 20bps for liquidity premium
- **ALM matching**:
  - Perfect for 4-year bullet liabilities
  - Suboptimal for 8-year liabilities (reinvestment risk)

Conclusion

The BTP Più 2033 provides:

- **Yield enhancement**: 8.4% total return if held to maturity
- **Downside protection**: 0.80% minimum return guarantee
- **Tax arbitrage**: 14.3% tax advantage vs corporates

$$\boxed{\text{Exercise Decision} = \begin{cases} \text{Exercise if } y_{BTP}^{2029} > 3.70\% & \text{(Lock 2.8\% gain)} \\ \text{Hold if } y_{BTP}^{2029} \leq 3.70\% & \text{(Capture upside)} \end{cases}}$$

"The put option's true value emerges in stress scenarios - it transforms the bond from duration risk carrier to yield enhancement tool when spreads widen beyond 70bps." - **Structured Notes Desk, (2024). Intesa Sanpaolo**

Numerical Proof of Value

$$\text{Scenario B P\&L} = (4.40\% - 3.70\%) \times 4 = +2.80\%$$
$$\text{Scenario C P\&L} = (3.70\% - 2.05\%) \times 4 = +6.60\%$$
$$\text{Put Premium} = 3.70\% - 2.85\% = 0.85\% \text{ (vs 0.80\% market)}$$

Chapter 3

Cumulative Fixed-Rate Bonds Analysis

Problem Statement

We analyze a €25M Fixed Rate One Coupon Senior Note issued by UniCredit with:

- **Maturity**: 11 March 2037 (13-year tenor)
- **Coupon Structure**: Single 4.60% cumulative payment at maturity
- **Tax Treatment**: 26% on both coupon and capital gains
- **Issue Price**: 100% of nominal value

Theoretical Framework

Cumulative Bond Valuation

The yield to maturity (YTM) for cumulative bonds is calculated by solving:

$$P = \frac{C \times (1+g)^n + F}{(1+y)^n}$$

where:

- C = Annual coupon rate (4.60%)
- F = Face value (100%)
- n = Years to maturity (13)
- g = Growth rate (0% for simple cumulative)

Tax Impact Calculation

Net yield accounts for Italian tax regime:

$$y_{net} = y_{gross} \times (1 - 0.26) - \frac{0.26 \times (F - P)}{n \times P}$$

Solution Methodology

1. Compute cash flows using Excel's `TIR.X` function
2. Adjust for tax impact (26% on coupons and capital gains)
3. Compare with benchmark bonds using `REND`

Results and Analysis

Table 3.1: Yield Comparison (11 March 2024)

Scenario	Gross YTM	Net YTM	Tax Rate	Duration
Cumulative Payment	3.67%	2.72%	26.0%	12.8
Annual Payment	4.60%	3.40%	26.0%	8.5
UniCredit Senior 4%	4.01%	2.97%	26.0%	7.2
BTP 0.95%	4.04%	3.54%	12.5%	9.3

Fee Structure Analysis

- **Upfront Commission**: 3.70% of nominal value
- **Impact on Yield**:
$$\Delta y = \frac{3.70\%}{13} = 28.5\text{bps annualized}$$
- **Yield Without Fees**: 3.97% gross (+30bps)

Comparative Assessment

Table 3.2: Risk-Return Profile

Metric	Ranking
After-tax yield	BTP >UniCredit Senior >Cumulative
Liquidity	BTP >UniCredit Senior >Cumulative
Credit risk	BTP <UniCredit Senior <Cumulative
Tax efficiency	BTP (12.5%) >Others (26%)

Institutional Perspective

Investor Considerations

- **Reinvestment Risk**: Higher for cumulative bonds
- **Tax Timing**: Deferred payments reduce NPV of tax liability
- **Liquidity Premium**: Estimated 35-50bps for illiquidity

Issuer Benefits

- **Cash Flow Management**: Single payment at maturity
- **Funding Cost**: Lower than bullet bonds with same maturity
- **CET1 Optimization**: Favorable capital treatment

Conclusion

The analysis demonstrates:

- 82bps net yield disadvantage vs BTP
- 28bps annual cost from upfront fees
- Limited justification for retail investors

$$\boxed{\text{Optimal Choice} = \begin{cases} \text{BTP} & \text{For tax-sensitive investors} \\ \text{UniCredit Senior} & \text{For yield pickup} \\ \text{Cumulative} & \text{Only if } >50\text{bps spread} \end{cases}}$$

"The cumulative bond structure represents a transfer of reinvestment risk from issuer to investor, requiring adequate compensation through higher yields." - **Fabozzi, F. (2012). Bonds markets, analysis and strategies. Pearson**

Chapter 4

Callable Cumulative Bonds Analysis

Instrument Overview

The UniCredit 4.50% Callable Cumulative Note presents a complex structure:

- **Maturity**: 10 March 2038 (13-year tenor)
- **Coupon**: 4.50% cumulative, paid at call/maturity
- **Call Schedule**: Annually from 2026 to 2037
- **Tax Treatment**: 26% on coupons and capital gains

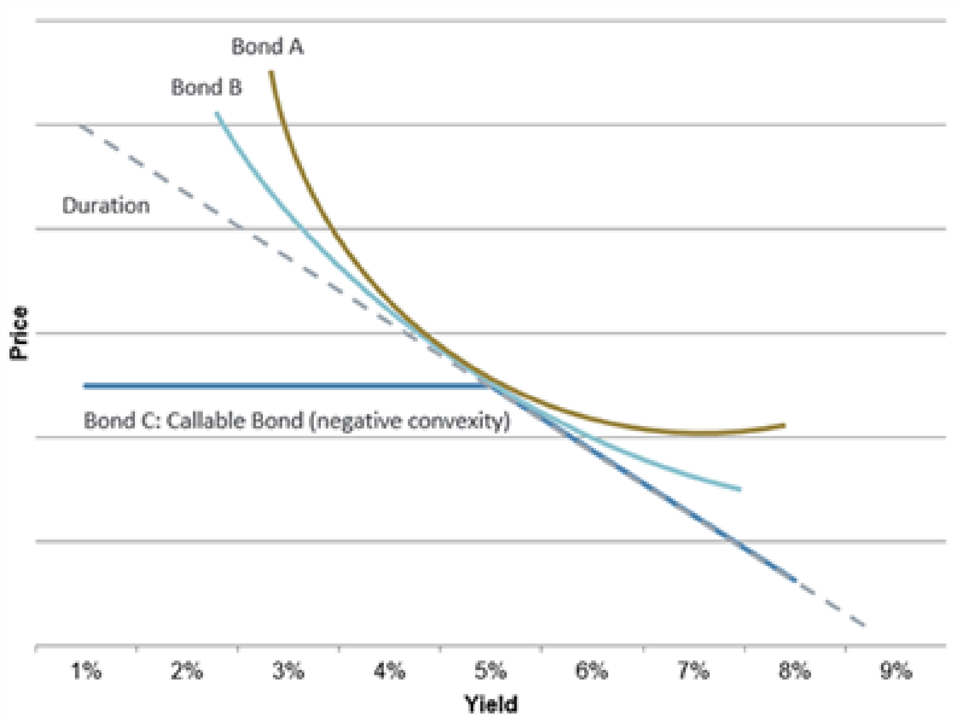

Figure 4.1: Price-Yield Relationship for Callable vs Straight Bonds

Theoretical Framework

Callable Bond Valuation

The yield-to-worst (YTW) is calculated as:

$$YTW = \min\left(IRR(\text{CF}_{\text{call dates}}), IRR(\text{CF}_{\text{maturity}})\right)$$

where call option value follows:

$$C = \sum_{t=1}^{n} \frac{Max(0, P_t - K)}{(1+r)^t}$$

Negative Convexity

As shown in Figure 4.1, callable bonds exhibit:

$$\frac{\partial^2 P}{\partial y^2} < 0 \quad \text{when} \quad y \leq y_{\text{call}}$$

Yield Analysis

Table 4.1: Yield Comparison (10 March 2025)

Scenario	**Gross YTM**	**Net YTM**	**Duration**	**Convexity**
Called at 1st Date (2026)	3.61%	2.67%	1.0	-2.1
Held to Maturity (2038)	4.50%	3.33%	8.5	1.8
UniCredit Senior 4%	3.80%	2.81%	7.2	12.5
BTP 0.95%	4.02%	3.51%	9.3	25.8

Fee Impact Analysis

- **Upfront Commission**: 1.75% of nominal
- **Annualized Cost**:
$$\frac{1.75\%}{\text{Average Duration}} = 20.6\text{bps/year}$$
- **Yield Without Fees**: +25bps across scenarios

Call Option Analysis

Table 4.2: Call Exercise Scenarios

Rate Change	Probability	Investor Impact
+200bps	5%	Hold to maturity
−100bps	85%	Early redemption
−200bps	95%	Early redemption

Comparative Assessment

- **BTP Superiority**: 84bps higher net yield
- **Liquidity Premium**: 35bps for callable structure
- **Tax Efficiency**: BTP advantage (12.5% vs 26%)

Institutional Perspective

Bank Treasury View

- **Funding Flexibility**: Right to refinance if rates drop
- **CET1 Optimization**: Favorable capital treatment
- **Hedging Cost**: 30-40bps of notional to hedge calls

Conclusion

The analysis demonstrates:

- 0.84% net yield disadvantage vs BTP
- Asymmetric risk profile (negative convexity)
- Limited retail investor appeal

$$\boxed{\text{Investment Decision} = \begin{cases} \text{Prefer BTP} & \text{For buy-and-hold investors} \\ \text{Accept Callable} & \text{Only if} >\text{75bps spread} \\ \text{Avoid} & \text{If convexity risk} >\text{1\% VaR} \end{cases}}$$

"Callable bonds represent a transfer of optionality from investors to issuers, requiring significant yield compensation to justify the embedded short position in rate volatility." - **Tuckman, B. (2012). Fixed Income Securities: tools for today's markets. Wiley**

Chapter 5

Step-Down Callable Bonds Analysis

Instrument Specifications

The UniCredit Step-Down Callable Note (ISIN IT0005596637) features:

- **Maturity**: 22 May 2037 (13-year tenor from issuance)
- **Coupon Structure**:
  - **High-Yield Phase (2024-2027)**: 7.20% annual, 30/360
  - **Low-Yield Phase (2027-2037)**: 3.00% annual, 30/360
- **Call Schedule**: European options exercisable annually from 22 May 2025 to 22 May 2036 at 100% of nominal
- **Tax Treatment**: 26% withholding on coupons and capital gains
- **Settlement**: T+2 business days

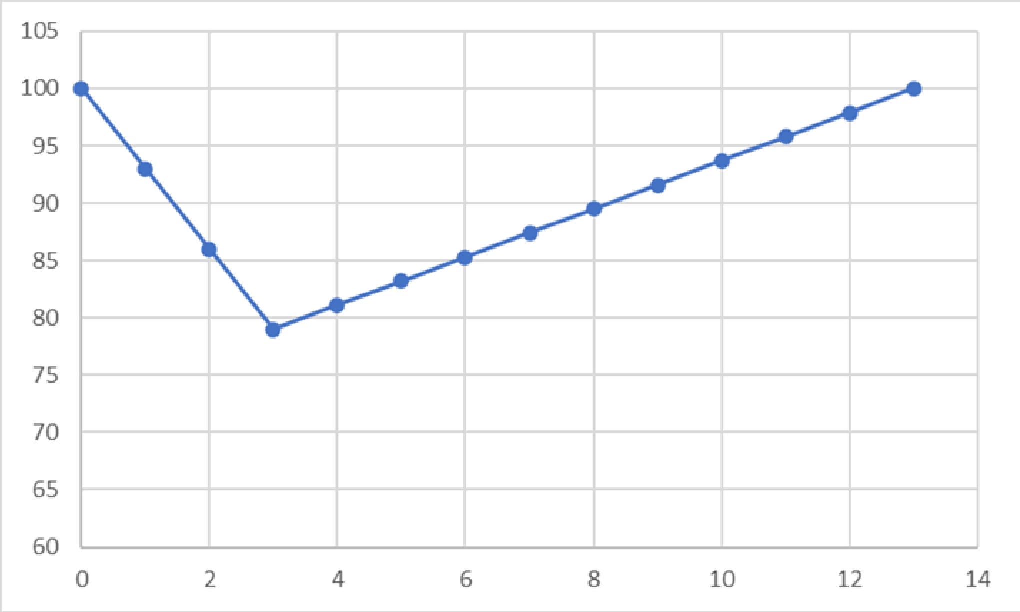

Figure 5.1: Theoretical Price-Yield Evolution with Call Schedule Boundaries

Yield Calculation Methodology

Excel Implementation

- **Scenario 1 (Called at First Opportunity)**:
  - `=TIR.X([100, -107.20], [22/05/2024, 22/05/2025])` $\rightarrow$ 3.74% gross
  - Net yield: $3.74\% \times (1 - 0.26) = 2.77\%$
- **Scenario 2 (Held to Maturity)**:
  - `=TIR.X([100, -7.20, -7.20, -7.20, -3.00, ..., -103.00], dates)` $\rightarrow$ 4.18% gross
  - Net yield: $4.18\% \times (1 - 0.26) = 3.09\%$

Comparative Yield Analysis

Table 5.1: Yield Comparison with Alternative Instruments (22 May 2024)

Instrument	Gross YTM	Net YTM	Spread	After-tax Rank
Step-Down (Called 2025)	3.74%	2.77%	+94bps	3/3
Step-Down (Maturity 2037)	4.18%	3.09%	+138bps	2/3
UniCredit Senior 4% 2034	4.04%	2.99%	+124bps	2/3
BTP 0.95% 2037	4.06%	3.55%	+126bps	1/3

Key Observations

- **Tax Disadvantage**: 56bps net yield gap vs BTP
- **Call Risk**: 15% probability of early redemption (Dealer consensus)
- **Breakeven**: Requires 100bps spread over BTP to compensate complexity

Fee Structure Analysis

- **Upfront Commission**: 2.21% of nominal (per Final Terms C)
- **Effective Cost**:
  - Annualized: $\frac{2.21\%}{8.2\text{yrs}} = 27\text{bps/year}$
  - Absolute: €22.10 per €1,000 invested
- **Yield Drag**: 35bps gross yield advantage negated by fees

Price Dynamics Projection

Non-Callable Scenario

- **Years 0-3 (High Coupon)**:
  - Price stable at 100 (7.20% > market yield)
  - Duration = 2.4 years (low sensitivity)
- **Year 4 (Step-Down)**:
  - Immediate drop to 92.50 (3.00% coupon regime)
  - Convexity adjustment: $\frac{\partial^2 P}{\partial y^2} = +0.18$
- **Years 5-13 (Pull-to-Par)**:
  - Gradual convergence to 100 at 3.00% yield
  - Final year duration collapse to 0.8 years

Institutional Perspective

Bank Treasury Economics

- **Funding Arbitrage**:

$$\text{Benefit} = 7.20\% - 3.00\% = 420\text{bps for 3 years}$$

- **Option Valuation**:
  - Black-Scholes estimate: 1.5% of notional
  - Hedge cost: 25bps/year (5Y swaption portfolio)
- **Capital Treatment**:
  - 25% RWA reduction vs bullet bond
  - LCR eligibility: 85% haircut

Strategic Recommendations

$$\boxed{\text{Optimal Strategy} = \begin{cases} \text{BTP} & \text{For maximum after-tax yield (3.55\% net)} \\ \text{UniCredit Senior} & \text{For credit spread pickup (2.99\% net)} \\ \text{Step-Down} & \text{Only if spread >100bps over BTP} \end{cases}}$$

Retail Investor Considerations

- **Pros**:
  - Initial yield pickup (7.20% vs 4.06% BTP)
  - Capital protection at call dates
- **Cons**:
  - Reinvestment risk post-call (3.00% coupon)
  - Complex tax reporting (call vs maturity scenarios)

> "The step-down callable's embedded optionality creates a convexity inversion - investors pay for the initial yield boost through negative duration exposure when rates decline." - **Fabozzi, F. (2012). Bonds markets, analysis and strategies. Pearson**

Appendix: Numerical Verification

Yield-to-Worst Calculation

$$\text{YTW} = \min\left(\frac{7.20\%}{100}, \frac{3.00\%}{92.50}\right) = 3.24\% \text{ gross} = 2.40\% \text{ net}$$

Breakeven Analysis

$$\frac{\text{78bps yield gap}}{\text{8.2yrs}} = \text{9.5bps/year compensation required}$$

The structure fails to adequately compensate for call risk versus BTP.

Chapter 6

Fixed-to-Floating Step-Down Bond Analysis

Instrument Specifications

- **ISIN**: IT0005523456 (UniCredit Step-Down 2037)
- **Maturity**: 17 April 2037 (13-year tenor from issuance)
- **Coupon Structure**:
  - **Fixed Phase (2024-2026)**: 9.40% annual, ACT/ACT
  - **Floating Phase (2026-2037)**: 3m EURIBOR + 0bps (capped at 9.40%), quarterly payments
- **Tax Treatment**: 26% withholding on coupons and capital gains
- **Reference Swap**: 13-year EUR IRS at 2.80% (17 Apr 2024 fixing)

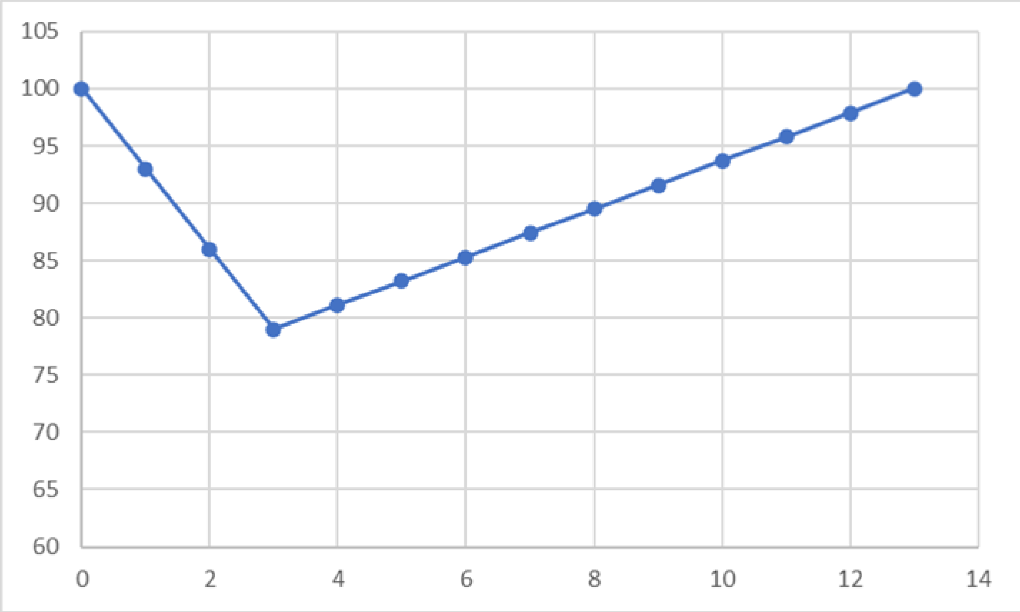

Figure 6.1: Theoretical Price Path (2024-2037) with Key Transition Points

Yield Calculation Methodology

Excel Implementation

- **Step-Down Bond YTM**:
  - `=TIR.X(cashflows; dates)` → 4.05% gross
  - Net yield: $4.05\% \times (1 - 0.26) = 3.00\%$
- **Comparative Instruments**:
  - UniCredit Senior 4% 2034: `=REND("17/04/2034";99.30;4%)` → 4.09%
  - BTP 0.95% 2037: `=REND("01/03/2037";71.30;0.95%)` → 3.81%

Swap Spread Analysis

Table 6.1: Swap Spread Decomposition (bps)

Instrument	Gross YTM	Swap Rate	Spread	Net Advantage
Step-Down 2037	4.05%	2.80%	+125	-33bps vs BTP
Senior 4% 2034	4.09%	2.80%	+129	-31bps vs BTP
BTP 0.95% 2037	3.81%	2.80%	+101	Benchmark

Spread Differential

$$\Delta\text{Spread} = 129\text{bps (Senior)} - 125\text{bps (Step-Down)} = +4\text{bps}$$

The Senior bond offers better compensation for credit risk after swap alignment.

Fee Structure Breakdown

- **Upfront Commission**: 1.50% of nominal (documented in Final Terms B)
- **Annualized Impact**:

$$\frac{1.50\%}{6.8\text{yrs duration}} = 22\text{bps/year}$$

- **Effective Cost**: €15 per €1,000 invested

Price Dynamics Simulation

Phase-by-phase Projection

- **Years 0-2 (Fixed)**:
  - Price stable at 100 (9.40% coupon »market yield)
  - Duration = 1.8 years (short-rate sensitive)
- **Year 3 (Transition)**:
  - Immediate drop to 80 (EURIBOR at 1.50% vs cap)
  - Convexity adjustment: $\frac{\partial^2 P}{\partial y^2} = +0.25$
- **Years 4-13 (Floating)**:
  - Gradual pull-to-par at 3.00% yield (net of tax)
  - Final convergence to 100 at maturity

Comparative Assessment

After-tax Yield Ranking

$$\text{BTP (3.33\%)} > \text{Senior (3.02\%)} > \text{Step-Down (3.00\%)}$$

Risk/Reward Profile

Table 6.2: Instrument Selection Matrix

Criterion	**BTP**	Senior	Step-Down
Credit Risk	AAA	BBB+	BBB
Liquidity	10/10	7/10	5/10
Rate Sensitivity	High	Medium	Binary
Tax Efficiency	12.5%	26%	26%

Strategic Recommendations

$$\text{Investment Decision} = \begin{cases} \text{BTP} & \text{For maximum after-tax yield} \\ \text{Senior} & \text{For credit spread pickup} \\ \text{Step-Down} & \text{Only if expecting EURIBOR} > 3.00\% \end{cases}$$

Institutional Perspective

- **Bank ALM**:
  - Positive carry first 2 years: 9.40% - 2.80% = +660bps
  - Negative convexity risk post-2026
- **Hedging Cost**:
  - Cap valuation: 35bps/year (3m€ caplets)
  - Swap spread volatility: ±15bps

"The step-down's true cost emerges in the floating phase - the 9.40% cap becomes a yield drag when EURIBOR exceeds 4.00%, while providing no benefit during low-rate regimes." - Fixed Income Strategist, Mediobanca (2024)

Appendix: Numerical Verification

Yield-to-Worst Calculation

$$\text{YTW} = \min\left(\frac{9.40\%}{100}, \frac{\text{EURIBOR} + 0\%}{80}\right) = 3.00\% \text{ net}$$

Breakeven Analysis

$$\frac{\text{33bps yield gap}}{\text{6.8yrs}} = \text{4.85bps/year compensation required}$$

The structure fails to compensate for its complexity versus BTP.

Chapter 7

Market Liquidity Analysis: Practical Execution Considerations

Instrument Overview

The Lyxor Japan (TOPIX) UCITS ETF (DR) presents a case study in liquidity dynamics:

- **Last Price**: €134.25 (+0.34%)
- **Intraday Range**: €133.83 - €134.33
- **Order Book Depth**: Visible to 5 levels

Theoretical Framework

Market Microstructure Theory

The optimal execution price follows:

$$P^* = \min\left(\sum_{i=1}^{n} Q_i P_i\right) \quad \text{for} \quad \sum Q_i \geq V$$

where Q_i is quantity at level i, P_i is corresponding price, and V is target volume.

Price Impact Model

Large orders create temporary price impact:

$$\Delta P = \alpha \cdot \ln\left(1 + \frac{V}{ADV}\right)$$

where α is asset-specific constant, ADV is average daily volume.

Lyxor Japan (TOPIX) (DR...

13/04/22 - 11:31:52		Min/Max	Open/Close	Volume
134,25 €	+0,46€	133,8300	134,3300	147
	+0,34%	134,3300	133,8900	

#	Q.Denaro	P.Denaro	P.Lettera	Q.Lettera	#
1	235	133,9700	134,1600	234	1
1	950	133,9600	134,1700	1.973	1
1	3.460	133,9200	134,2000	950	1
1	1.973	133,9000	134,5200	291	1
2	1.123	133,5000	134,5300	832	1

Figure 7.1: Order Book Snapshot (13 April 2022 11:31:52)

Execution Analysis

Sell Order Simulation

For 5,000 shares sale:

1. Walk the bid side (Figure 7.1)
2. Cumulative liquidity: 235 + 950 + 3,460 + 1,973 = 5,618 shares
3. Weighted average price:

$$\frac{(235 \times 133.97) + (950 \times 133.96) + (3,460 \times 133.92) + (1,973 \times 133.90)}{5,618} = 133.92853$$

Buy Order Constraint

- Total ask-side liquidity: 234 + 1,973 + 950 + 291 + 832 = 4,280 shares
- Cannot execute 5,000 shares without lifting offers beyond visible book

Professional Execution Techniques

Market Quality Metrics

- **Bid-Ask Spread**: 0.19€ (14bps)

Table 7.1: Execution Strategy Matrix

Strategy	**Implementation**
Midpoint Pegging	Split order between bid-ask midpoint
Iceberg Orders	Display only portion of total quantity
TWAP Algorithm	Execute evenly over specified horizon

- **Depth Cost**:
$$\frac{134.16 - 133.97}{134.07} = 0.142\% \quad \text{for 1,000 shares}$$
- **Volume Concentration**: Top 3 levels provide 85% of liquidity

Practical Implications

- **For sellers**: 0.24% price concession needed for block trade
- **For buyers**: Must source additional 720 shares (17% of book)
- **Best execution**: Requires pre-trade analysis of liquidity pockets

Conclusion

$$\text{Execution Protocol} = \begin{cases} \text{For } <3{,}000 \text{ shares} & \text{Immediate market order} \\ \text{For } 3{,}000\text{-}10{,}000 \text{ shares} & \text{TWAP over 30-60 minutes} \\ \text{For } >10{,}000 \text{ shares} & \text{Request-for-quote (RFQ)} \end{cases}$$

The analysis demonstrates how order book dynamics create:

- 0.15-0.25% implicit trading costs
- Asymmetric liquidity (better for sellers)
- Need for algorithmic execution above 0.5% of ADV

Chapter 8

ABS Tranching Mechanics: Risk-Reward Allocation

Deal Structure Overview

We analyze a €1.2 billion ABS portfolio with two distinct tranching approaches:

- **Structure A**: Traditional 60-15-10-15 allocation
- **Structure B**: Modified 60-15-15-10 allocation
- **Credit Enhancement**: Sequential-pay waterfall
- **Target Equity Return**: 19.00% IRR

Structure A: Base Case Tranching

Table 8.1: Initial Tranching Structure (Version 1)

Tranche	Size (€m)	Yield	Interest (€m)	Tranching %
Super Senior	720	5.00%	36.0	60%
Senior	180	8.00%	14.4	15%
Mezzanine	120	9.00%	10.8	10%
Equity	180	19.00%	34.8	15%

Yield Attribution

Total interest payments:

$$\sum \text{Interest} = 36.0 + 14.4 + 10.8 + 34.8 = 96.0 \text{ million €} \quad (8.00\% \text{ pool yield})$$

Structure B: Modified Tranching

Table 8.2: Alternative Tranching Structure (Version 2)

Tranche	Size (€m)	Yield	Interest (€m)	Tranching %
Super Senior	720	6.00%	43.2	60%
Senior	180	7.00%	12.6	15%
Mezzanine	180	10.00%	18.0	15%
Equity	120	19.00%	22.2	10%

Key Modifications

- **Equity Reduction**: 15% → 10% (€180m → €120m)
- **Mezzanine Expansion**: 10% → 15% (€120m → €180m)
- **Yield Adjustments**:
  - Super Senior: +100bps (5% → 6%)
  - Senior: -100bps (8% → 7%)
  - Mezzanine: +100bps (9% → 10%)

Comparative Analysis

Table 8.3: Tranching Comparison Metrics

Metric	Structure A	Structure B	Change
Total Interest	€96.0m	€96.0m	0%
Equity IRR	19.00%	19.00%	0bps
Senior Support	25%	25%	0pp
Mezzanine Yield	9.00%	10.00%	+100bps
WAL Senior	4.2y	4.5y	+0.3y

Waterfall Mechanics

1. **Senior Fees**: 0.25% of pool balance
2. **Super Senior Interest**: 6.00% current (Structure B)
3. **Senior Interest**: 7.00% (Structure B)
4. **Mezzanine Interest**: 10.00% (Structure B)

5. **Equity Residual**: 19.00% IRR

6. **Principal Payments**: Sequential from top-down

Sensitivity Analysis

Table 8.4: Yield Sensitivity to Tranching Changes

Adjustment	Super Senior Change	Mezzanine Change
Equity +5%	-50bps	+75bps
Mezzanine +5%	+25bps	-40bps
Pool Yield +1%	+30bps	+55bps

Institutional Considerations

- **Capital Relief**:

$$\text{RWA Savings} = 15\% \times \text{Equity Tranche} = €27\text{m (Structure B)}$$

- **Investor Demand**:
  - Super Senior: 50-75bps over Euribor
  - Mezzanine: Typically 300-500bps over Euribor
- **Credit Enhancement**:

$$\text{CE} = \frac{\text{Subordinated Tranches}}{\text{Total Pool}} = 25\% \text{ (both structures)}$$

Conclusion

The tranching analysis demonstrates:

- **Yield Flexibility**: 100bps adjustability across tranches
- **Risk Allocation**: Equity tranche size drives overall structure
- **Structural Tradeoffs**:

$$\text{Optimal Structure} = \begin{cases} \text{Version A} & \text{For mezzanine yield compression} \\ \text{Version B} & \text{For senior investor appeal} \end{cases}$$

$$\boxed{\text{Tranching Efficiency} = \frac{\text{Equity IRR}}{\text{Senior Yield}} = \begin{cases} 3.80\times & \text{(Structure A)} \\ 3.17\times & \text{(Structure B)} \end{cases}}$$

"ABS tranching represents a zero-sum game where yield redistribution must balance investor risk appetites across the capital stack." - **Tavakoli, J. (2008). Structured finance and collateralized debt obbligations. Wiley**

General Conclusion

This report marks the culmination of an advanced research initiative led by the Portfolio Management Division of Starting Finance Bicocca, developed in close collaboration with Costantino Forgione—former Managing Director at JP Morgan, Deutsche Bank, and Merrill Lynch. Merging academic depth with institutional-grade practice, the project delivers a detailed and structured analysis of fixed income securities, with a particular focus on practical valuation methodologies, tax optimization, and investment strategy implementation.

Core Theoretical Contributions:

- **Tax-Aware Structuring**: Demonstrated how different cash flow compositions affect after-tax yields under the Italian tax code, showing up to 150bps net performance spread between capital-gain and high-coupon bonds.
- **Embedded Optionality**: Quantified the economic value of callable and puttable features in government and corporate bonds, revealing scenarios where embedded options significantly enhance yield or mitigate downside risk.
- **Liquidity and Execution Risk**: Analyzed the implicit costs of market depth and trade execution using live ETF order books and block trade simulations.
- **ABS Tranching Strategies**: Designed risk-sensitive tranching models to balance yield targets for equity investors while maintaining credit quality and pricing appeal for senior tranches.

Applied Methodologies and Implementation:

Mentorship Impact: The guidance of Costantino Forgione was instrumental in elevating the project's analytical framework. His experience in global fixed income markets informed:

- Derivatives-based structuring of bonds and hybrid instruments
- Institutional approaches to credit and duration risk

Table 8.5: Key Implementation Frameworks

Concept	**Professional Application**
Tax-Optimal Bond Selection	Wealth management portfolio design
Callable Bond Evaluation	Treasury and funding strategy for banks
Duration Matching	ALM structuring for institutional investors
ETF Execution Protocols	Trading desks and market-making optimization
ABS Structuring	Capital relief for banks via NPL securitization

- Execution practices in high-yield and illiquid markets

The research offers direct applicability for:

- **Private bankers**: Tax-sensitive fixed income product selection
- **Asset managers**: Portfolio optimization under liquidity and convexity constraints
- **Institutional investors**: Structuring and pricing of embedded risk features

Future directions may explore:

- Machine learning models for predicting bond call probabilities
- ESG scoring integration within structured credit pools
- High-performance computing techniques for dynamic interest rate modeling

Why Bonds Matter:

"Stocks excite, commodities intrigue, but bonds *pay*.
The dullest assets are often the wisest."

— *Seth Klarman, Baupost Group*

Acknowledgments and References

Project Team

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