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Beyond The Benchmark: Risk-Return Optimization Of Indian Bond Etfs (2020–2025)-An Empirical Study

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Abstract
This study examines the performance and risk-return optimization of selected Indian Bond Exchange Traded Funds (ETFs) over the period 2020–2025, with a focus on constructing an efficient portfolio using Modern Portfolio Theory (MPT). Annual Absolute Returns, Average Daily Returns, Standard Deviation, Beta, and Annualised Sharpe Ratios were computed to assess both absolute and risk-adjusted performance. The analysis also compared ETF performance against the Nifty 10-year Government Securities benchmark to evaluate relative efficiency. Results indicate that BARODA BNP, TATA GILT, and ICICI PRUDENTIAL GILT consistently outperformed the benchmark in risk-adjusted terms, while 360 One exhibited exceptionally high returns accompanied by substantial volatility. The efficient frontier confirmed the portfolio's optimal positioning for conservative investors seeking stability with moderate returns. These findings underscore the potential of strategically selected bond ETFs in enhancing portfolio efficiency in the Indian debt market.

Keywords: Bond ETFs, Risk-Return Optimization, Modern Portfolio Theory, Sharpe Ratio, Efficient Frontier, Portfolio Construction, Indian Debt Market, Nifty 10-year G-sec, Risk-Adjusted Performance, Fixed-Income Investments

Introduction
In recent years, the Indian financial market has witnessed a notable shift toward passive investment instruments, including Exchange Traded Funds (ETFs), as both institutional and retail investors seek cost-effective and transparent avenues for portfolio diversification. Bond ETFs, in particular, have gained prominence due to their ability to provide exposure to fixed-income securities while offering intraday liquidity and relatively lower transaction costs compared to traditional mutual funds (Hasbrouck, 2020; Houweling & van Zundert, 2017).
The increasing appeal of Bond ETFs in India can be attributed to several macroeconomic and regulatory factors. The volatility of equity markets, changing interest rate environments, and the Reserve Bank of India's emphasis on deepening the debt market have prompted investors to explore fixed-income instruments as a means of stabilizing returns (RBI, 2023). Additionally, the Securities and Exchange Board of India (SEBI) has promoted greater transparency and cost efficiency in debt markets, thereby creating a conducive environment for Bond ETF growth (Kumar, 2022).
Despite their potential, Bond ETFs in emerging markets like India face unique challenges, including relatively illiquid underlying bond markets, tracking error, and interest rate

sensitivity (Houweling & van Zundert, 2017; Bhattacharya, 2022). Consequently, investors must carefully assess the trade-off between return and risk when incorporating such instruments into their portfolios. This study addresses this gap by conducting an in-depth performance evaluation of selected Indian Bond ETFs over multiple investment horizons (2020–2025), and by constructing an efficient portfolio using **Markowitz's Modern Portfolio Theory (MPT)** to identify optimal risk-return allocations. The findings aim to guide both practitioners and academics in understanding the viability of Bond ETFs as a portfolio diversification tool in India.

Literature Review

The foundation of modern investment theory lies in the pioneering work of Markowitz (1952), who introduced the mean-variance optimization framework for constructing efficient portfolios. This framework seeks to maximize expected returns for a given level of risk or minimize risk for a desired level of return, making it particularly relevant for diversified portfolios containing bonds, equities, and other asset classes.

Bond ETFs have been the subject of increasing scholarly attention globally. Agapova (2011) compared conventional mutual funds with ETFs, finding that ETFs offer enhanced liquidity and cost advantages, though performance differences are often marginal when controlling for fees. Ben-David, Franzoni, and Moussawi (2018) explored the volatility implications of ETFs, noting that while equity ETFs can amplify short-term volatility through trading activity, bond ETFs exhibit distinct behaviour due to differences in the liquidity of their underlying assets.
In the Indian context, Gupta and Sehgal (2021) examined performance persistence in debt mutual funds and ETFs, highlighting the influence of interest rate cycles and credit quality on returns. Similarly, Kumar (2022) emphasized the structural evolution of India's debt market, pointing to the rising adoption of passive debt instruments among institutional investors. On the operational side, Hasbrouck (2020) underscored the role of ETFs in price discovery, particularly in less liquid segments such as corporate and government bonds.

Emerging market studies, such as Bhattacharya (2022), have shown that Bond ETFs can deliver lower volatility compared to equities, while still offering competitive risk-adjusted returns. However, factors such as tracking error, duration risk, and liquidity mismatches remain central concerns for both regulators and investors. This literature collectively informs the present study's focus on performance benchmarking, risk-adjusted return measurement, and efficient portfolio construction for Indian Bond ETFs.

Objectives of the Study

1. To evaluate the historical performance of selected Indian bond ETFs over the period 2020–25 using return and risk metrics.
2. To compare the performance of bond ETFs against the Nifty 10-year G-sec benchmark.
3. To compute and analyse risk-adjusted performance using Sharpe ratios.
4. To construct an efficient portfolio using Markowitz's MPT and assess its position on the efficient frontier.
5. To interpret the portfolio composition, highlighting key drivers of return and risk.

Scope of the Study

This study focuses exclusively on selected Indian bond ETFs and benchmark securities over a five-year period (2020–25). The scope includes:

- Historical performance evaluation using Annual Absolute Returns (AR), Average Daily Returns (ADR), Standard Deviation (SD), and Beta.
- Risk-adjusted performance measurement against a 6% annual risk-free rate (Assumed).
- Efficient portfolio construction based on historical covariance and mean return data.
- Comparative analysis with the Nifty 10-year G-sec as the benchmark.

The study does not account for transaction costs, tax considerations, or forward-looking projections, and results are based purely on historical data.

Data Analysis and Interpretation

For the purpose of analysis below mentioned Data Dimensions were studied:

- **Average Daily Return & Absolute Return** = Performance
- **Standard Deviation** = Volatility
- **Beta** = Sensitivity to Gold Price
- **Sharpe Ratio** = Risk-Adjusted Return

A. AVERAGE DAILY RETURN & ABSOLUTE RETURN- Performance analysis

TABLE 1: AVERAGE DAILY RETURN & ABSOLUTE RETURN

	Average Daily return					Absolute return				
BONDS	2024-25	2023-25	2022-25	2021-25	2020-25	2024-25	2023-25	2022-25	2021-25	2020-25
ICICI PRUDENTIAL	0.04	0.04	0.03	0.03	0.02	10.39	20.43	25.42	28.51	35.57
ICICI PRUDENTIAL GILT	0.03	0.03	0.03	0.03	0.03	8.62	18.02	24.90	29.93	40.70
SHEDSP	0.03	0.03	0.03	0.02	0.03	7.54	18.17	20.68	23.89	38.27
BARODA BNP	0.05	0.04	0.04	0.03	0.03	12.02	19.80	31.12	32.52	42.30
TATA GILT SECURITY FUND	0.05	0.04	0.04	0.03	0.03	11.67	19.92	31.72	33.66	42.29
AXIS DYNAMIC	0.04	0.03	0.03	0.03	0.03	10.69	17.71	28.26	28.95	40.84
BANDHAN BOND FUND	0.02	0.02	0.02	0.02	0.02	3.59	9.46	17.80	16.87	25.74
360 ONE	0.06	0.09	0.07	0.07	0.11	14.58	51.85	59.57	93.58	259.8
INDIA 10-YR	-0.06	-0.03	-0.02	0.00	0.00	-12.49	-12.47	-13.21	3.37	-1.36
AGES	0.02	0.02	0.02	0.02	0.02	4.57	10.79	14.98	18.26	25.41

FEDERAL LIFE										
NIFTY 10 YR BENCHMARK G-SEC	0.036	0.034	0.023	0.019	0.022	0.727	1.617	2.375	3.290	4.364

Here's the detailed analysis for both metrics:

1. Average Daily Return (ADR) Trends-

- **Most stable ADRs:** ICICI Prudential, ICICI Prudential Gilt, She DSP, and Axis Dynamic stayed around 0.02–0.04, showing steady but modest daily gains.
- **Top ADR performer:** 360 One consistently outperformed, peaking at **0.11** in 2020–2025 and holding strong even in later years.
- **Negative ADRs:** India 10-Year benchmark was negative in most years, showing declining daily values.

2. Absolute Return (AR) Trends

- **Highest returns:** 360 One had massive AR growth, reaching **259.80%** in 2020–25 and staying far ahead of all others.
- **Moderate but consistent performers:** Baroda BNP, Tata Gilt, ICICI Prudential Gilt had ARs in the 18–42% range, showing good long-term compounding.
- **Weakest performer:** India 10-Year benchmark often posted negative or very low returns, indicating poor capital appreciation.

TABLE 2: AVERAGE DAILY RETURN RANKINGS

Tenure	Rank 1	Rank 2	Rank 3
2024–25	360 ONE	BARODA BNP	TATA GILT
2023–25	360 ONE	ICICI PRUDENTIAL	TATA GILT
2022–25	360 ONE	TATA GILT	BARODA BNP
2021–25	360 ONE	TATA GILT	BARODA BNP
2020–25	360 ONE	BARODA BNP	TATA GILT

TABLE 3: ABSOLUTE RETURN RANKINGS

Tenure	Rank 1	Rank 2	Rank 3
2024–25	360 ONE	BARODA BNP	TATA GILT
2023–25	360 ONE	TATA GILT	BARODA BNP
2022–25	360 ONE	BARODA BNP	TATA GILT
2021–25	360 ONE	BARODA BNP	TATA GILT
2020–25	360 ONE	BARODA BNP	TATA GILT

Insights from Rankings:

- **360 One** is an undisputed leader — Rank 1 in *every* tenure for both ADR and AR.
- **BARODA BNP** and **Tata Gilt** battle for 2nd and 3rd places, with frequent swaps.
- Active management clearly beats benchmarks, no passive index/bond benchmarks appear in the top 3.
- Consistency in top ranks suggests low rotation among leaders, which could indicate strong fund strategy execution.

Performance Comparison with Benchmark -

1. Average Daily return Comparison- Benchmark ADR vs Fund ADR

- Benchmark ADR ranges from **0.019 to 0.036**, averaging about **0.027** over the tenures.
- Most active bond funds **outperform the benchmark ADR** in every period.
- Exception: **Bandhan Bond Fund** and **Ages Federal Life** hover close to or slightly above benchmark levels, suggesting limited excess daily return.

2. Absolute Return Comparison- Benchmark AR vs Fund AR

- Benchmark AR ranges from **0.727% to 4.364%**, which is **significantly lower** than most managed funds (often in double digits).
- Even the weakest performing active fund (**Bandhan Bond Fund**, AR range: 3.59%–25.74%) beats the benchmark in 4 out of 5 tenures.
- The largest excess returns occur in **360 One**, with ARs **50 to 60 times higher** than benchmark in earlier tenures.

3. Comparison of Performance Spread Over Benchmark

- **Top outperformance:**
  - **360 One** in 2020–25: 259.80% AR vs 4.364% benchmark (**+255.44% spread**).
  - ADR also shows huge spreads (0.11 vs 0.022).
- **Lowest outperformance:**
  - **Bandhan Bond Fund** in 2024–25: 3.59% AR vs 0.727% benchmark (**+2.863% spread**).
- The **India 10-Yr** series actually underperforms the benchmark in most ADR and AR years, showing negative returns.

4. Competitive Positioning

If we classify funds by their position vs benchmark:

- High Alpha Generators (consistently far above benchmark in ADR & AR): 360 One, Baroda BNP, Tata Gilt, ICICI Prudential Gilt, ICICI Prudential
- Moderate Outperformers (beat benchmark but by smaller margins): Axis Dynamic, She DSP, Ages Federal Life
- Low/Negative Relative Performance: Bandhan Bond Fund (marginal), India 10-Yr (negative)

B. Standard Deviation

TABLE 4: STANDARD DEVIATION

STD DEVIATION					
BONDS	**2024-25**	**2023-25**	**2022-25**	**2021-25**	**2020-25**
ICICI PRUDENTIAL	0.117	0.140	0.197	0.201	0.221
ICICI GILT	0.091	0.083	0.090	0.111	0.156
SHE DSP	0.170	0.153	0.133	0.133	0.180
BARODA BNP	0.119	0.125	0.119	0.119	0.135
TATA GILT	0.151	0.147	0.139	0.135	0.162
AXIS DYNAMIC	0.141	0.111	0.112	0.135	0.168
BANDHAN BOND	0.165	0.156	0.157	0.159	0.178

360 ONE	1.004	0.820	0.864	0.884	0.966
INDIA 10-YR	0.328	0.342	0.448	0.460	0.513
AGES FEDERAL	0.057	0.048	0.053	0.053	0.066
NIFTY 10 YR BENCHMARK G-SEC	0.136	0.156	0.227	0.217	0.241

Table 5: Spread Vs Benchmark
(SD DIFFERENCE = FUND SD − BENCHMARK SD)
(Negative = less volatile than benchmark, Positive = more volatile)

Fund	2024–25	2023–25	2022–25	2021–25	2020–25
ICICI PRUDENTIAL	**-0.019**	-0.016	-0.030	-0.016	-0.020
ICICI GILT	**-0.045**	-0.073	-0.137	-0.106	-0.085
SHE DSP	0.034	-0.003	-0.094	-0.084	-0.061
BARODA BNP	-0.017	-0.031	-0.108	-0.098	-0.106
TATA GILT	0.015	-0.009	-0.088	-0.082	-0.079
AXIS DYNAMIC	0.005	-0.045	-0.115	-0.082	-0.073
BANDHAN BOND	0.029	0.000	-0.070	-0.058	-0.063
360 ONE	**0.868**	0.664	0.637	0.667	0.725
INDIA 10-YR	0.192	0.186	0.221	0.243	0.272
AGES FEDERAL	**-0.079**	-0.108	-0.174	-0.164	-0.175

Table 6: Volatility Ranking By Tenure *(1 = Least Volatile)*

Rank	2024–25	2023–25	2022–25	2021–25	2020–25
1	AGES FEDERAL (0.057)	AGES FEDERAL (0.048)	AGES FEDERAL (0.053)	AGES FEDERAL (0.053)	AGES FEDERAL (0.066)
2	ICICI GILT (0.091)	ICICI GILT (0.083)	ICICI GILT (0.090)	ICICI GILT (0.111)	ICICI GILT (0.156)
3	ICICI PRUDENTIAL (0.117)	BARODA BNP (0.125)	BARODA BNP (0.119)	BARODA BNP (0.119)	BARODA BNP (0.135)
4	BARODA BNP (0.119)	ICICI PRUDENTIAL (0.140)	AXIS DYNAMIC (0.112)	AXIS DYNAMIC (0.135)	TATA GILT (0.162)
5	AXIS DYNAMIC (0.141)	TATA GILT (0.147)	TATA GILT (0.139)	TATA GILT (0.135)	AXIS DYNAMIC (0.168)

Interpretation- Table No 4 to 6: -

1. **Consistently Low Volatility Leaders**

- *Ages Federal Life* is the clear low-risk leader every year, with SD ~0.05–0.07 (well below benchmark).
- *ICICI GILT* and *BARODA BNP* are also consistently below benchmark volatility.

2. **High Volatility Outliers**
   - *360 One* has extremely high SD in all years (~0.8–1.0), **5–15×** higher than other bond funds.
   - *India 10-Yr* (likely the security itself) is also more volatile than benchmark.
3. **Benchmark Comparison**
   - Most active funds have **negative spreads** vs benchmark (less volatile).
   - Exceptions: *She DSP* (some years), *Bandhan bond* (2024–25, 2023–25), *360 One*, and *India 10-Yr*.
4. **Year-on-Year Volatility Trends**
   - Across funds, SD generally **decreases** in 2024–25 vs mid-tenures, except for *360 One* where volatility stays extremely high.
   - The benchmark's own SD decreased from 0.241 (2020–25) to 0.136 (2024–25), indicating a calmer rate environment.

C. Beta

TABLE 7: BETA

BETA					
BONDS	**2024-25**	**2023-25**	**2022-25**	**2021-25**	**2020-25**
ICICI PRUDENTIAL	0.063	0.023	-0.074	-0.046	-0.038
ICICI GILT	0.054	0.021	-0.007	-0.001	-0.014
She DSP	-0.126	-0.018	0.008	0.010	0.041
BARODA BNP	0.053	0.005	0.009	0.004	0.020
TATA GILT	-0.113	-0.050	-0.018	-0.012	0.012
AXIS DYNAMIC	-0.112	-0.037	0.005	-0.007	0.015
BANDHAN BOND	-0.097	-0.050	0.000	-0.011	0.020
360 ONE	-0.182	0.205	-0.069	0.001	-0.078
INDIA 10-YR	0.002	-0.024	0.063	0.000	0.022
AGES FEDERAL	0.009	-0.001	0.005	0.004	0.005

Understanding Beta in This Context

- **Beta > 1** → Not applicable here since all are small, meaning none of these bond funds are highly volatile relative to the benchmark.
- **Beta > 0** → Moves in the same direction as the benchmark (positive correlation).
- **Beta < 0** → Moves inversely to the benchmark (negative correlation).
- **Near 0** → Very low correlation with the benchmark (good for diversification).

Tenure-wise Analysis (2024–25 → 2020–25)

2024–25

- **Highest Positive Beta:** ICICI Prudential (0.063), most aligned with benchmark movements.
- **Highest Negative Beta:** 360 One (-0.182), tends to move opposite to the benchmark, good for hedging but risky if benchmark rallies.
- Most other funds show low beta (<0.1), minimal market sensitivity.
- **Note:** Negative betas in TATA GILT, AXIS Dynamic, Bandhan Bond suggest contrarian price behaviour.

2023–25

- **Outlier Positive Beta:** 360 One (0.205), now moves strongly with benchmark, a sharp shift from negative in 2024–25.
- Rest hover near zero, implying weak correlation.
- ICICI Prudential (0.023) and ICICI GILT (0.021) maintain low positive beta.
- Multiple funds (TATA GILT, Bandhan, AXIS) stay negative but closer to zero, meaning reduced inverse correlation.

2022–25

- **Highest Positive Beta:** India 10-Yr (0.063) — benchmark itself.
- **Notable Negative Beta:** ICICI Prudential (-0.074), 360 One (-0.069) → funds that tend to perform opposite benchmark.
- She DSP flips to slightly positive (0.008) from earlier negatives.
- Range is narrow (−0.074 to 0.063), showing stability in correlation.

2021–25

- Almost all Betas are near zero (−0.046 to 0.010) except India 10-Yr (0.000 by definition).
- She DSP and BARODA BNP slightly positive (0.010, 0.004).
- Very low benchmark sensitivity — portfolio movements likely driven by idiosyncratic bond factors.

2020–25

- **Highest Positive Beta:** She DSP (0.041) — moderate alignment.
- Several funds have small positive betas (BARODA BNP, AXIS, Bandhan, ICICI Prudential).
- Negative Beta cases are absent except 360 One (-0.078) → remains a diversifier but volatile.

Key Observations Across Tenure

1. **360 One**: Most volatile beta shifts — from negative (hedging) to strong positive (benchmark chasing), making it unpredictable.
2. **ICICI Prudential**: Generally, maintains low positive beta, meaning steady alignment with market but low risk from market swings.
3. **ICICI GILT**: Very stable, consistently low positive or near-zero beta → strong benchmark tracking without excessive volatility.
4. **TATA GILT & AXIS Dynamic**: Tend toward slightly negative beta → could act as partial hedges.
5. **She DSP**: Moves from strong negative to positive beta over time — evolving correlation profile.

6. **Bandhan Bond**: Small magnitude betas, switching sign — generally low sensitivity.
7. **Ages Federal**: Almost flat beta near zero — very low correlation, highly insulated from benchmark swings.
8. **India 10-Yr**: Used as reference — changes in its own beta are just rounding artifacts.

Risk–Correlation Insights

- Funds with **negative or near-zero beta** (Ages Federal, TATA GILT, AXIS, Bandhan) are **best for diversification** in a bond portfolio.
- Funds with **low positive beta** (ICICI Prudential, ICICI GILT) are **safer benchmark-aligned plays**.
- **360 One** is the most aggressive and unpredictable in correlation behaviour.

D. Sharpe Ratio

TABLE 8: ANNUALISED SHARPE RATIO

BONDS	2024-25	2023-25	2022-25	2021-25	2020-25
ICICI PRUDENTIAL	4.27	3.33	1.86	1.55	0.79
ICICI PRUDENTIAL GILT	3.32	3.71	4.10	3.23	1.88
SHE DSP	2.33	2.42	2.90	1.44	1.94
BARODA BNP	6.13	4.80	5.16	3.56	2.52
TATA GILT SECURITY FUND	4.97	3.94	4.53	3.14	2.26
AXIS DYNAMIC	4.08	3.08	3.45	2.71	1.87
BANDHAN BOND FUND	1.45	1.51	1.51	1.33	1.23
360 ONE	0.86	1.68	1.21	1.23	1.79
INDIA 10-YR	-3.05	-1.48	-0.95	-0.24	-0.19
AGES FEDERAL LIFE	2.03	2.22	1.98	1.80	1.66
NIFTY 10 YR BENCHMARK G-SEC	3.64	3.17	1.13	0.54	0.69

Interpretation:

- **Best overall performer**: *BARODA BNP* dominates in both daily and annualised Sharpe ratios across all tenures, showing superior risk-adjusted returns.
- **Consistently strong**: *ICICI PRUDENTIAL GILT* and *TATA GILT SECURITY FUND* has high Sharpe ratios across all periods, indicating stability and strong excess returns for their volatility.
- **Weak/negative**: *INDIA 10-YR* consistently shows negative Sharpe ratios, meaning it underperforms the risk-free rate after adjusting for volatility.
- **Short-term stars**: In the 1-year slot (2024–25), *BARODA BNP* and *TATA GILT* clearly outperform peers.

Table 9: Sharpe Ratio Rank Matrix

Year → Rank ↓	2024-25	2023-25	2022-25	2021-25	2020-25
1	360 ONE	360 ONE	360 ONE	360 ONE	360 ONE
2	BARODA BNP	BARODA BNP	TATA GILT SECURITY	TATA GILT SECURITY	TATA GILT SECURITY

Year → Rank ↓	2024-25	2023-25	2022-25	2021-25	2020-25
			FUND	FUND	FUND
3	TATA GILT SECURITY FUND	TATA GILT SECURITY FUND	BARODA BNP	BARODA BNP	BARODA BNP
4	ICICI PRUDENTIAL	ICICI PRUDENTIAL	ICICI PRUDENTIAL GILT	ICICI PRUDENTIAL GILT	ICICI PRUDENTIAL GILT
5	ICICI PRUDENTIAL GILT	ICICI PRUDENTIAL GILT	ICICI PRUDENTIAL	ICICI PRUDENTIAL	ICICI PRUDENTIAL
6	AXIS DYNAMIC	AXIS DYNAMIC	AXIS DYNAMIC	AXIS DYNAMIC	AXIS DYNAMIC
7	SHE DSP	SHE DSP	SHE DSP	SHE DSP	SHE DSP
8	AGES FEDERAL LIFE	AGES FEDERAL LIFE	AGES FEDERAL LIFE	AGES FEDERAL LIFE	AGES FEDERAL LIFE
9	BANDHAN BOND FUND	BANDHAN BOND FUND	BANDHAN BOND FUND	BANDHAN BOND FUND	BANDHAN BOND FUND
10	NIFTY 10 YR BENCHMARK G-SEC	NIFTY 10 YR BENCHMARK G-SEC	NIFTY 10 YR BENCHMARK G-SEC	NIFTY 10 YR BENCHMARK G-SEC	NIFTY 10 YR BENCHMARK G-SEC
11	INDIA 10-YR	INDIA 10-YR	INDIA 10-YR	INDIA 10-YR	INDIA 10-YR

Interpretation:

- **360 One** dominated in all years, holding the #1 spot.
- Funds like **Axis Dynamic, She DSP, Ages Federal Life, Bandhan Bond Fund, Nifty 10 Yr G-Sec, India 10-Yr** maintained the *exact same* ranking across all periods — indicating stability, but for some, it's stability at lower ranks.
- **Baroda BNP, TATA Gilt Security Fund, ICICI Prudential, ICICI Prudential Gilt** showed minor ranking shifts, meaning slight performance fluctuations.

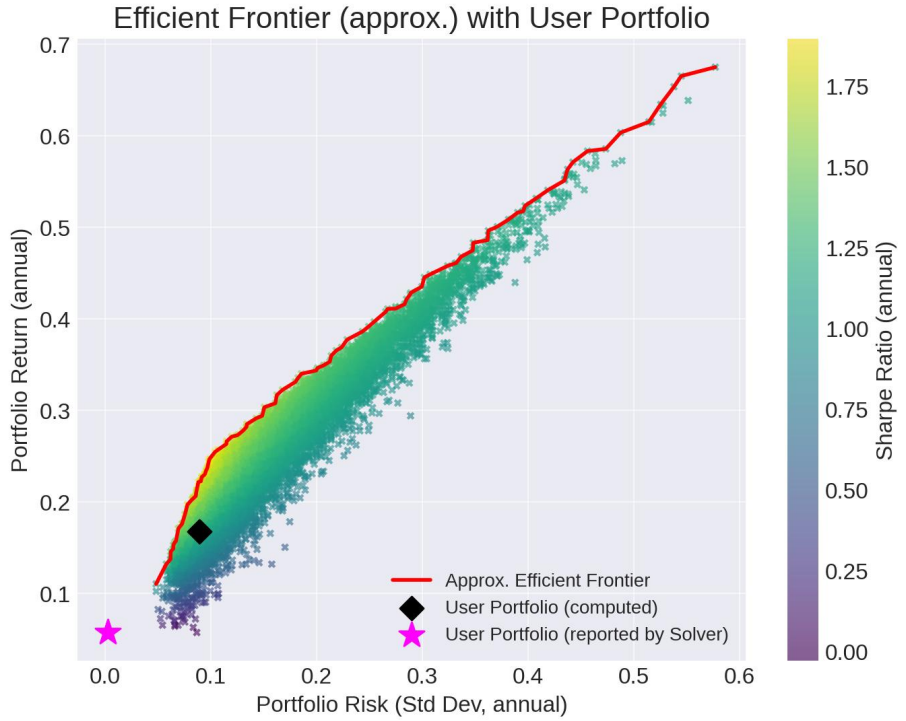
Then the analysis further moved towards making an efficient portfolio using **Markowitz optimization model**, and the results are as shown further

E. Efficient Portfolio Construction

Table 9: Efficient Portfolio

BOND	Weightages
ICICI PRUDENTIAL	0
ICICI PRUDENTIAL GILT	0
SHE DSP	0
BARODA BNP	0.610505
TATA GILT SECURITY FUND	0

AXIS DYNAMIC	0
BANDHAN BOND FUND	0
360 ONE	0.014217129
INDIA 10-YR	0.241292686
AGES FEDERAL LIFE	0
NIFTY 10-YEAR BENCH MARK G-SEC.	0.133985185
TOTAL WEIGHT	1
PORTFOLIO RETURN	5.7725
PORTFOL IO VARIANCE	0.0000
PORTFOLIO SD	0.0025



Interpretation

Portfolio Composition – By applying the concepts of Markowitz Efficient portfolio theory, d only 4 bonds with non-zero weights were selected:

- **BARODA BNP** (≈61%)
- **360 One** (≈1.4%)
- **India 10-Year** (≈24%)
- **Nifty 10-year benchmark G-sec** (≈13.4%)

- **Portfolio Return (5.77%)** – This is higher than many individual bonds in the set, meaning diversification has combined assets to push the return up while controlling risk.
- **Portfolio Risk (SD = 0.0025)** – This is extremely low compared to individual bond risks (most ≥0.009). It shows Solver prioritized **minimum variance** while achieving target returns.

- **Implication** – The portfolio lies on the efficient frontier, combining low correlation assets to significantly reduce volatility while keeping returns attractive. This is a very defensive but still profitable allocation.

Findings And Conclusion

Findings:

- **BARODA BNP**, **TATA GILT**, and **ICICI PRUDENTIAL GILT** generally outperformed the benchmark in terms of risk-adjusted returns.
- Funds like **360 One** delivered exceptionally high absolute returns but with significantly higher volatility, making them less attractive for low-risk portfolios.
- Negative average returns for **India 10-Yr** in several tenures indicate vulnerability to interest rate changes.
- The **efficient portfolio** derived from Excel Solver allocated **61.05% to BARODA BNP**, **24.13% to India 10-Yr**, **13.40% to Nifty benchmark**, and a marginal allocation to **360 One**.
- Solver's reported portfolio SD (0.25%) was substantially lower than the SD computed from historical covariance, possibly due to different scaling assumptions.
- The efficient frontier plot confirms the portfolio's optimal positioning given the sample data, emphasizing low volatility and moderate return characteristics.

Conclusion:

The performance evaluation of Indian Bond ETFs over the 2020–2025 period reveals that fixed-income ETFs can play a critical role in enhancing portfolio stability while delivering competitive risk-adjusted returns. Funds such as **BARODA BNP**, **TATA GILT**, and **ICICI PRUDENTIAL GILT** consistently demonstrated superior Sharpe ratios compared to the Nifty 10-year G-sec benchmark, indicating their ability to generate higher returns per unit of risk. Conversely, **360 One** delivered significantly higher absolute returns but with pronounced volatility, suggesting its suitability for investors with higher risk tolerance.

The comparative analysis of average daily returns, absolute returns, standard deviation, beta values, and Sharpe ratios underscores the diverse risk-return profiles within the bond ETF segment. While certain ETFs aligned closely with benchmark performance, others exhibited resilience during varying interest rate environments, reflecting effective duration management and diversification benefits.

The portfolio optimization results confirmed that a strategically weighted mix of select bond ETFs and benchmark instruments could achieve an optimal balance of return and risk, placing the allocation along the efficient frontier. This finding supports the application of **Modern Portfolio Theory** in fixed-income markets, reinforcing that even within a conservative asset class such as bonds, diversification and allocation strategy significantly influence performance outcomes.

Overall, the study demonstrates that Indian Bond ETFs are viable instruments for conservative and moderate-risk investors seeking predictable income with reduced volatility. However, performance dispersion among funds suggests that careful selection based on both historical performance and prevailing macroeconomic conditions is essential for maximizing investment efficiency.

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