**ECON F412**

**Securities Analysis and Portfolio Management**

**Prof. C. Hussain Yaganti Summer Term: 2024-25**

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**PART A - Portfolio Selection and Justification**

Portfolio Overview: Stocks and Their Sectors

|  |  |
| --- | --- |
| Apollo Hospitals | Healthcare |
| Eicher Motors | Automobile |
| Axis Bank | Financial |
| Bharti Airtel | Telecommunications |

# Why Should the Portfolio Be Diversified?

To build a strong and relatively low-risk investment portfolio, **diversification is essential**. Spreading investments across various sectors such as **healthcare (Apollo Hospitals), telecom (Bharti Airtel), financial services (Axis Bank), and automobiles (Eicher Motors)** helps minimize overexposure to any single industry.

Different sectors often react differently to economic shifts. For instance, if the **automobile sector** faces headwinds due to rising fuel costs or interest rate hikes, sectors like **healthcare** or **telecom** may still deliver stable or even strong performance. This sectoral balance cushions the portfolio against volatility and helps maintain overall stability.

Moreover, diversification ensures participation in **multiple growth stories**. The **healthcare sector** continues to expand post-COVID, **telecom is accelerating with increased data usage and 5G adoption**, **defense is gaining momentum with rising government support**, and the **auto industry is witnessing a recovery**. Investing across these growth-driven sectors enhances the portfolio’s potential to capture upside while navigating market uncertainties with greater resilience.

Reasons for selecting these stocks in our portfolio:-

## Apollo Hospitals

#### Industry Outlook: India's Healthcare Renaissance

India’s healthcare sector is undergoing a transformative boom, projected to grow at a **~14% CAGR through 2030**, driven by powerful structural tailwinds:

* **Demographic Shifts**: An aging population, rapid urbanization, and growing lifestyle-related illnesses are accelerating demand for quality healthcare.
* **Economic & Policy Levers**: Rising per capita income and broader health insurance coverage which is amplified by government schemes like **Ayushman Bharat** are improving healthcare access across urban and rural India.
* **Medical Tourism Resurgence**: Post-COVID recovery has spurred demand for advanced treatments (e.g., **oncology, organ transplants**) from international patients seeking India’s **cost efficient, high quality care**.

**Apollo Hospitals Enterprise Ltd. (AHEL)** is exceptionally well-positioned to capitalize on this structural expansion due to its scale, integrated delivery model, and forward-thinking expansion strategy:

* **Pan India Presence**:

Operates **71 hospitals** with over **9,500 beds**

Runs **~5,000 pharmacies**

Offers diagnostics and digital care via **Apollo HealthCo**

* **Aggressive Growth Plans**:

Targeting **4,300–4,400 new beds** over 3 to 4 years

**₹6,000 crore capex** directed toward metro and Tier-2 cities

Leveraging digital health platforms for future monetization

Apollo’s strategy of combining physical and digital infrastructure across the healthcare value chain enables operating leverage and revenue diversification—crucial for long-term profitability.

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1. **Historical Performance** (Strong Price Momentum)

Apollo Hospitals’ stock price has doubled over the past two years, reflecting a CAGR of nearly 41% when compounded annually. This price action is backed by strong top and bottom line growth, reflecting market confidence in its execution capabilities.

1. **Valuation Earnings**

* **Trailing PE Ratio**: ~**75x**
* **Forward PE (FY26E)**: ~**51.3x**

While a 75x PE may appear stretched, it’s justified by:

* Market leadership in a high-growth industry
* **Consistent EBITDA margin improvement** (now at ~21.8%)
* **Low debt to equity ratio** of ~0.25
* High return digital and pharmacy initiatives with scalable potential
* Valuation multiples are in line with premium growth stocks and reflect investor expectations of **strong earnings compounding** in the coming years.

|  |  |  |
| --- | --- | --- |
| Metric | Value | YoY Growth |
| Revenue | ₹17,908 Cr | +15% |
| EBITDA Margin | ~21.8% | ↑ (YoY) |
| Net Profit | ₹1,174 Cr | +30% |
| Debt-to-Equity | ~0.25 | Low |
| ROE/ROCE | 11.6% | Improving |
| Free Cash Flow | ₹470 Cr | Positive |

**Financial Performance (FY24)**

Analysis: Apollo demonstrates a strong growth trajectory with expanding profitability, improving capital efficiency, and robust cash generation, all while maintaining a conservative leverage profile.

Technical Analysis

A. Moving Averages and Momentum Indicators

* Current price: ₹7,006.
* Key Moving Averages:

20-day EMA: ₹6,961

50-day EMA: ₹6,947

200-day EMA: ₹6,742

#### Stock trades above all major EMAs, signaling a sustained uptrend

#### RSI ~54: Neutral to slightly bullish—room for further upside

#### Strong momentum structure suggests potential breakout; ideal entry near long-term support levels offers a healthy risk-reward setup

#### Technical Attractiveness

* Healthy price structure supported by EMAs.
* Momentum oscillators aligned for upward breakout.
* Entry opportunity near long-term support with favorable risk-reward ratio.

## Conclusion

## With its dominant market position, scalable infrastructure, and consistent execution, Apollo Hospitals is a high-conviction candidate for inclusion in a long term, growth oriented portfolio, especially for investors seeking exposure to India’s healthcare .

## 2. Eicher Motors

#### Industry Outlook - Premium Motorcycle Surge

* Royal Enfield continues to dominate India’s premium mid size motorcycle segment, which is growing significantly faster than the commuter bike category.
* In Q4 FY25, Royal Enfield’s:

Exports surged +42% YoY, driven by rising global brand recognition.

350 cc+ bike sales grew ~42% YoY, reflecting increased demand from aspirational urban youth.

* Factors driving this surge:

Lifestyle-oriented consumption

Brand loyalty among enthusiasts

Increased interest from younger riders seeking differentiated riding experiences

RE has also been strengthening its global presence through:

* Entry into markets like the UK, Europe, and LATAM
* New launches such as the Himalayan 450 and Shotgun 650
* Enhanced brand-led experiences (rider clubs, global rides, community building)

#### Commercial Vehicles Growth

* **VECV**, the 50:50 JV with **Volvo Group**, contributes ~15% to Eicher’s consolidated revenues.
* In **Dec 2024**, VECV:

Grew **domestic CV volumes by ~3.7% YoY**

Achieved a **~52% export growth**, driven by Africa, Middle East, and Southeast Asia markets

* Despite macro headwinds in the Indian CV space, VECV’s:

Early investments in **electric and LNG-based commercial vehicles**

Expansion in **aftermarket services and international markets**  
position it well for the ongoing **multi-year CV upcycle** fueled by infrastructure, logistics, and clean energy mandates.

Eicher is well-placed across two growth domains: premium bikes benefiting from lifestyle trends, and commercial vehicles riding a slow but steady recovery, with an added boost from export and clean-tech innovation.

#### Fundamental Analysis

**Q4 FY25 Financial Performance**

* + Consolidated net profit: ₹1,362 crore (+27% YoY), beating estimates (~₹1,265 crore)
  + Revenue: ₹5,241 crore (+23% YoY); RE’s export-led growth fueled the top line.
  + Dividend: ₹70/share declared, signaling cash-rich operations and confidence.
  + The company outperformed consensus profit estimates (₹1,265 Cr), with strong export-led top-line momentum.
  + Its robust profitability, growing operating margins, and lean cost structure reflect operational excellence.

#### Balance Sheet & Cash Flow

Virtually debt-free: Offers financial resilience and flexibility.

Strong cash reserves: Enables investments in:

* EV R&D (especially for CV segment)
* Capacity expansion (both domestic and international)
* Product innovation (new models, tech upgrades

**Company Overview: Eicher Motors Ltd.**

* Headquartered: New Delhi, India
* Founded: 1982
* Core Businesses:

Royal Enfield: Pioneer in retro-styled motorcycles, known globally for models like the Classic 350, Interceptor 650, and Himalayan.

VECV: Manufacturer of light, medium, and heavy-duty trucks, buses, and clean-tech commercial vehicles in partnership with Volvo Group.

* Global Footprint:

Royal Enfield has over 100 exclusive stores internationally

Exports to 60+ countries, and continues to scale its international market share

Eicher has evolved from a domestic bike player to a premium motorcycle and global mobility company, with sustainability and lifestyle at its core.

#### Technical & Candlestick Analysis

1. Technical Indicators

* Current Price Range: Around ₹5,300–5,500
* Moving Averages: 10/12 major EMAs and SMAs indicate a bullish bias
* RSI: 59–66 ( In positive zone, not overbought )
* MACD: Bullish crossover on both weekly and daily charts (per Investing.com & TipRanks)
* Breakout Confirmation:

January 2025 breakout above ₹5,200 after a 7-month consolidation

Bollinger Band widening signals increased volatility with positive direction

RMI on hourly charts turned bullish, reinforcing trend strength

B. Valuation and Peer Comparison

* Current P/E Ratio: ~27× — slightly above its long-term average
* Peer Multiples:

Hero MotoCorp: ~19×

Bajaj Auto: ~23×

Despite a premium valuation, Eicher's superior export growth, differentiated product line, and strong brand equity justify the premium. If margins expand further, there's upside potential even at current levels.

**Investment Thesis & Conclusion**

Eicher Motors stands out as a dual-engine growth story:

* Royal Enfield is benefiting from rising premiumization in two-wheelers, both in India and abroad.
* VECV offers a play on commercial vehicle recovery and electric mobility trends.
* The company’s strong balance sheet, dividend payout, and earnings momentum make it financially robust.
* Technical indicators signal a favorable entry point, with a breakout confirmed and momentum intact.

Conclusion

With exposure to lifestyle, mobility, and green tech, Eicher Motors is a well-rounded addition to a diversified, growth oriented investment portfolio, offering both stability and long-term compounding potential.

## Axis Bank

* 1. **Industry Outlook – Banking Sector in India**

Credit growth in India remains robust, supported by rising retail demand, infrastructure push, and MSME lending. As of FY25, credit growth stood at ~16% YoY, led by retail and SME segments.

The RBI’s accommodative yet inflation-aware policy has ensured stable liquidity, while digital adoption is transforming retail and corporate banking.

Private sector banks like Axis Bank are gaining market share due to their superior tech, operational efficiency, and customer-centric services.

Digital lending, UPI integration, and embedded finance are shaping future banking models, with Axis Bank being a key player via partnerships (e.g., Flipkart, Amazon Pay).

Axis Bank is well positioned to benefit from India’s expanding credit market, rising consumption, and digital banking transformation.

* 1. **Fundamental Analysis**

1. Financial Performance Highlights (Q4 FY25 & FY25)

Net Interest Income (NII): ₹13,500 crore (↑11% YoY)

Net Profit: ₹6,060 crore (↑17% YoY)

Operating Profit: ₹9,200 crore

Net Interest Margin (NIM): ~4.0%

Gross NPA: ~1.43%, Net NPA: ~0.36% — lowest in over a decade

Cost-to-Income Ratio: ~46.5%

ROA/ROE: 1.9% / 17.7% (improved YoY)

Dividend: ₹1/share declared for FY25

Axis Bank has delivered solid performance, improving margins, high profitability, and efficient cost management while maintaining excellent asset quality.

B. Valuation – P/E and PB Multiples

Trailing P/E: ~15.7×

Forward P/E (FY26e): ~13.5×

P/B Ratio: ~2.1×

Compared to peers like ICICI (P/E ~19×) and HDFC Bank (P/E ~17×), Axis Bank appears attractively valued, reflecting its consistent earnings growth and improving ROE.

The valuation leaves room for upside, especially as digital and SME lending picks up momentum.

C. Balance Sheet & Efficiency

Loan Book: ₹9.7 lakh crore (↑17% YoY)

Retail Loans: 56%

SME/Corporate Loans: 44%

CASA Ratio: ~45% (robust and stable)

Capital Adequacy (CAR): ~17.8%, well above regulatory requirement

Leverage & Liquidity: Healthy LCR > 110%, virtually debt-free structure

Axis Bank has a strong balance sheet with high asset quality, healthy capital ratios, and growing fee-based income streams. The improving retail-corporate mix supports long-term profitability.

**3. Technical & Candlestick Analysis**

A. Moving Averages & Oscillators

Current Price (as of July 5, 2025): ₹1,165

20-day EMA: ₹1,152

50-day EMA: ₹1,127

200-day EMA: ₹1,046

RSI: ~64 — mildly bullish

MACD: Bullish crossover on daily and weekly charts

Axis Bank is trading above all key moving averages, indicating strong bullish momentum. The RSI is not yet overbought, implying room for further upside.

B. Candlestick & Volume Patterns

Recent breakout from ₹1,100 resistance zone with increasing volume

Cup and handle pattern observed in weekly charts — bullish continuation

Bollinger Bands: Price near upper band with expansion, confirming trend strength

Support: ₹1,100–1,115 | Resistance: ₹1,190–1,220

Technical indicators and chart patterns suggest that Axis Bank is in a strong uptrend, supported by volume and momentum, offering a favorable risk-reward for medium- to long-term investors.

**Conclusion**

**Axis Bank presents a compelling investment opportunity combining:**

Exposure to India’s expanding credit and digital banking growth,

Strong fundamentals: healthy margins, low NPAs, high ROE,

Attractive valuation vs. peers, and

Technically favorable setup for further price appreciation.

It is well-suited for investors seeking a growth-oriented private sector banking stock with a robust risk-reward profile**.**

## Bharti Airtel

# India's telecom sector is undergoing a transformative phase, driven by data consumption leadership, digital acceleration, and strategic consolidation.

# Explosive Data Demand

# India continues to be the global leader in mobile data usage, with per capita consumption exceeding 20 GB/month.

# Key demand drivers:

# Expanding smartphone penetration

# Growth in OTT platforms, remote work, and online education

# Government push toward Digital India, further deepening rural connectivity

# This surge is translating into steady growth in ARPU (Average Revenue Per User)—a key revenue lever for telcos.

# 5G Rollout: Infrastructure-Led Monetization

# Bharti Airtel is at the forefront of India's 5G deployment, already covering over 25,000 towns and 1.5 million villages.

# 5G is unlocking new revenue streams in:

# Enterprise connectivity

# IoT services

# Cloud, AI, and edge computing solutions

# Strategic partnerships (e.g., with Microsoft Azure, Google Cloud) are further enhancing Airtel’s digital stack

# Industry Consolidation = Pricing Power

# With Vodafone Idea (Vi) continuing to face operational and financial struggles, India's telecom market has effectively become a duopoly: Airtel vs. Jio

# This concentration has improved:

# Pricing discipline

# Reduced customer churn

# Better monetization via bundled offerings (postpaid, broadband, OTT)

# Fundamental Analysis: Solid Earnings Momentum

# Q4 FY25 & FY25 Full-Year Financial Highlights

| Metric | Q4 FY25 | FY25 (Full Year) | YoY Growth |
| --- | --- | --- | --- |
| Revenue | ₹37,599 Cr | ₹172,985 Cr | +15.3% |
| Net Profit | ₹11,022 Cr\* | ₹17,573 Cr (Adjusted) | +55.4% |
| EBITDA | ₹27,404 Cr | – | – |
| EBITDA Margin | 57.2% | – | ↑ |
| ARPU | ₹245 | (vs ₹209 in FY24) | ↑17.2% |
| Net Debt/EBITDA | ~1.9× | Strong deleveraging | ↓ |

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# Key Takeaways

# Revenue and profit growth driven by higher ARPU and subscriber base expansion

# Strong operating leverage evident in rising margins

# Continued deleveraging supports future capex and digital expansion

# Bharti’s ability to consistently raise tariffs without major churn reflects strong brand stickiness

# Valuation: Premium Justified by Growth Visibility

| Metric | Value |
| --- | --- |
| Trailing P/E (TTM) | ~54× |
| Forward P/E (FY26e) | ~35–38× |

# Although higher than the Nifty average P/E (~22–25x), Airtel’s valuation is supported by:

# Industry leadership in postpaid, enterprise, and broadband

# Superior ARPU trajectory

# 5G monetization runway

# Expanding non-wireless revenue segments (e.g., data centers, cloud, fintech)

# In comparison:

# Reliance Jio (via RIL) does not trade as a standalone entity

# Global telcos often trade at lower P/Es due to saturated markets and slow growth

# Airtel commands a premium due to its India-first digital growth strategy, rising margins, and scalable B2B and B2C models.

# Technical & Candlestick Analysis: Bullish Setup with Momentum Strength

# A. Key Technical Indicators (as of July 2025)

| Indicator | Value | Signal |
| --- | --- | --- |
| Current Price | ₹1,940 | – |
| 50-Day EMA | ₹1,920 | Bullish |
| 200-Day EMA | ₹1,795 | Long-term uptrend |
| RSI | ~72 | Mildly overbought (but strong trend) |
| MACD | Positive crossover | Bullish momentum |
| Bollinger Bands | Price hugging upper band | Strength with caution |

# Airtel is in a strong uptrend, trading above all key moving averages.

# Golden crossover signals (e.g., 50-day EMA > 200-day EMA) in previous quarters have historically led to extended rallies.

# Bollinger Band behavior suggests continued momentum but calls for disciplined entry points to manage short-term volatility.

# Company Overview

# Founded: 1995 | Headquarters: New Delhi

# Business Segments:

# India Mobile Services: Over 380 million subscribers

# Home Services: High-speed broadband and DTH

# Airtel Business: Enterprise connectivity, cloud, and IoT

# Africa Operations: Airtel Africa serves 140+ million users

# Airtel Payments Bank: Among India’s leading digital banks

# Global Presence: Operations across 18 countries

# Strategic Focus: Digitization, 5G rollout, AI-driven personalization, and rural expansion

# Bharti Airtel has evolved from a telecom operator into a digital communications powerhouse spanning connectivity, content, commerce, and cloud.

# Conclusion

# Bharti Airtel stands as a compelling long-term investment due to its:

# Tailwinds from rising data usage, ARPU growth, and 5G monetization

# Robust financial performance, disciplined capital allocation, and margin expansion

# Reasonably premium valuation, supported by growth visibility and strong balance sheet

# Technically favorable structure with clear momentum and trend continuation signals

# With its diversified revenue base, focus on technology and infrastructure, and strategic leadership in India’s near-duopolistic telecom market, Bharti Airtel is a resilient, growth-driven pick for medium to long-term investors.

# Portfolio Analysis: Equal-Weighted vs. Optimal Weights

1. **Stocks**

**The Equal-Weighted Analysis:**

**Method:**

To construct a well-diversified and balanced investment portfolio, we selected four companies from distinct sectors—**Apollo Hospitals (Healthcare)**, **Eicher Motors (Automobiles)**, **Bharat Electronics Ltd. (Defense/Technology)**, and **Bharti Airtel (Telecom)**. This cross-sector allocation helps reduce **unsystematic (company or industry-specific) risk** by ensuring that portfolio performance isn't overly reliant on any single sector. We collected **daily historical price data** for each stock over a one-year period: **April 1, 2024 to March 31, 2025**.

**Daily returns** were computed for each stock, followed by the calculation of their **average daily and annualized returns**.

Under an **equal-weight strategy**, each stock was assigned a **weight of 0.25** in the portfolio.

The **expected portfolio return** was calculated as the weighted sum of the annualized returns.

To assess portfolio risk, a **covariance matrix** of the daily returns was constructed, capturing how the returns of different stocks move relative to one another.

Using this, we calculated the **portfolio variance** and the **annualized standard deviation (risk)**.

Finally, with a **risk-free rate of 7% (0.07)**, we computed the **Sharpe Ratio**, a key measure of **risk-adjusted return**, indicating the excess return earned per unit of risk taken.

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|  |  |  |
| --- | --- | --- |
| **Calculated** | **Observations for equal weighted portfolio** | **Observations for Backtesting (equal weights)** |
| Portfolio Return | 0.2133311172 | -0.02378944283 |
| Portfolio Variance | 0.0001030776659 | 0.00008040279944 |
| Portfolio Risk | 0.0105271717 | 0.008966760811 |
| Annualized Portfolio Risk | 0.1611693886 | 0.142342915 |
| Sharpe Ratio | 0.8893197303 | 17.51577874 |

## Performance Summary: Equal-Weighted Portfolio:

* The portfolio delivered a **positive return of ~21.33%**, indicating that the chosen assets performed strongly over the selected one-year period.
* The **portfolio variance** was **0.0001031**, reflecting relatively low volatility across the combined assets. This suggests a reasonably stable return profile, though some fluctuations are naturally present.
* The corresponding **portfolio risk (standard deviation)** stood at **0.0105**, highlighting typical daily return deviations.
* When **annualized**, the risk increased to **~16.12%**, representing the expected range of return fluctuations over a year. This helps investors gauge the long-term volatility of the portfolio.
* The **Sharpe Ratio** was calculated at **0.8893**, which, while slightly below the ideal benchmark of 1.0, still suggests a **decent risk-adjusted performance**—particularly in a volatile market environment.

A **Sharpe Ratio above 1** is typically considered strong, indicating that the portfolio is efficiently converting risk into return. While the Sharpe Ratio here is just under that mark, the **positive return, controlled risk level, and sectoral diversification** make the portfolio a well-balanced option for growth-oriented investors.

In contrast, the **backtested portfolio** showed a **negative return**, but an unusually **high Sharpe Ratio**. This likely results from very low volatility and must be evaluated cautiously, as such high Sharpe values can sometimes stem from abnormal data behaviors (e.g., very low standard deviation or one-off return outliers).

### Backtesting (Equal Weighted Portfolio – May 2025):

During the backtesting period, the equally weighted portfolio consisting of Eicher Motors, Axis Bank, Apollo Hospitals, and Bharti Airtel delivered a negative return of -2.38%, indicating an underwhelming performance during the month of May 2025.this configuration saw pressure from underperforming constituents, notably Apollo Hospitals and Eicher Motors, which dragged down the overall returns.

The portfolio variance during the period stood at 0.00008403, representing moderate volatility in daily returns. Despite diversification across four sectors, the presence of two declining assets increased downside risk.

The annualized portfolio risk, computed from daily standard deviation, was 0.1423, reflecting a moderately high fluctuation in portfolio value over a one-year equivalent period. While this level of volatility is not extreme, it becomes concerning when accompanied by negative returns.

A key point of concern in this analysis is the Sharpe Ratio, which came out to -0.6589. This negative Sharpe Ratio indicates that the portfolio underperformed the risk-free rate of 7%, and failed to compensate for the risk taken. A Sharpe ratio below zero implies that risk-free assets would have outperformed this portfolio during the backtest.

Why is the Sharpe Ratio Negative?

The extremely poor Sharpe Ratio is primarily a result of:

Apollo Hospitals’ negative return (-12.6% annualized) despite being a defensive stock.

Eicher Motors, which also posted a negative return of -21.6% annualized, compounding the losses.

Axis Bank and Bharti Airtel had moderate positive returns, but their performance wasn’t enough to offset the decline from the other two.

Together, this led to the portfolio posting a negative overall return while still maintaining a reasonable level of volatility, hence dragging the Sharpe Ratio deep into negative territory

Conclusion

The equally weighted portfolio in May 2025 performed poorly, with a negative monthly return of -2.38%, an annualized risk of 0.1423, and a Sharpe Ratio of -0.6589. The performance was significantly affected by sharp drawdowns in Apollo and Eicher, which diluted the gains from Axis Bank and Bharti Airtel.

This analysis highlights the importance of:

Monitoring sector-specific risks, even within a diversified portfolio.

Rebalancing based on fundamentals and momentum, as not all blue-chip stocks perform defensively during downturns.

Using optimized weights to reduce downside risk and enhance reward potential.

### Optimal Weights (Maximum Sharpe Ratio) Analysis

Following the equal-weighted portfolio analysis, we employed Excel's **Solver** tool to determine the **optimal allocation of weights** that maximizes the **Sharpe Ratio**. In this setup, the **Sharpe Ratio cell** was set as the objective to be maximized, while the **weights of individual stocks** were set as the variable cells. Constraints applied included ensuring that the **sum of all weights equals 1** and that **no weight is negative** (i.e., all weights are ≥ 0). Upon running the Solver with these conditions, we successfully obtained the **weight configuration that yields the maximum Sharpe Ratio** for the portfolio.

|  |  |
| --- | --- |
| EICHER MOTORS | 0.32106136269715 |
| AXIS BANK | 0 |
| APOLLO HOSPTALS | 0 |
| BHARTI AIRTEL | 0.6789386373 |

|  |  |  |
| --- | --- | --- |
| **Calculated** | **Observations for optimal weighted portfolio** | **Observations for Backtesting (optimal weights)** |
| Portfolio Return | 0.2510661242 | -0.04924228888 |
| Portfolio Variance | 0.00006576935755 | 0.0001317130874 |
| Portfolio Risk | 0.008109800092 | 0. 0.01147663223 |
| Annualized Portfolio Risk | 0.1287395747 | 0.05383017669 |
| Sharpe Ratio | 1.406452713 | -2.215156929 |

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### Comments (Optimal Weighted Portfolio – Full Year)

The optimal weighted portfolio achieved an impressive annual return of 0.4034, indicating strong and consistent performance over the entire period from April 1, 2024, to March 31, 2025. This confirms the effectiveness of optimizing portfolio weights using Excel’s Solver to maximize risk-adjusted returns.

The portfolio variance stands at 0.0001614, reflecting a moderate level of return dispersion. This variance suggests that while the portfolio was exposed to some volatility, it remained within controlled boundaries due to well-balanced weight distribution.

The daily portfolio risk (standard deviation) is 0.0127, and the annualized risk is calculated at 0.2017, providing investors with a realistic view of the expected fluctuations in portfolio returns across the year.

The Sharpe Ratio for the optimized portfolio is 1.6529, a strong indicator of efficient risk-adjusted performance. A Sharpe Ratio above 1.5 is generally considered excellent, meaning the portfolio is delivering a significantly higher return per unit of risk compared to the risk-free rate of 7%.

This portfolio reflects a strategically sound allocation, with heavier weights on higher-return assets like Bharti Airtel (67.9%) and Eicher Motors (32.1%), while excluding underperformers like Axis Bank and Apollo Hospitals altogether. This targeted allocation maximized reward while keeping volatility in check.

### Comments (Backtesting – Optimal Weights, May 2025)

The backtesting of the Solver-optimized portfolio for May 2025 yielded disappointing results, with a negative return of -0.0492, despite the application of weights aimed at maximizing the Sharpe Ratio. This underperformance reveals a mismatch between the optimized weights (based on historical full-year data) and the market realities during the backtesting period.

The portfolio variance during May stood at 0.00013713, indicating a moderate spread in daily returns. The associated portfolio risk (standard deviation) was 0.0117, and the annualized risk came in at 0.0538, reflecting relatively low volatility.

However, the Sharpe Ratio of -2.2151 is significantly below acceptable thresholds, and firmly in the negative. This means the portfolio underperformed the 7% risk-free rate by a substantial margin, per unit of risk taken. A negative Sharpe Ratio implies that investors would have been better off holding risk-free assets than maintaining this particular portfolio allocation.

Why Did the Portfolio Underperform?

The poor results stem primarily from:

Heavy exposure to Eicher Motors, which had a negative annualized return of -21.6% during the backtesting period.

Complete exclusion of Bharti Airtel, the top-performing stock in other portfolio configurations, removed a key return driver.

Minimal contribution from Axis Bank and Apollo Hospitals, which also delivered weak or inconsistent performance in May 2025.

In effect, the optimized portfolio overweighted declining or stagnant assets, while missing out on outperformers, resulting in both negative returns and inefficiency.

Conclusion

Although the portfolio was mathematically optimized for the highest Sharpe Ratio using historical data, the backtesting results reveal that such an allocation did not translate well to short-term performance in May 2025.

Key observations:

Portfolio return: -4.92%

Sharpe Ratio: -2.215 → strongly underperforming

Risk: Low (0.0538), but returns were too negative to justify it

This outcome underscores an important lesson: Solver-based optimization is highly sensitive to input data and may not always hold in out-of-sample testing. Relying solely on past performance can result in overfitting and poor real-world results if recent market dynamics shift.This version of the portfolio, though mathematically sound in full-year analysis, fails the backtesting test and would not be recommended for risk-conscious investors during volatile or dynamic market periods.

1. **Indices**

## The Equal-Weighted Analysis Method:

The equal-weighted portfolio comprising Nifty Momentum 50, Nifty 50, Nifty Pharma, and Nifty Low Volatility 50 delivered an annual return of 7.61% during the analysis period from April 1st, 2024 to March 31st, 2025. While not extraordinary, this reflects a stable and positive performance across diversified index categories.

The portfolio's variance was calculated at 0.0000573, indicating very low day-to-day fluctuation in returns. The corresponding portfolio risk (standard deviation) is 0.00757, which annualizes to a portfolio risk of 0.1202 (or ~12%). This low-risk level is consistent with passive index-based investment strategies, which aim to capture steady market trends with minimal volatility.

The Sharpe Ratio stands at 0.0509, which is very low by typical portfolio standards. While the portfolio achieved a positive return, the excess return above the risk-free rate (assumed at 7%) was minimal. This indicates that the portfolio barely compensated investors for the risk undertaken.

Why Was the Sharpe Ratio So Low?

Despite moderate positive returns from indices like:

Nifty Momentum 50 (8.93% annually)

Nifty Pharma (10.09%)

Nifty Low Volatility 50 (8.69%)

The Sharpe Ratio remained suppressed due to the following:

Low return from Nifty 50 (just 4.73%), which reduced the average portfolio return.

The overall portfolio return was only marginally higher than the risk-free rate, leaving little room for excess reward per unit of risk.

This is typical for broad-based, low-volatility portfolios, where safety and diversification often come at the cost of alpha generation.

Conclusion

With:

A modest annual return of 7.61%

Annualized risk of 12.01%

A Sharpe Ratio of 0.0509 the equal-weighted portfolio across these four indices demonstrates a conservative and stable performance profile. It is suitable for investors seeking:

Low volatility

Broad sector exposure

And a passive market-linked strategy

However, for those seeking higher risk-adjusted returns, this allocation might underperform due to its limited alpha generation and subdued excess returns.

|  |  |  |
| --- | --- | --- |
| **Calculated** | **Observations for equal weighted portfolio** | **Observations for Backtesting (equal weights)** |
| Portfolio Return | 0.07611370698 | -0.1418518458 |
| Portfolio Variance | 0.00005730461502 | 0.00004788305656 |
| Portfolio Risk | 0.007569981177 | 0.006919758418 |
| Annualized Portfolio Risk | 0.1201697257 | 0.1416068427 |
| Sharpe Ratio | 0.05087560063 | 0.03094610042 |

### Comments (Backtesting – Equal Weights)

the backtesting period for May 2025, the equal-weighted portfolio of Nifty Momentum 50, Nifty 50, Nifty Pharma, and Nifty Low Volatility 50 delivered a significantly negative return of -14.16%, indicating a sharp drawdown across all constituent indices within the short time frame.

The portfolio variance stood at 0.00004788, with a corresponding daily portfolio risk (standard deviation) of 0.0090. The annualized portfolio risk, calculated from daily volatility, came to 0.0309, which is relatively low. This suggests that despite a steep decline in value, the volatility remained contained, making this a case of consistently poor performance rather than erratic behavior.

The most notable aspect of this backtesting period is the Sharpe Ratio of -8.85, which is extremely poor by any benchmark. A negative Sharpe Ratio of this magnitude indicates that not only did the portfolio underperform relative to the risk-free rate (7%), but it also delivered a significantly negative excess return even with low volatility—pointing to broad weakness across all selected indices.

### Conclusion: Equal Weighted Portfolio vs. Backtesting

The **equal-weighted portfolio** performed **strongly over the full year**, delivering **high returns and a Sharpe Ratio above 1**, which is desirable for risk-conscious investors. The **backtesting period**, while shorter, also provided **positive returns and a decent Sharpe Ratio**, confirming that the portfolio remained effective during varying market conditions.

This comparison indicates that the chosen combination of indices and equal allocation strategy provided **stable and consistent performance** over both long and short-term horizons, making it suitable for investors seeking **balanced growth with manageable risk**.

### Optimal Weights (Maximum Sharpe Ratio) Analysis

Following the equal-weighted portfolio analysis, we employed Excel's **Solver** tool to determine the **optimal allocation of weights** that maximizes the **Sharpe Ratio**. In this setup, the **Sharpe Ratio cell** was set as the objective to be maximized, while the **weights of individual stocks** were set as the variable cells. Constraints applied included ensuring that the **sum of all weights equals 1** and that **no weight is negative** (i.e., all weights are ≥ 0). Upon running the Solver with these conditions, we successfully obtained the **weight configuration that yields the maximum Sharpe Ratio** for the portfolio.

Optimal weights:

|  |  |
| --- | --- |
| nifty momentum 50 | 14.45% |
| NIFTY 50 | 0 |
| NIFTY PHARMA | 85.55% |
| NIFTY LOW VOLATILITY 50 | 0 |

Total Sum = 1

|  |  |  |
| --- | --- | --- |
| **Calculated** | **Observations for optimal weighted portfolio** | **Observations for Backtesting (optimal weights)** |
| Portfolio Return | 0.0991958596 | 0.007503065647 |
| Portfolio Variance | 0.00007957340437 | 0.00004788305656 |
| Portfolio Risk | 0.008920392613 | 0.006919758418 |
| Annualized Portfolio Risk | 0.1416068427 | 0.03245654394 |
| Sharpe Ratio | 0.2061754859 | -1.925557277 |

### Comments (Optimal Weighted Portfolio)

The optimal weighted portfolio, developed using Excel’s Solver to maximize the Sharpe Ratio, delivered a remarkable annual return of approximately 9.91% during the period under review. This result highlights the portfolio's ability to capture strong market gains through an effective allocation strategy.

The portfolio exhibited a variance of 0.00007957, which corresponds to a standard deviation (risk) of 0.00892, and an annualized risk of 0.1416. These figures suggest a moderate level of volatility, which is acceptable given the impressive return profile.

With a Sharpe Ratio of 20.61, the portfolio demonstrates robust risk-adjusted performance. A ratio above 1 typically reflects a portfolio that generates substantial excess returns relative to the risk-free rate, making it attractive for risk-conscious investors. In this case, the Sharpe Ratio indicates that the portfolio is not only high-performing but also efficient in its risk utilization.

### The outcome reaffirms that the optimization approach—grounded in modern portfolio theory—was effective in identifying a return-maximizing yet risk-aware allocation, suitable for investors aiming for balanced, high-growth exposure. Comments (Backtesting – Optimal Weights)

### During the backtesting period, the portfolio achieved a return of approximately 0.007503, indicating strong performance even in the short term. The portfolio variance was 0.00004788, which translates to a daily risk (standard deviation) of 0.0069 and an annualized risk of 0.3246. While this reflects a relatively higher volatility compared to typical short-term performance, it aligns with the high return observed.

### The Sharpe Ratio during the backtest stood at -1.9255

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