In [17]:

```
!pip install pandas
!pip install numpy
!pip install matplotlib
```

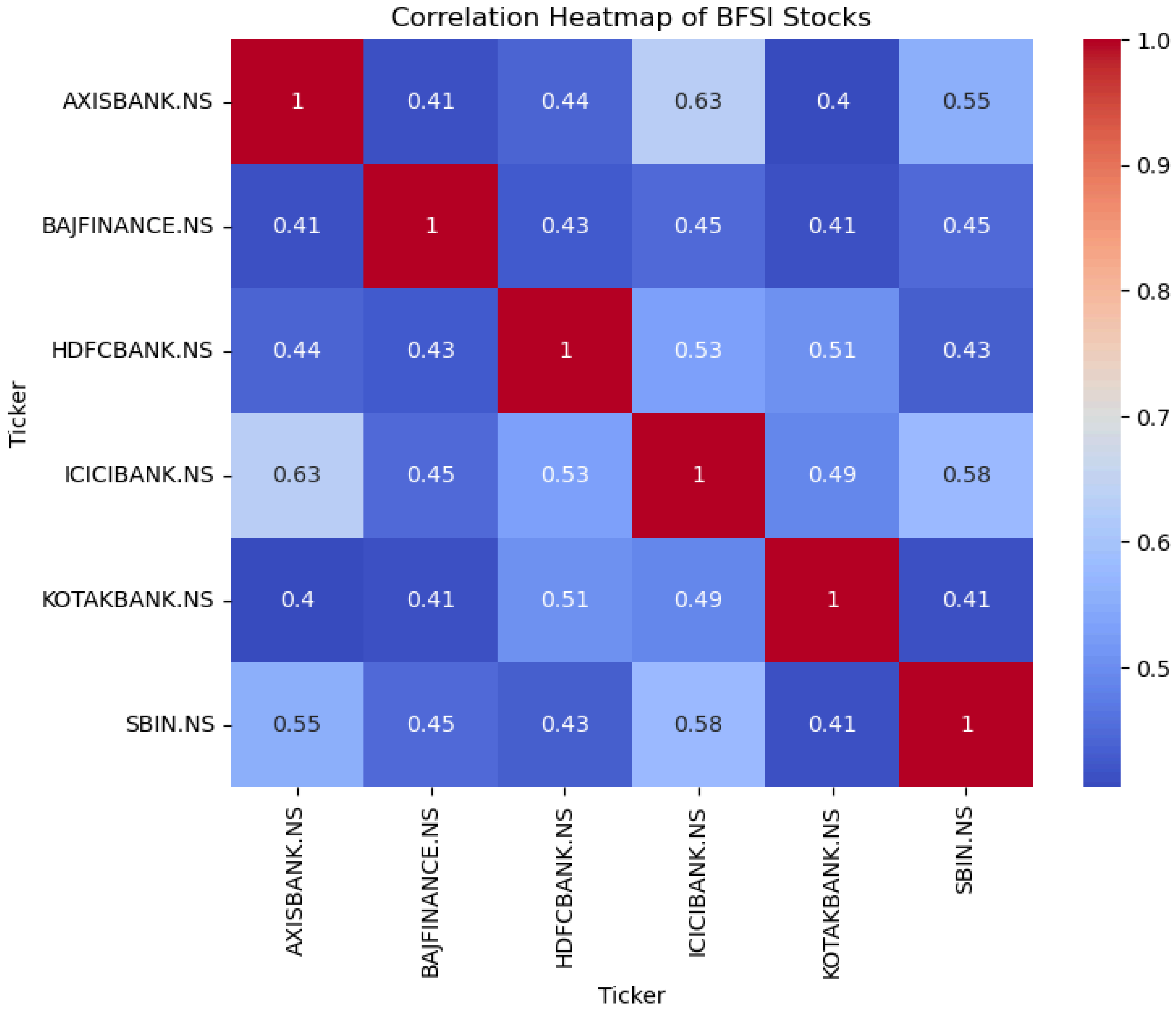
```
Requirement already satisfied: pandas in c:\users\aditya sakpal\anaconda3\lib\site-packages (2.2.2)
Requirement already satisfied: numpy>=1.26.0 in c:\users\aditya sakpal\anaconda3\lib\site-packages (from pandas) (1.26.4)
Requirement already satisfied: python-dateutil>=2.8.2 in c:\users\aditya sakpal\anaconda3\lib\site-packages (from pandas) (2.9.
0.post0)
Requirement already satisfied: pytz>=2020.1 in c:\users\aditya sakpal\anaconda3\lib\site-packages (from pandas) (2024.1)
Requirement already satisfied: tzdata>=2022.7 in c:\users\aditya sakpal\anaconda3\lib\site-packages (from pandas) (2023.3)
Requirement already satisfied: six>=1.5 in c:\users\aditya sakpal\anaconda3\lib\site-packages (from python-dateutil>=2.8.2->pan
das) (1.16.0)
Requirement already satisfied: numpy in c:\users\aditya sakpal\anaconda3\lib\site-packages (1.26.4)
Requirement already satisfied: matplotlib in c:\users\aditya sakpal\anaconda3\lib\site-packages (3.8.4)
Requirement already satisfied: contourpy>=1.0.1 in c:\users\aditya sakpal\anaconda3\lib\site-packages (from matplotlib) (1.2.0)
Requirement already satisfied: cycler>=0.10 in c:\users\aditya sakpal\anaconda3\lib\site-packages (from matplotlib) (0.11.0)
Requirement already satisfied: fonttools>=4.22.0 in c:\users\aditya sakpal\anaconda3\lib\site-packages (from matplotlib) (4.51.
0)
Requirement already satisfied: kiwisolver>=1.3.1 in c:\users\aditya sakpal\anaconda3\lib\site-packages (from matplotlib) (1.4.
4)
Requirement already satisfied: numpy>=1.21 in c:\users\aditya sakpal\anaconda3\lib\site-packages (from matplotlib) (1.26.4)
Requirement already satisfied: packaging>=20.0 in c:\users\aditya sakpal\anaconda3\lib\site-packages (from matplotlib) (23.2)
Requirement already satisfied: pillow>=8 in c:\users\aditya sakpal\anaconda3\lib\site-packages (from matplotlib) (10.3.0)
Requirement already satisfied: pyparsing>=2.3.1 in c:\users\aditya sakpal\anaconda3\lib\site-packages (from matplotlib) (3.0.9)
Requirement already satisfied: python-dateutil>=2.7 in c:\users\aditya sakpal\anaconda3\lib\site-packages (from matplotlib) (2.
9.0.post0)
Requirement already satisfied: six>=1.5 in c:\users\aditya sakpal\anaconda3\lib\site-packages (from python-dateutil>=2.7->matpl
otlib) (1.16.0)
```

In [29]:

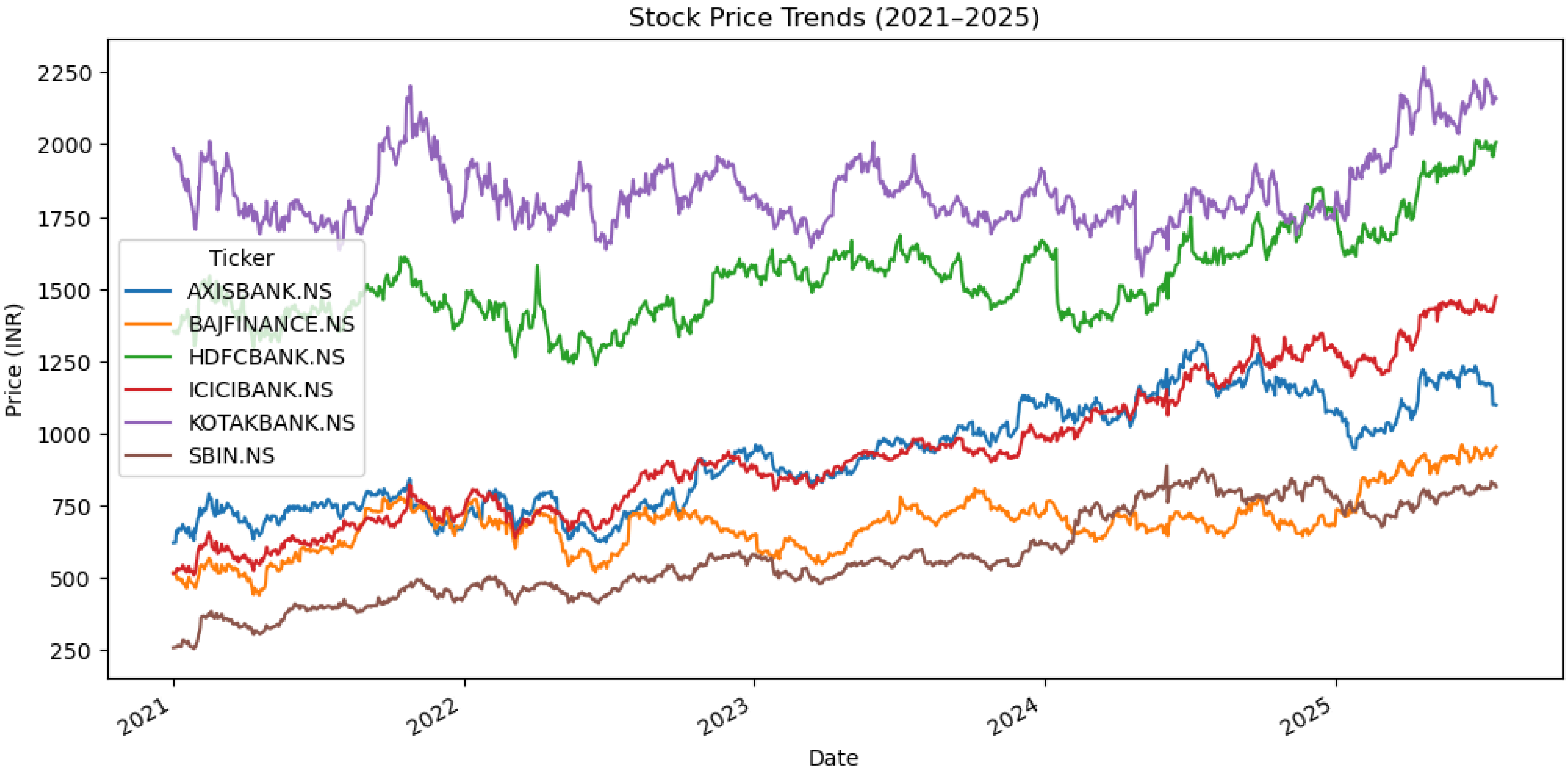
```
import yfinance as yf
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from pypfopt.efficient_frontier import EfficientFrontier
from pypfopt.expected_returns import mean_historical_return
from pypfopt.risk_models import CovarianceShrinkage
from pypfopt.plotting import plot_efficient_frontier
```

```
tickers = ['HDFCBANK.NS', 'ICICIBANK.NS', 'KOTAKBANK.NS', 'SBIN.NS', 'AXISBANK.NS', 'BAJFINANCE.NS']
data = yf.download(tickers, start="2021-01-01", end="2025-07-23", auto_adjust=True)['Close']

returns = data.pct_change().dropna()

plt.figure(figsize=(8,6))
sns.heatmap(returns.corr(), annot=True, cmap="coolwarm")
plt.title("Correlation Heatmap of BFSI Stocks")
plt.show()

data.plot(figsize=(12,6))
plt.title("Stock Price Trends (2021-2025)")
plt.ylabel("Price (INR)")
plt.xlabel("Date")
plt.show()

mean_return = returns.mean()
volatility = returns.std()
sharpe = mean_return / volatility

sharpe_df = pd.DataFrame({
    'Mean Return': mean_return,
    'Volatility': volatility,
    'Sharpe Ratio': sharpe
})
print("\n Sharpe Ratio for Individual Stocks:\n")
print(sharpe_df)

mu = mean_historical_return(data)
S = CovarianceShrinkage(data).ledoit_wolf()

ef = EfficientFrontier(mu, S)
weights = ef.max_sharpe()
cleaned_weights = ef.clean_weights()

print("\n Optimized Portfolio Allocation (Max Sharpe Ratio):")
for stock, weight in cleaned_weights.items():
    print(f"{stock}: {weight:.2%}")

plt.figure(figsize=(8,6))
plt.pie(cleaned_weights.values(), labels=cleaned_weights.keys(), autopct='%1.1f%%', startangle=140)
plt.title("Optimal Portfolio Allocation")
plt.axis('equal')
plt.show()

ef_plot = EfficientFrontier(mu, S)
plot_efficient_frontier(ef_plot, show_assets=True)
plt.title("Efficient Frontier (Risk vs Return)")
plt.show()

expected_return, risk, sharpe_ratio = ef.portfolio_performance(verbose=True)

print(f"\n Optimized Portfolio Sharpe Ratio: {sharpe_ratio:.2f}")
```

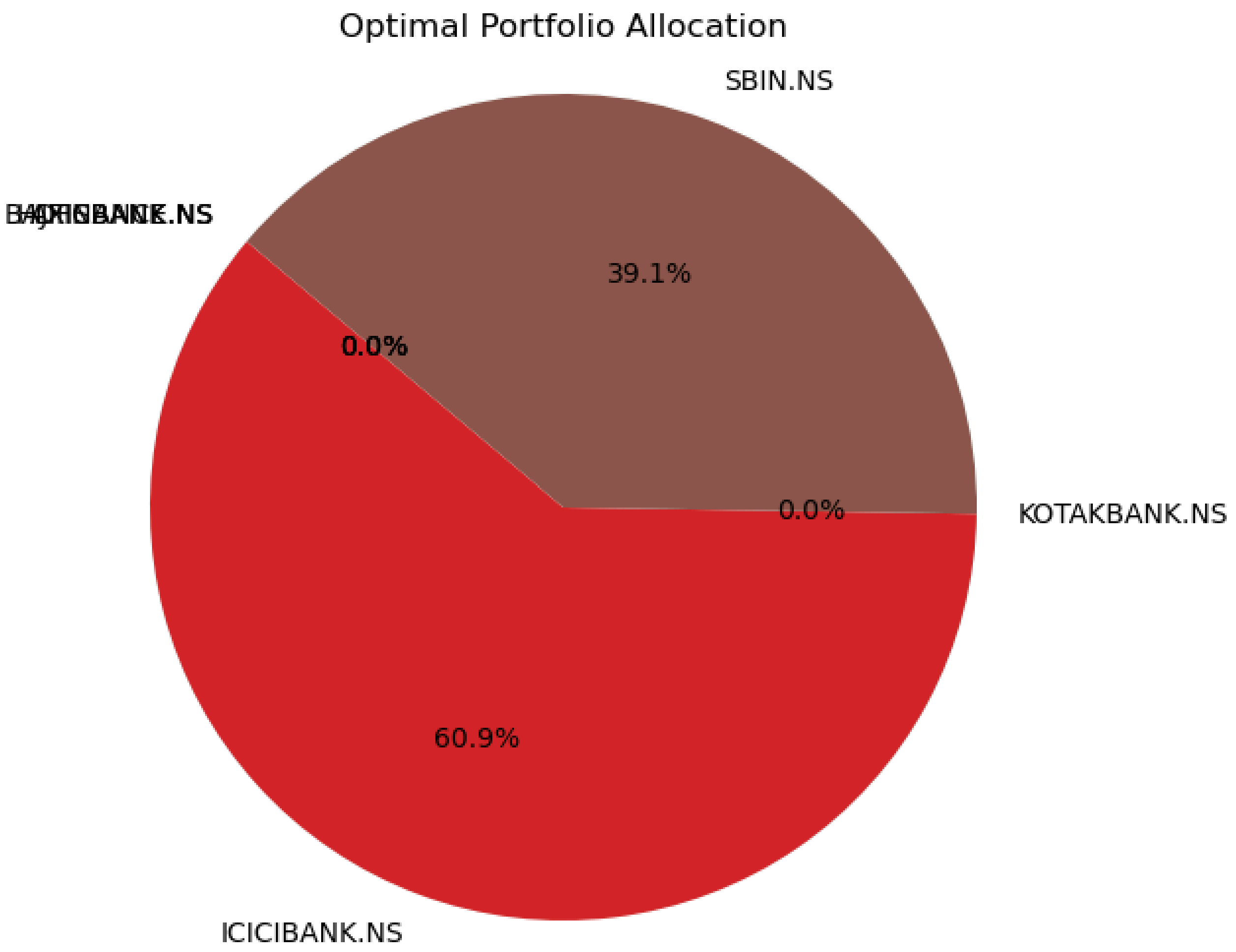
```
[*********************100%***********************]  6 of 6 completed
```

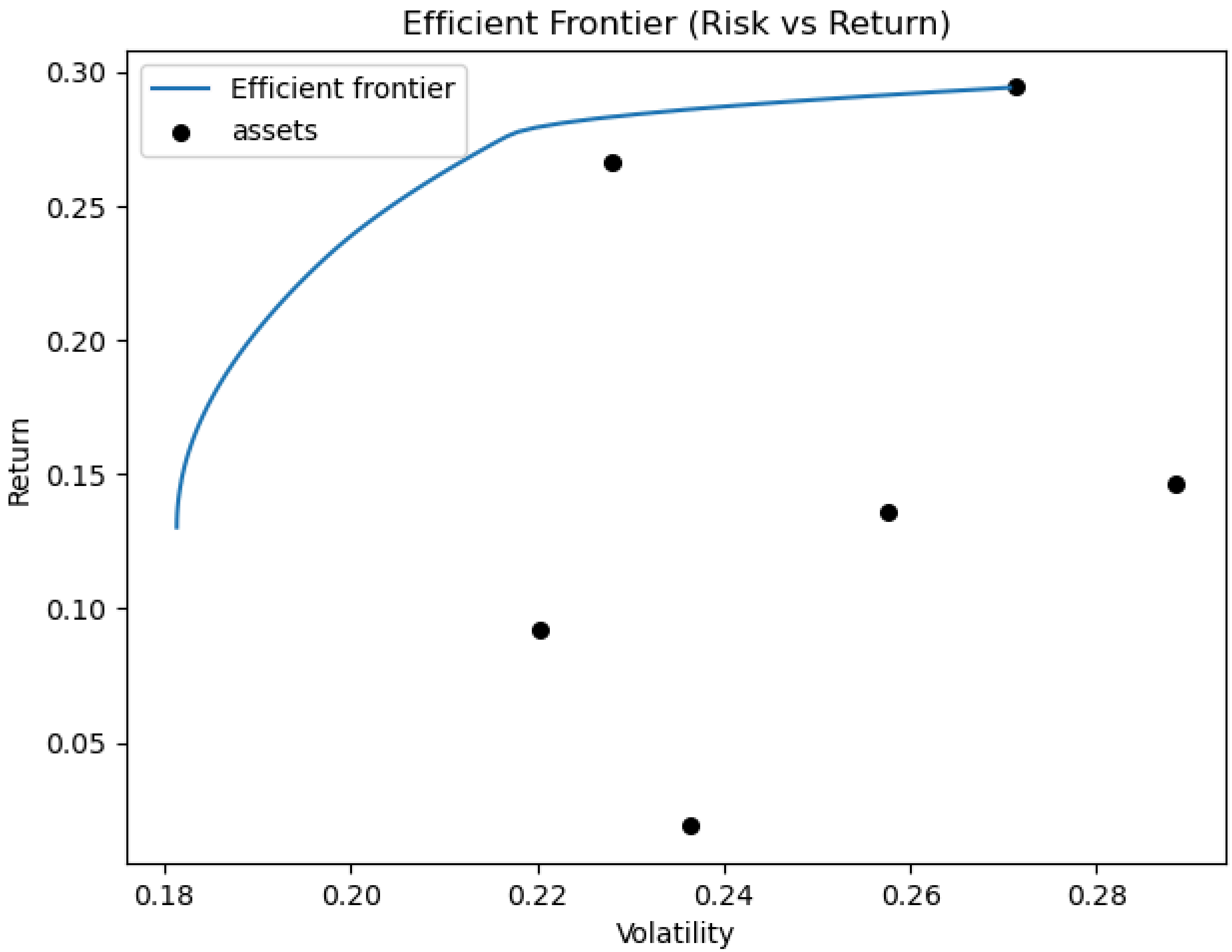


Ticker	AXISBANK.NS	BAJFINANCE.NS	HDFCBANK.NS	ICICIBANK.NS	KOTAKBANK.NS	SBIN.NS
AXISBANK.NS	1	0.41	0.44	0.63	0.4	0.55
BAJFINANCE.NS	0.41	1	0.43	0.45	0.41	0.45
HDFCBANK.NS	0.44	0.43	1	0.53	0.51	0.43
ICICIBANK.NS	0.63	0.45	0.53	1	0.49	0.58
KOTAKBANK.NS	0.4	0.41	0.51	0.49	1	0.41
SBIN.NS	0.55	0.45	0.43	0.58	0.41	1


Stock Price Trends (2021–2025)
Price (INR)
2250
2000
1750
1500
1250
1000
750
500
250
Ticker
AXISBANK.NS
BAJFINANCE.NS
HDFCBANK.NS
ICICIBANK.NS
KOTAKBANK.NS
SBIN.NS
2021
2022
2023
2024
2025
Date

```
 Sharpe Ratio for Individual Stocks:

               Mean Return  Volatility  Sharpe Ratio
Ticker
AXISBANK.NS       0.000638    0.016237      0.039293
BAJFINANCE.NS     0.000707    0.018220      0.038812
HDFCBANK.NS       0.000446    0.013853      0.032222
ICICIBANK.NS      0.001038    0.014344      0.072396
KOTAKBANK.NS      0.000186    0.014880      0.012473
SBIN.NS           0.001170    0.017117      0.068355

 Optimized Portfolio Allocation (Max Sharpe Ratio):
AXISBANK.NS: 0.00%
BAJFINANCE.NS: 0.00%
HDFCBANK.NS: 0.00%
ICICIBANK.NS: 60.87%
KOTAKBANK.NS: 0.00%
SBIN.NS: 39.13%
```


Optimal Portfolio Allocation
SBIN.NS
39.1%
BAJFINANCE.NS [illegible]
0.0%
0.0%
KOTAKBANK.NS
60.9%
ICICIBANK.NS



```
Expected annual return: 27.7%
Annual volatility: 21.8%
Sharpe Ratio: 1.27

 Optimized Portfolio Sharpe Ratio: 1.27
```