PortFolioIQ: Financial Portfolio Management System

Milestone 2

Of

Data Warehousing and Integration

BY

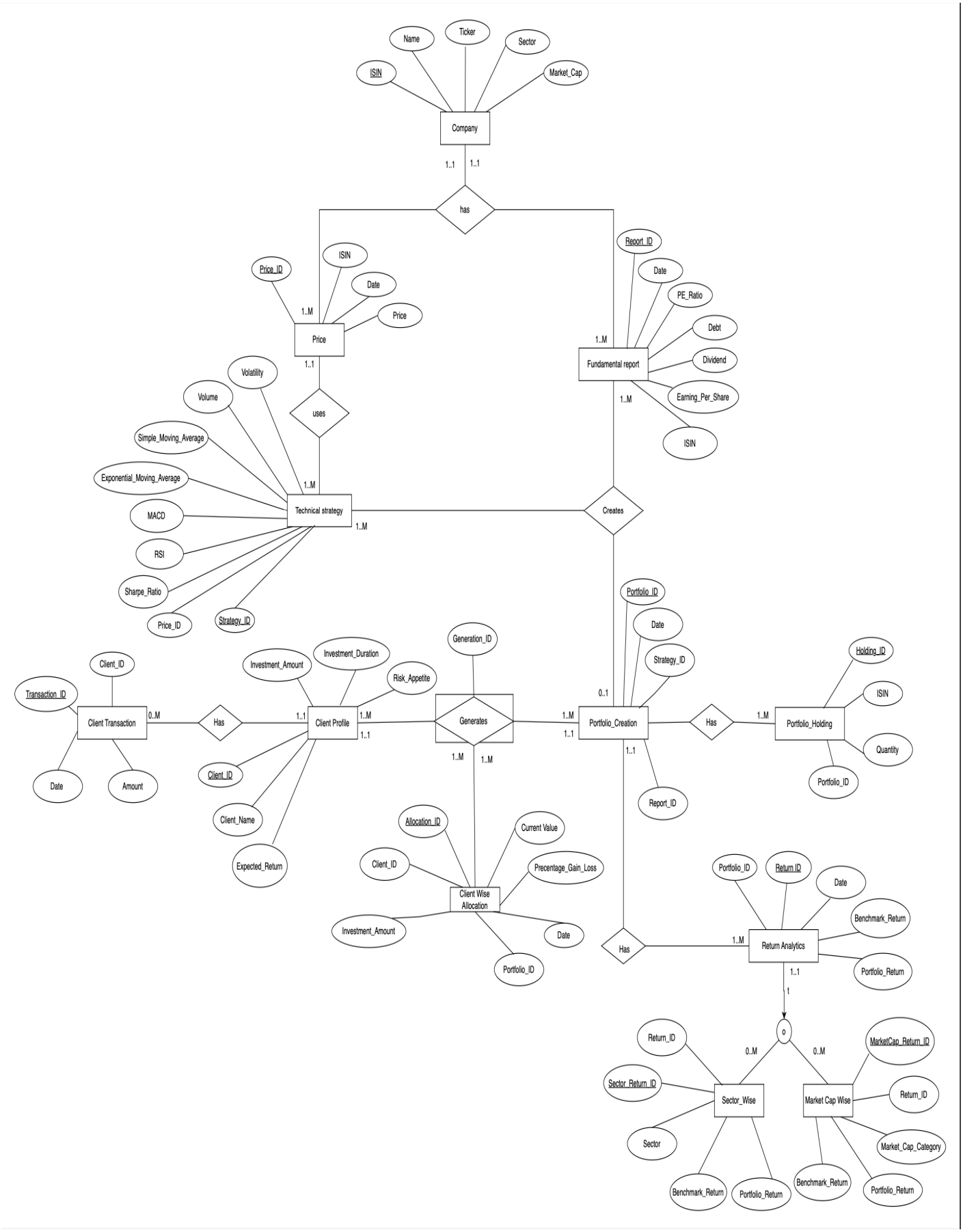
GROUP NUMBER 14:

ARCHIT SINGH (002813253)

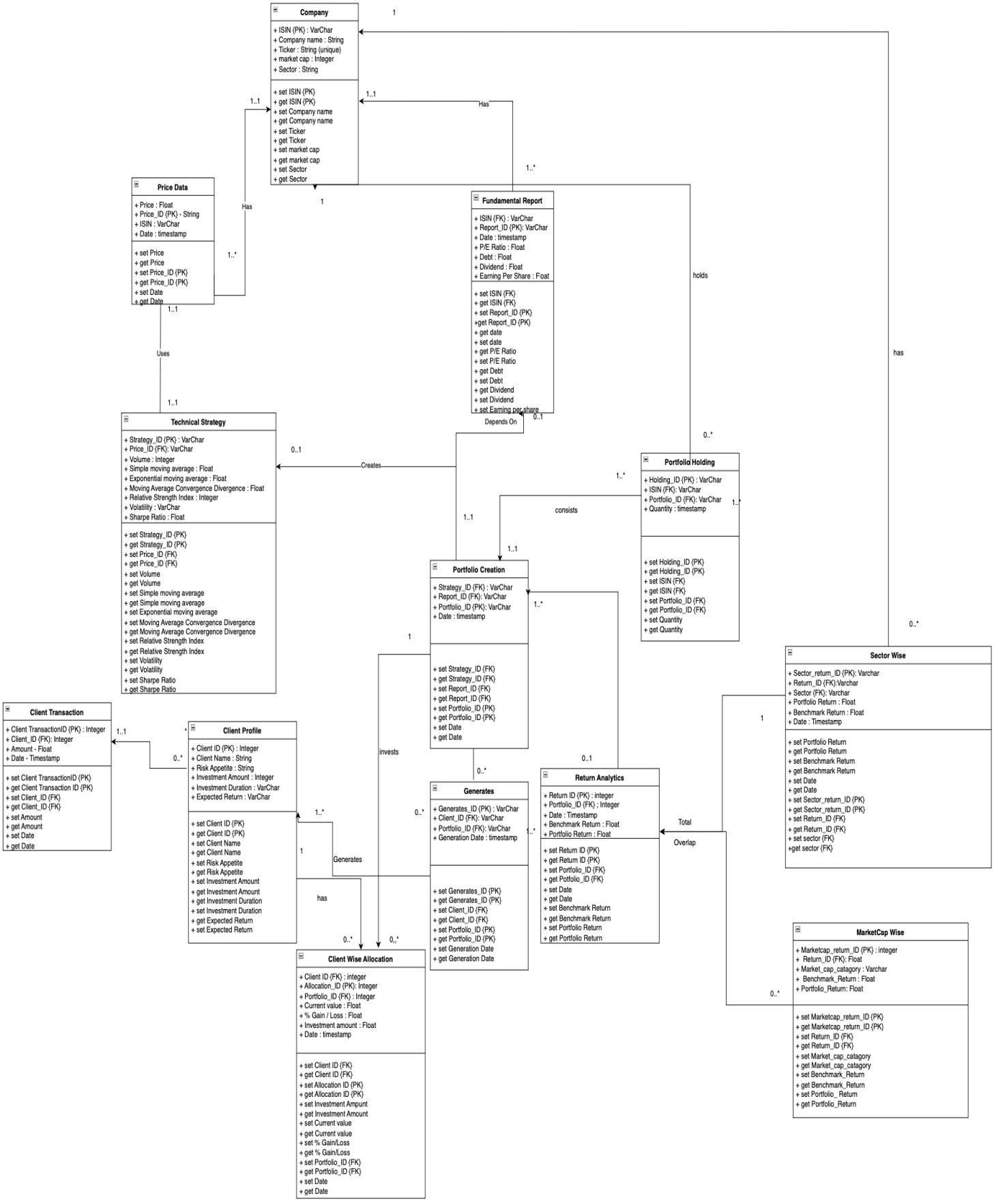
SANCIA SEROPHENE SALDANHA (002851577)

DEPARTMENT OF COLLEGE OF ENGINEERING
NORTHEASTERN UNIVERSITY
BOSTON, MASSACHUSETTS – 022115

A. Entity-Relationship Diagram:



B. Relational Model:



C. NORMALIZED RELATIONAL MODEL:

1. Company (ISIN, Ticker, Name, Sector, Market_Cap)

Primary Key:
ISIN (NOT NULL)

Attributes:
Ticker (NOT NULL)
Name
Sector
Market_Cap

2. Price (Price_ID, ISIN, Date, Price)

Primary Key:
Price_ID (NOT NULL)

Foreign Key:
ISIN references Company(ISIN) (NOT NULL)

Attributes:
Date (NOT NULL)
Price (NOT NULL)

3. Fundamental_Report (Report_ID, ISIN, Date, PE_Ratio, Debt, Dividend, Earnings_Per_Share)

Primary Key:
Report_ID (NOT NULL)

Foreign Key:
ISIN references Company(ISIN) (NOT NULL)

Attributes:
Date (NOT NULL)
PE_Ratio
Debt
Dividend
Earnings_Per_Share

4. Technical_Strategy (Strategy_ID, Price_ID, Volatility, Volume, Simple_Moving_Average, Exponential_Moving_Average, MACD, RSI, Sharpe_Ratio)

Primary Key:
Strategy_ID (NOT NULL)

Foreign Key:
Price_ID references Price(Price_ID) (NOT NULL)

Attributes:
Volatility
Volume
Simple_Moving_Average
Exponential_Moving_Average
MACD
RSI

Sharpe_Ratio

5. **Portfolio_Creation (Portfolio_ID, Strategy_ID, Report_ID, Date)**

Primary Key:
Portfolio_ID (NOT NULL)

Foreign Keys:
Strategy_ID references Technical_Strategy(Strategy_ID) (NULLABLE)
Report_ID references Fundamental_Report(Report_ID) (NULLABLE)

Attributes:
Date (NOT NULL)

6. **Portfolio_Holding (Holding_ID, Portfolio_ID, ISIN, Quantity)**

Primary Key:
Holding_ID (NOT NULL)

Foreign Keys:
Portfolio_ID references Portfolio_Creation(Portfolio_ID) (NOT NULL)
ISIN references Company(ISIN) (NOT NULL)

Attributes:
Quantity (NOT NULL)

7. **Client_Profile (Client_ID, Client_Name, Expected_Return, Investment_Amount, Investment_Duration, Risk_Appetite)**

Primary Key:
Client_ID (NOT NULL)

Attributes:
Client_Name
Expected_Return
Investment_Amount
Investment_Duration
Risk_Appetite

8. **Generates (Generation_ID, Client_ID, Portfolio_ID, Generation_Date)**

Primary Key:
Generation_ID (NOT NULL)

Foreign Keys:
Client_ID references Client_Profile(Client_ID) (NOT NULL)
Portfolio_ID references Portfolio_Creation(Portfolio_ID) (NOT NULL)

Attributes:
Generation_Date (NOT NULL)

9. **Client_Transaction (Transaction_ID, Client_ID, Date, Amount)**

Primary Key:
Transaction_ID (NOT NULL)

Foreign Key:
Client_ID references Client_Profile(Client_ID) (NOT NULL)

Attributes:
Date (NOT NULL)
Amount (NOT NULL)

10. **Client_Wise_Allocation (Allocation_ID, Client_ID, Portfolio_ID, Date, Investment_Amount, Current_Value, Percentage_Gain_Loss)**

Primary Key:
Allocation_ID (NOT NULL)

Foreign Keys:
Client_ID references Client_Profile(Client_ID) (NOT NULL)
Portfolio_ID references Portfolio_Creation(Portfolio_ID) (NOT NULL)

Attributes:
Date (NOT NULL)
Investment_Amount
Current_Value
Percentage_Gain_Loss

11. **Return_Analytics (Return_ID, Portfolio_ID, Date, Benchmark_Return, Portfolio_Return)**

Primary Key:
Return_ID (NOT NULL)

Foreign Key:
Portfolio_ID references Portfolio_Creation(Portfolio_ID) (NOT NULL)

Attributes:
Date (NOT NULL)
Benchmark_Return
Portfolio_Return

12. **Sector_Wise (Sector_Return_ID, Return_ID, Sector, Benchmark_Return, Portfolio_Return)**

Primary Key:
Sector_Return_ID (NOT NULL)

Foreign Keys:
Return_ID references Return_Analytics(Return_ID) (NOT NULL)
Sector references Company(Sector) (NOT NULL)

Attributes:
Benchmark_Return
Portfolio_Return

13. **Market_Cap_Wise (MarketCap_Return_ID, Return_ID, Market_Cap_Category, Benchmark_Return, Portfolio_Return)**

Primary Key:
MarketCap_Return_ID (NOT NULL)

Foreign Key:

Return_ID references Return_Analytics(Return_ID) (NOT NULL)

Attributes:
Market_Cap_Category (NOT NULL)
Benchmark_Return
Portfolio_Return

D. POTENTIAL DIMENSIONS, HIERARCHIES AND MEASURES:

Dimensions:
• **Clients:** The individuals who invest in portfolios, including their names, expected returns, investment amounts, durations, risk appetites, and unique IDs.

• **Portfolios:** Collections of investments created using specific strategies and reports, detailing when they were created, which strategies and reports were used, and unique portfolio IDs.

• **Companies:** The businesses available for investment, with information like their names, ticker symbols, sectors, market capitalizations, and unique identifiers (ISINs).

• **Holdings:** The specific investments within each portfolio, including which companies are held, the quantities owned, and unique holding IDs.

• **Transactions:** Records of financial activities made by clients, such as deposits and withdrawals, including dates, amounts, and unique transaction IDs.

• **Strategies and Reports:** The methods and analyses used to create portfolios, including technical strategies (like volatility and moving averages), fundamental reports (like P/E ratios and earnings per share), and their unique IDs.

• **Sectors:** Categories grouping companies based on the industries they operate in, such as Technology, Healthcare, or Finance.

• **Market Cap Categories:** Classifications of companies based on their market capitalization, like Mega Cap, Large Cap, Mid Cap, and Small Cap.

• **Time:** Information about when events occur, including dates, months, quarters, and years, allowing for time-based analysis.

Hierarchies:
• **Client Hierarchy:** Imagine a tree starting with a client at the root, branching out to the portfolios they've generated, then to the holdings within those portfolios, and finally to the companies they've invested in, including the sectors and market cap categories of those companies.

• **Portfolio Hierarchy:** Picture another tree beginning with a portfolio, branching into its holdings, then to the companies included, and further into their sectors and market cap categories.

• **Company Hierarchy:** Envision a structure starting with a company, then branching into its sector and market cap category, helping to categorize investments.

• **Time Hierarchy:** Think of a timeline that starts with the year, then narrows down to quarters, months, and days, helping to analyze trends over time.

Measures:
• **Investments:** This includes the total amount of money clients have invested, the current value of their investments, and the percentage gain or loss they've experienced.

• **Returns:** The performance metrics of portfolios, such as how much return a portfolio has generated compared to benchmarks, and returns analyzed by sectors or market cap categories.

• **Transactions:** We can count and sum the transactions clients make to understand their activity levels, including how much they're depositing or withdrawing over time.

• **Technical Indicators:** Measures like volatility, volume, moving averages, MACD, RSI, and Sharpe Ratio that help assess the performance and risk of investments.

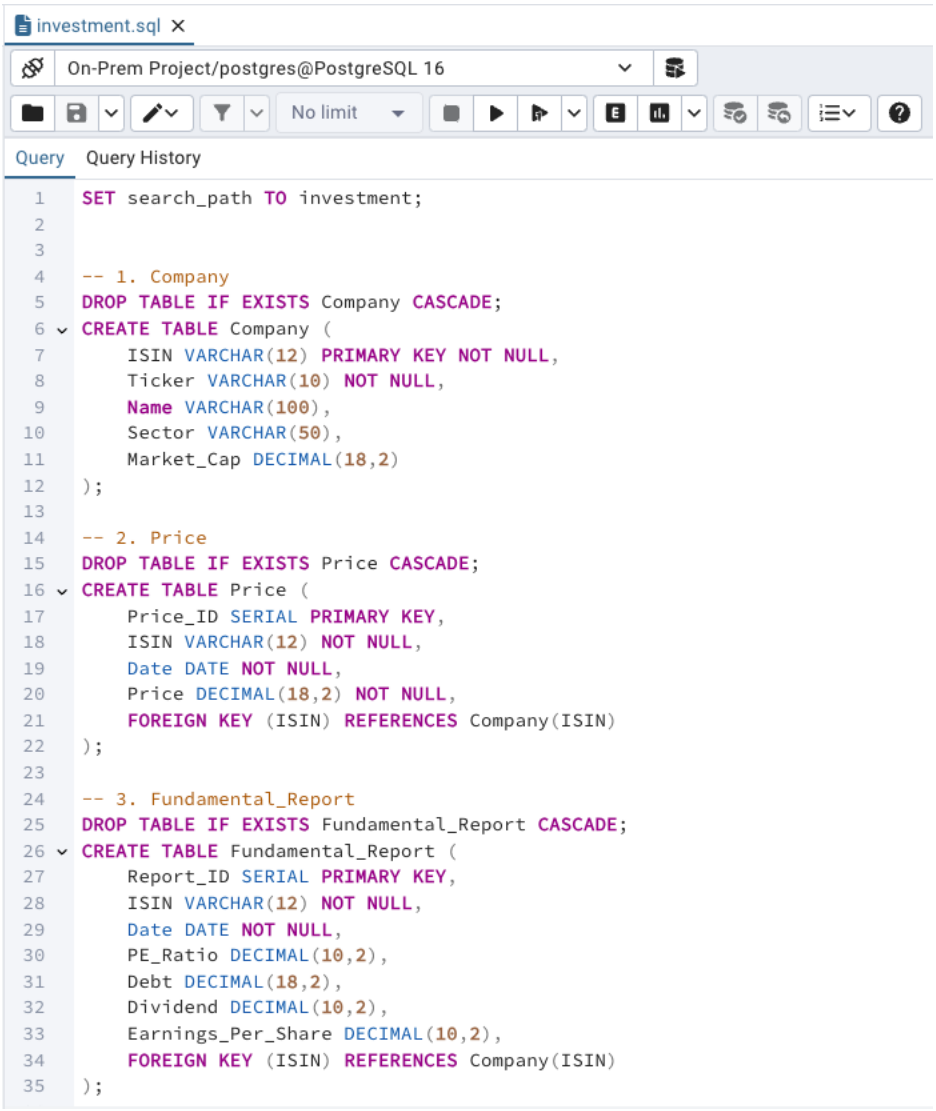
• **Fundamental Metrics:** Financial indicators like P/E ratios, debt levels, dividends, and earnings per share that provide insights into a company's financial health.

• **Client Activity:** The number of portfolios each client has, their investment durations, and their risk appetites can be measured to understand client behaviors.

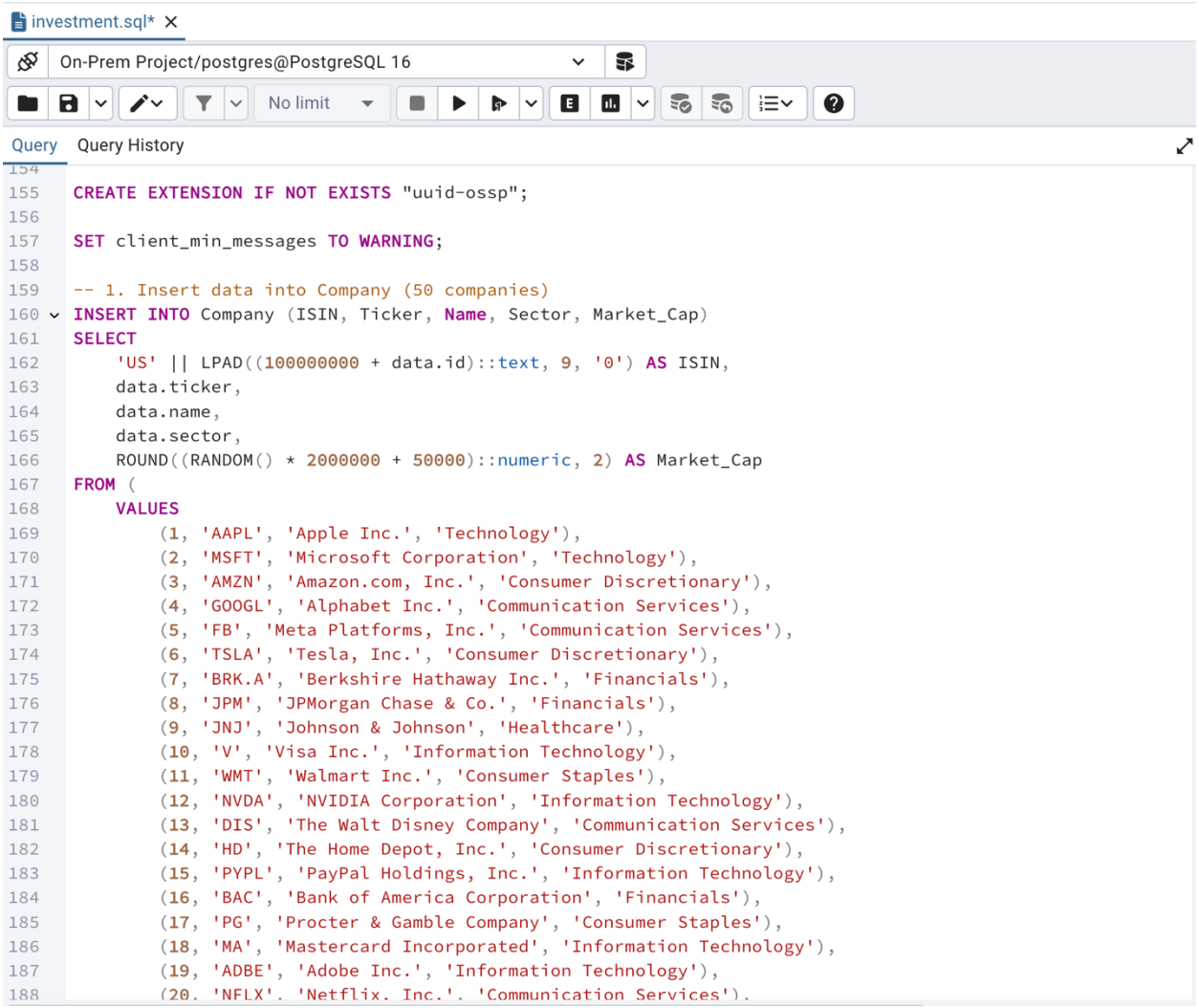
• **Market Performance:** Tracking stock prices and price changes over time to gauge market trends.

E. IMPLEMENTATION OF RELATIONAL MODEL IN POSTGRES:

Initially, we created a table schema in PostgreSQL:



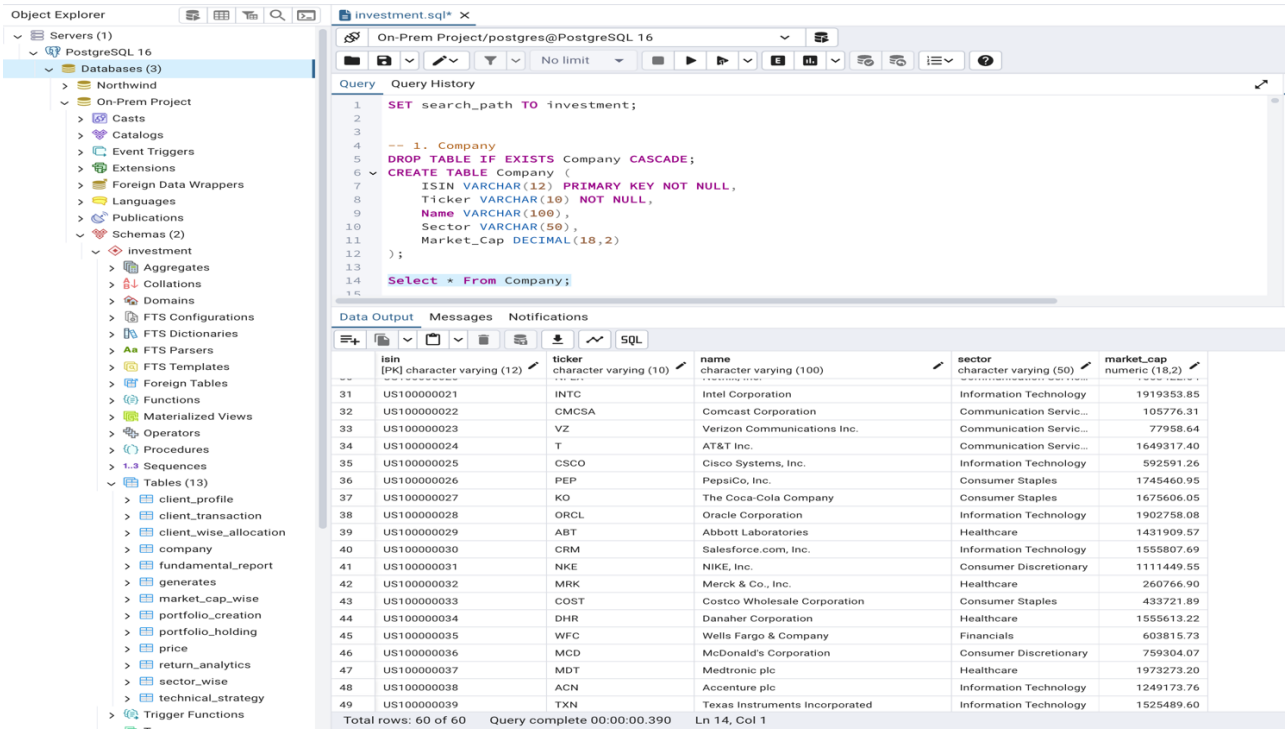
We then make use of the extension “uuid-ossp” to generate the data for all the tables:



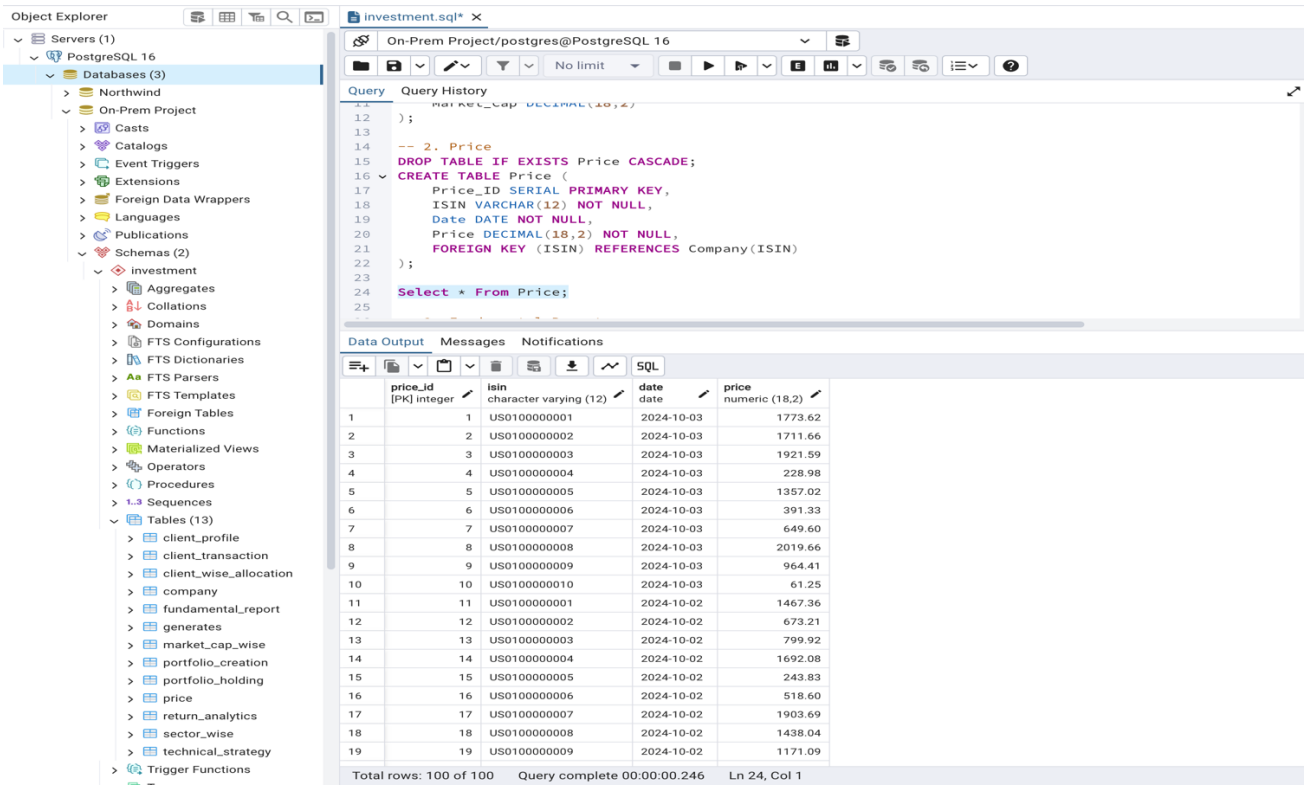

```sql
CREATE EXTENSION IF NOT EXISTS "uuid-ossp";

SET client_min_messages TO WARNING;

-- 1. Insert data into Company (50 companies)
INSERT INTO Company (ISIN, Ticker, Name, Sector, Market_Cap)
SELECT
    'US' || LPAD((100000000 + data.id)::text, 9, '0') AS ISIN,
    data.ticker,
    data.name,
    data.sector,
    ROUND((RANDOM() * 2000000 + 50000)::numeric, 2) AS Market_Cap
FROM (
    VALUES
        (1, 'AAPL', 'Apple Inc.', 'Technology'),
        (2, 'MSFT', 'Microsoft Corporation', 'Technology'),
        (3, 'AMZN', 'Amazon.com, Inc.', 'Consumer Discretionary'),
        (4, 'GOOGL', 'Alphabet Inc.', 'Communication Services'),
        (5, 'FB', 'Meta Platforms, Inc.', 'Communication Services'),
        (6, 'TSLA', 'Tesla, Inc.', 'Consumer Discretionary'),
        (7, 'BRK.A', 'Berkshire Hathaway Inc.', 'Financials'),
        (8, 'JPM', 'JPMorgan Chase & Co.', 'Financials'),
        (9, 'JNJ', 'Johnson & Johnson', 'Healthcare'),
        (10, 'V', 'Visa Inc.', 'Information Technology'),
        (11, 'WMT', 'Walmart Inc.', 'Consumer Staples'),
        (12, 'NVDA', 'NVIDIA Corporation', 'Information Technology'),
        (13, 'DIS', 'The Walt Disney Company', 'Communication Services'),
        (14, 'HD', 'The Home Depot, Inc.', 'Consumer Discretionary'),
        (15, 'PYPL', 'PayPal Holdings, Inc.', 'Information Technology'),
        (16, 'BAC', 'Bank of America Corporation', 'Financials'),
        (17, 'PG', 'Procter & Gamble Company', 'Consumer Staples'),
        (18, 'MA', 'Mastercard Incorporated', 'Information Technology'),
        (19, 'ADBE', 'Adobe Inc.', 'Information Technology'),
        (20, 'NFLX', 'Netflix, Inc.', 'Communication Services'),
```

As displayed the data has been successfully generated for each of the tables:

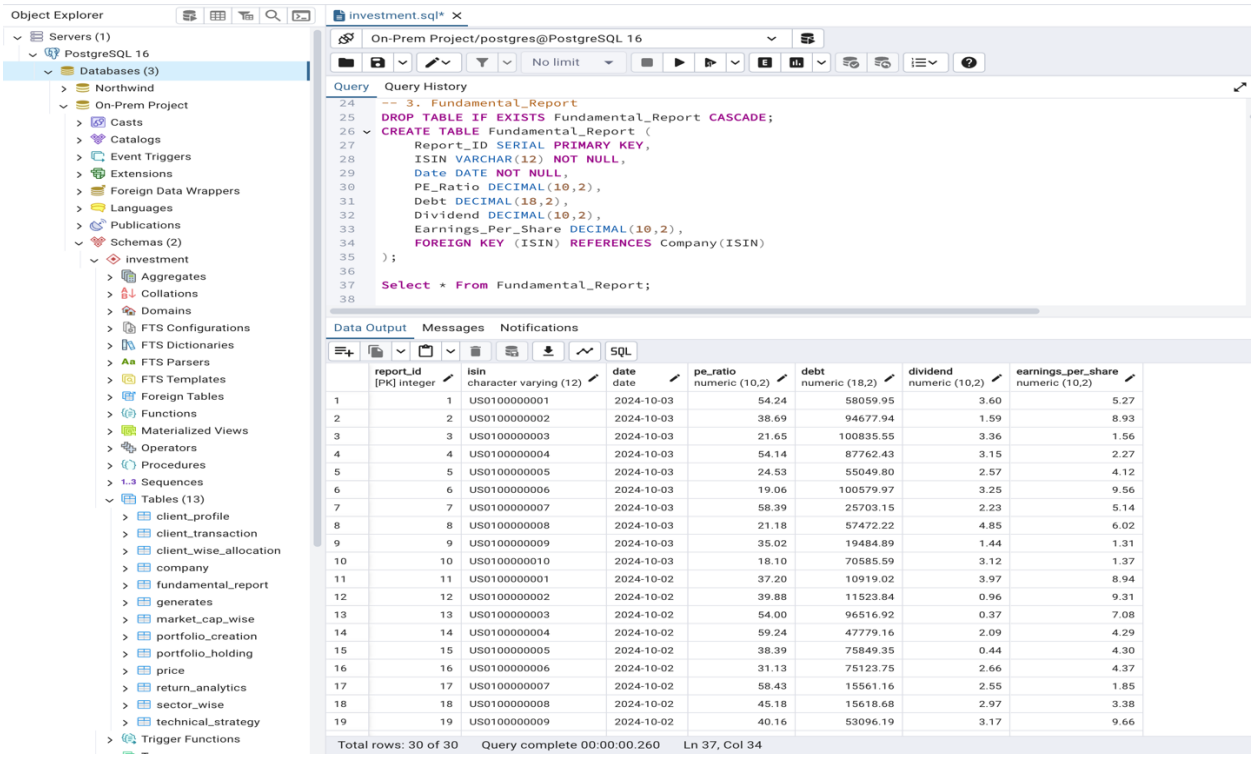
1. Company:



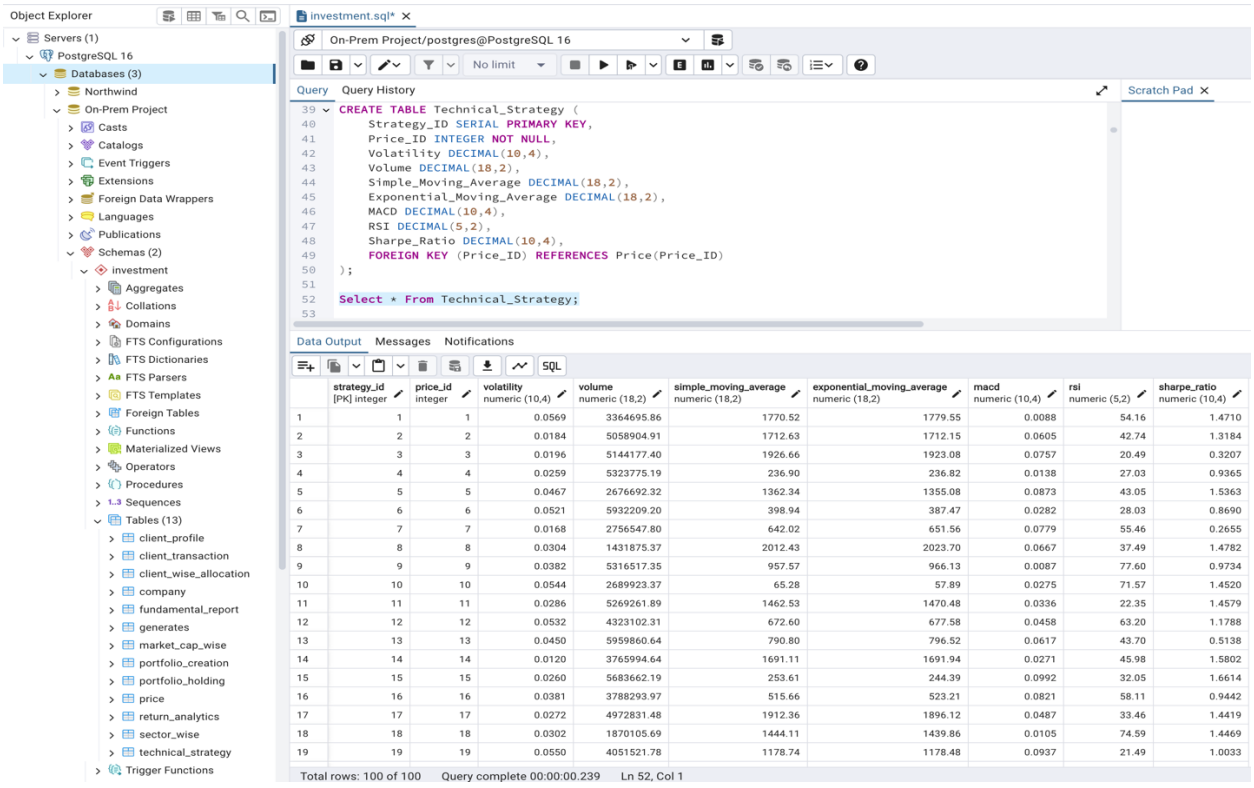
2. Price:



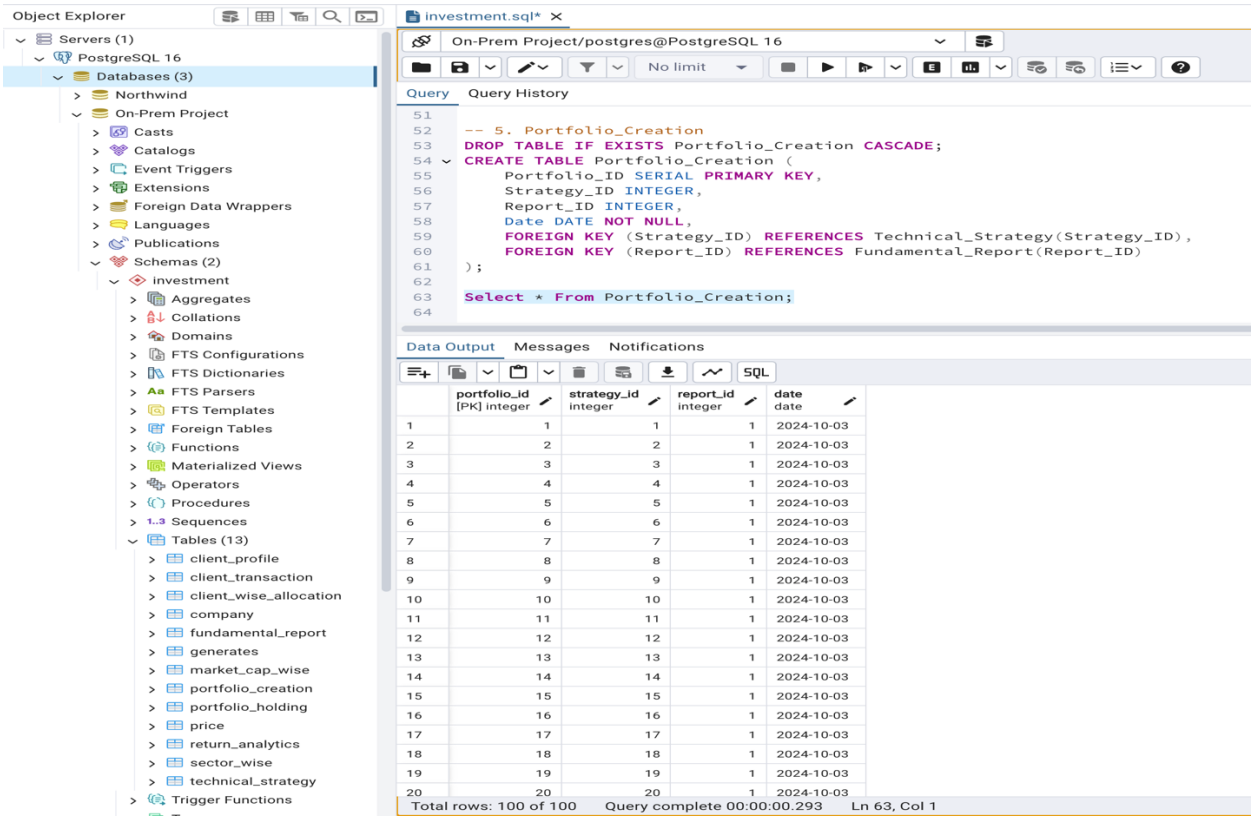
3. Fundamental_Report:



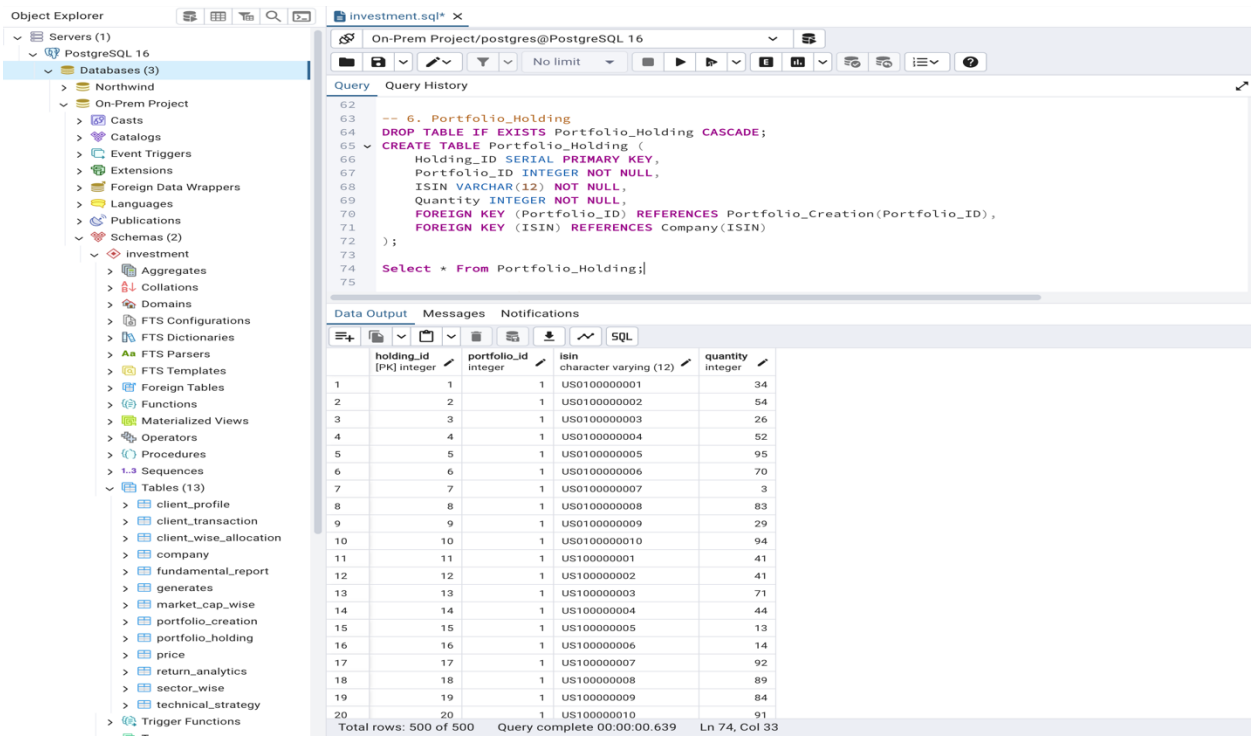
4. Technical_Strategy:



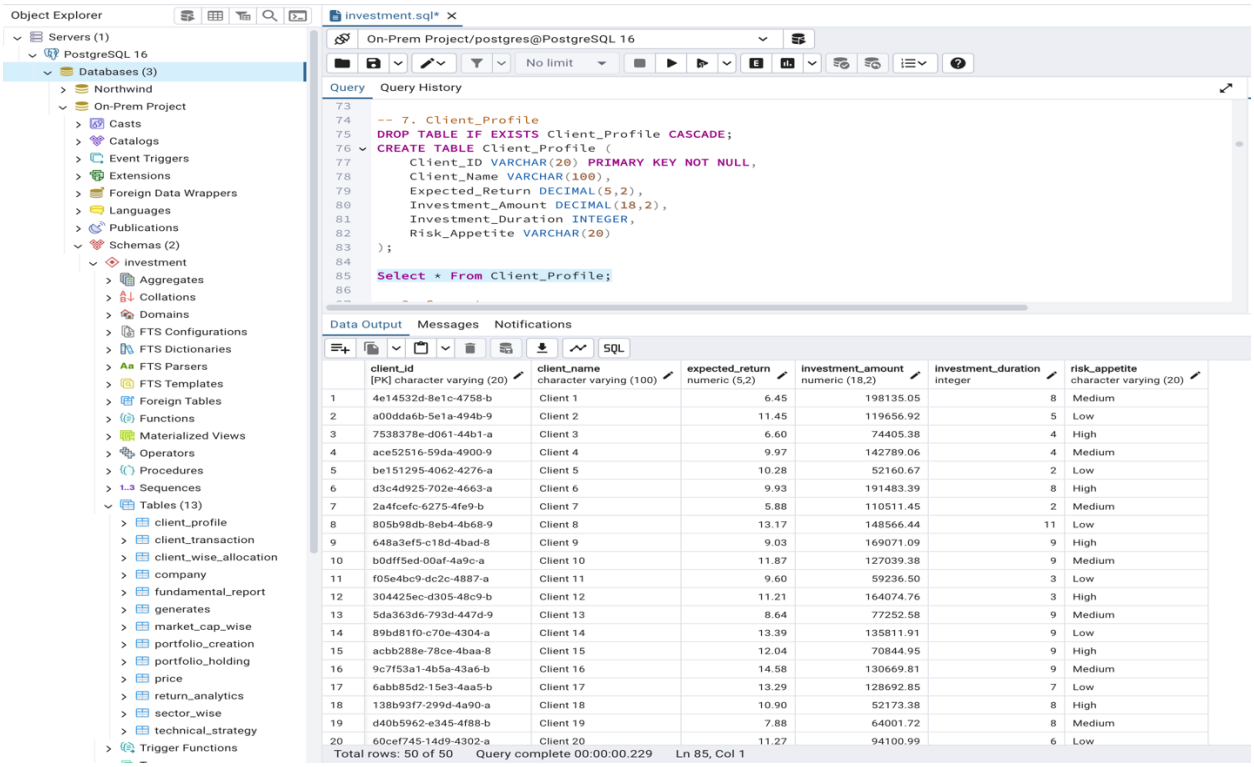
5. Portfolio Creation



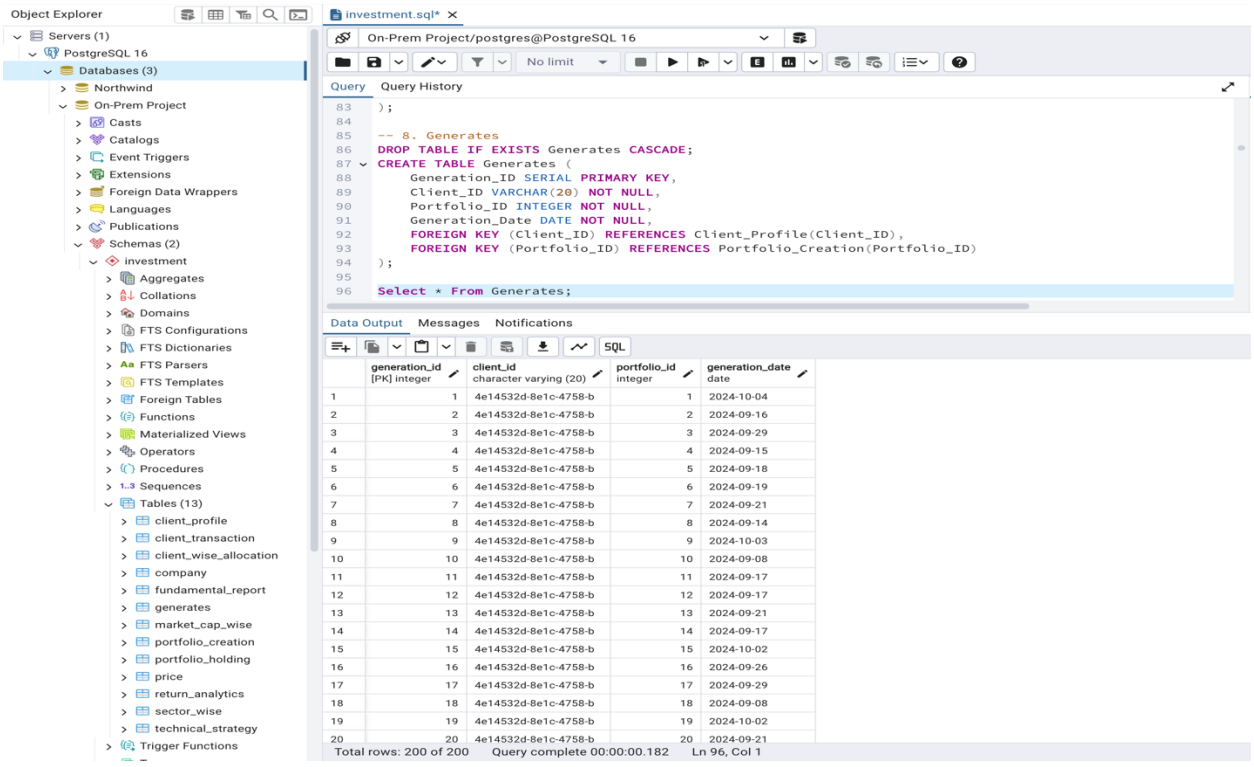
6. Portfolio_Holdings



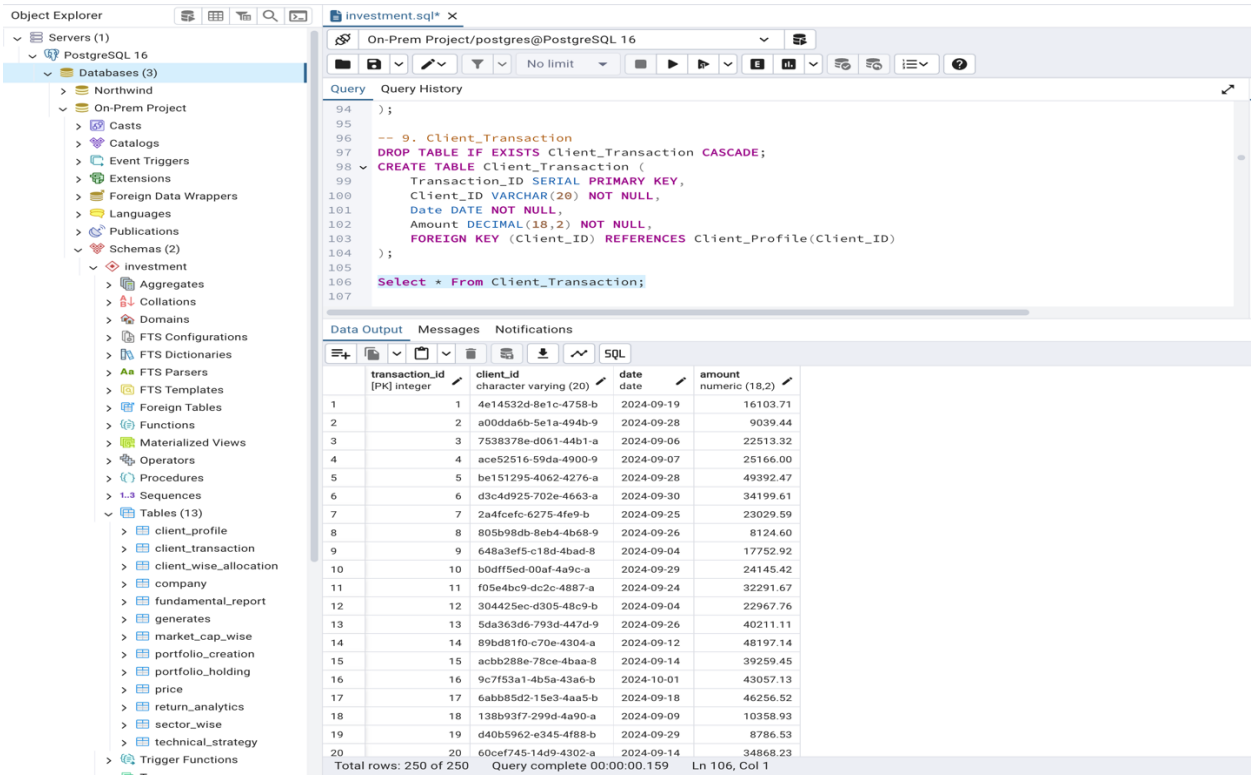
7. Client_Profile:



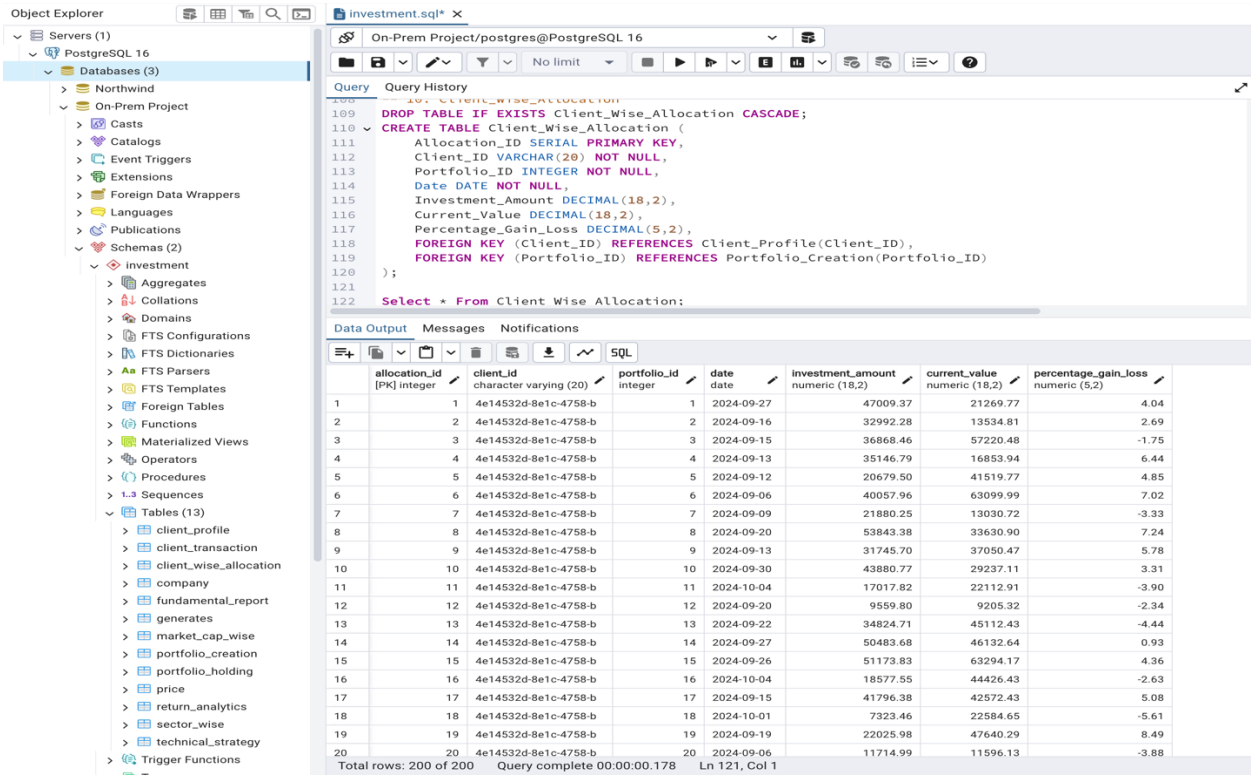
8. Generates:



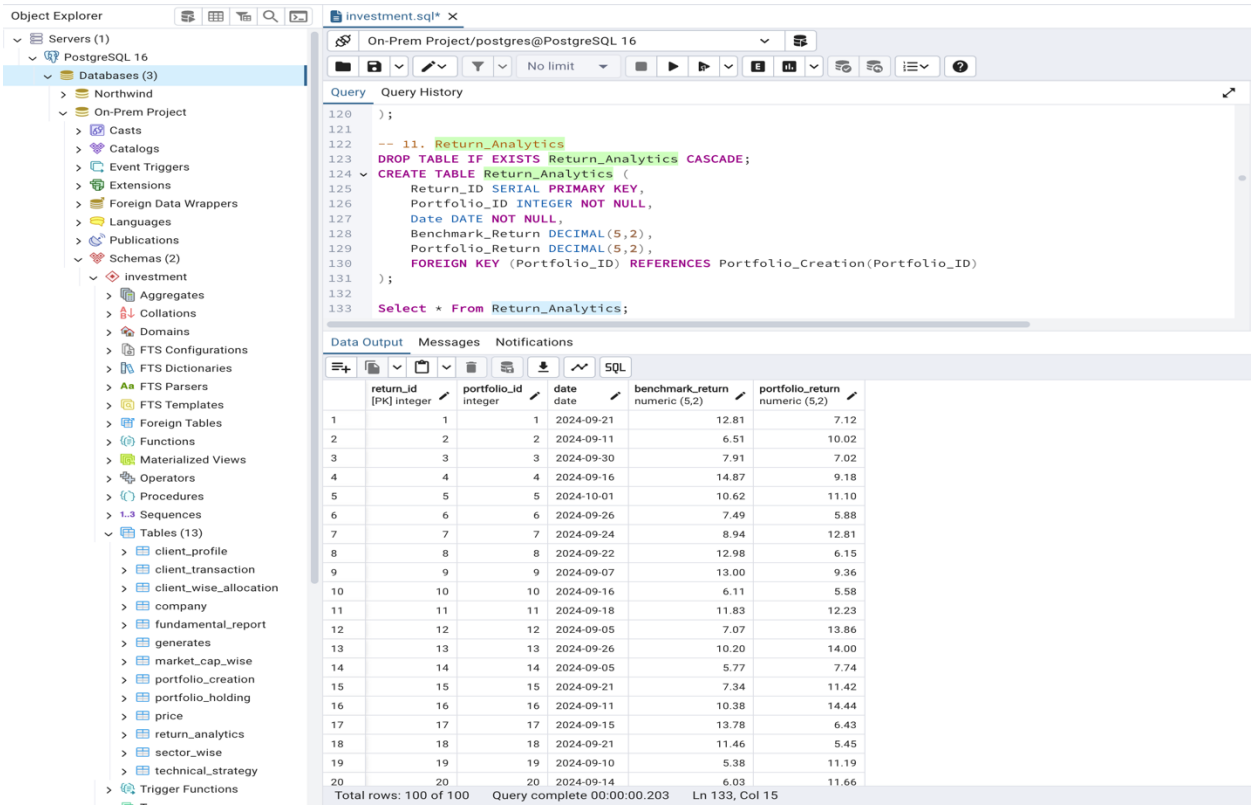
9. Client_Transaction:



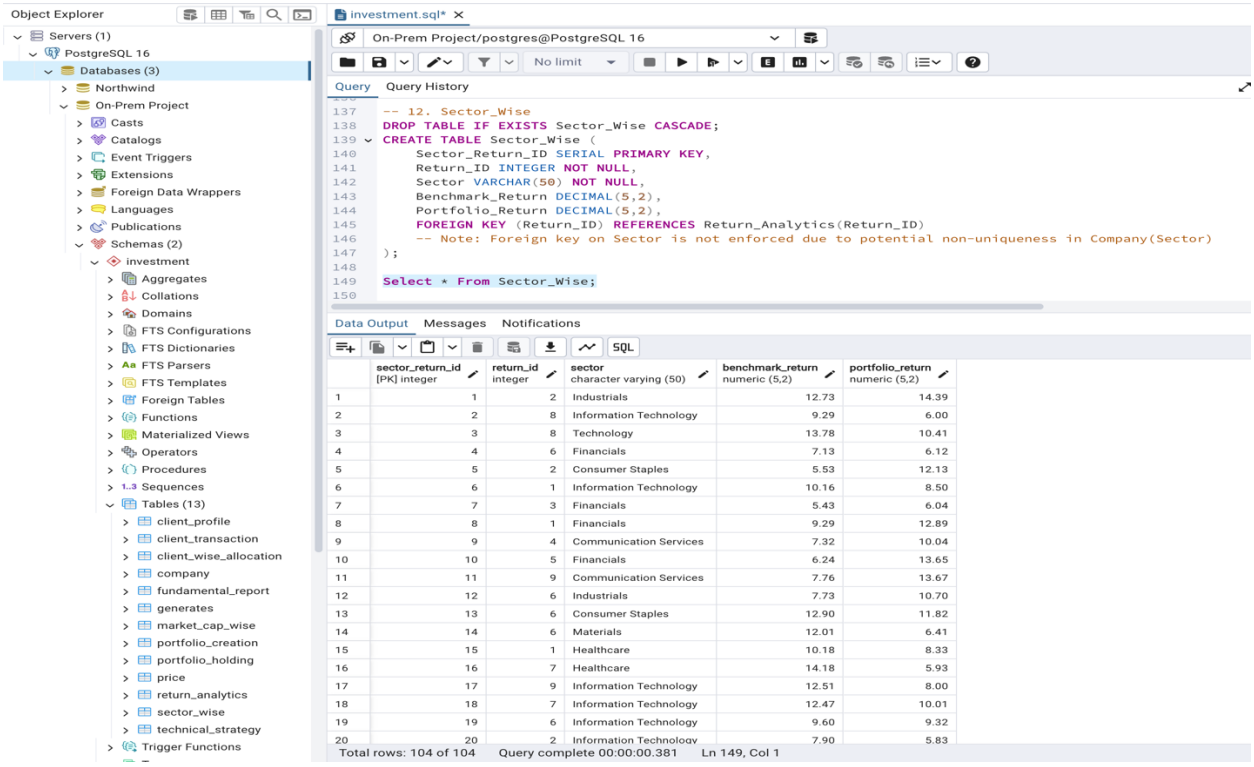
10. Client_Wise_Allocation



11. Return_Analytics:



12. Sector_Wise:



13. Market_Cap_Wise: