Part 2: Initial Portfolio Construction

Objective: Build and analyze an equal-weight portfolio from S&P 500 stocks.

Tasks:

1. Load preprocessed data from Part 1
2. Build equal-weight portfolio (w_i = 1/n)
3. Compute daily portfolio returns and simulate portfolio value

Deliverables:

- Daily portfolio returns time series
- Plot of portfolio value evolution from $100,000 initial investment

```
# Import libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from pathlib import Path

# Set plotting style
plt.style.use('default')
```

Task 1: Load Preprocessed Data

```
# Load data from Part 1
data_dir = Path('../Part 1: Data Acquisition & Preprocessing')
prices = pd.read_csv(data_dir / 'sp500_prices_5yr.csv',
                     index_col=0, parse_dates=True)
log_returns = pd.read_csv(data_dir / 'sp500_log_returns_5yr.csv',
                          index_col=0, parse_dates=True)
```

```python
tickers = list(prices.columns)
print(f'Loaded prices: {prices.shape}, log returns: {log_returns.shape}')

# Display the pre-loaded data
print("Displaying first 2 rows of the price data:")
print(prices.head(2))
print("Displaying first 2 rows of the log returns data:")
print(log_returns.head(2))
```

```
Loaded prices: (1254, 100), log returns: (1253, 100)
Displaying first 2 rows of the price data:
                AAPL       GOOG      GOOGL        AMZN       AVGO  \
Date
2020-08-07  108.203773  74.282959  74.471878  158.373001  28.915096
2020-08-10  109.776505  74.362976  74.394836  157.408005  29.041964

                BRK-B        COST       ABBV        BAC        CVX  ...  \
Date                                                                 ...
2020-08-07  209.479996  314.168213  75.978493  23.083563  69.710861  ...
2020-08-10  212.580002  313.329590  75.536942  23.481400  72.063995  ...

                ACGL          A          BR        BRO        DXCM  \
Date
2020-08-07  30.894695  94.532822  124.429184  44.604282  110.175003
2020-08-10  31.122908  93.914055  125.671204  44.478371  105.305000

                 STZ         AWK        AEE        ADM         AVB
Date
2020-08-07  158.571655  136.478394  71.071007  38.364449  129.755508
2020-08-10  158.506943  135.858887  71.996384  38.765251  129.704880

[2 rows x 100 columns]
Displaying first 2 rows of the log returns data:
                AAPL      GOOG     GOOGL      AMZN      AVGO     BRK-B  \
Date
2020-08-10  0.014430  0.001077 -0.001035 -0.006112  0.004378  0.014690
2020-08-11 -0.030191 -0.010603 -0.010936 -0.021671 -0.010224  0.000376

                COST      ABBV       BAC       CVX  ...     ACGL         A  \
Date                                                  ...
2020-08-10 -0.002673 -0.005828  0.017088  0.033198  ...  0.00736 -0.006567
2020-08-11 -0.022516  0.003134  0.013463 -0.001227  ...  0.00366 -0.008685
```

```
                  BR       BRO      DXCM       STZ       AWK       AEE  \
Date
2020-08-10  0.009932 -0.002827 -0.045209 -0.000408 -0.004550  0.012936
2020-08-11  0.039544 -0.005896 -0.024197  0.008248 -0.042208 -0.025426

                 ADM       AVB
Date
2020-08-10  0.010393 -0.000390
2020-08-11 -0.002250 -0.013484

[2 rows x 100 columns]
```

Task 2: Build Equal-Weight Portfolio

```python
# Build equal-weight portfolio
n = len(tickers)
weights = pd.Series(1.0 / n, index=tickers)
print(f'Equal weight per stock: {weights.iloc[0]:.4f}')

# Display portfolio weights
print("Displaying first 5 portfolio weights:")
print(weights.head(5))
```

```
Equal weight per stock: 0.0100
Displaying first 5 portfolio weights:
AAPL     0.01
GOOG     0.01
GOOGL    0.01
AMZN     0.01
AVGO     0.01
dtype: float64
```

Task 3: Compute Portfolio Returns and Value

```python
# Compute daily portfolio returns
portfolio_returns = log_returns.dot(weights)
# Simulate portfolio value from $100,000
initial_value = 100000
```

```
portfolio_value = initial_value * (1 + portfolio_returns).cumprod()
print(f'Final portfolio value: ${portfolio_value.iloc[-1]:,.2f}')
```

```
Final portfolio value: $188,671.72
```

Deliverable 1: Daily Portfolio Returns Time Series

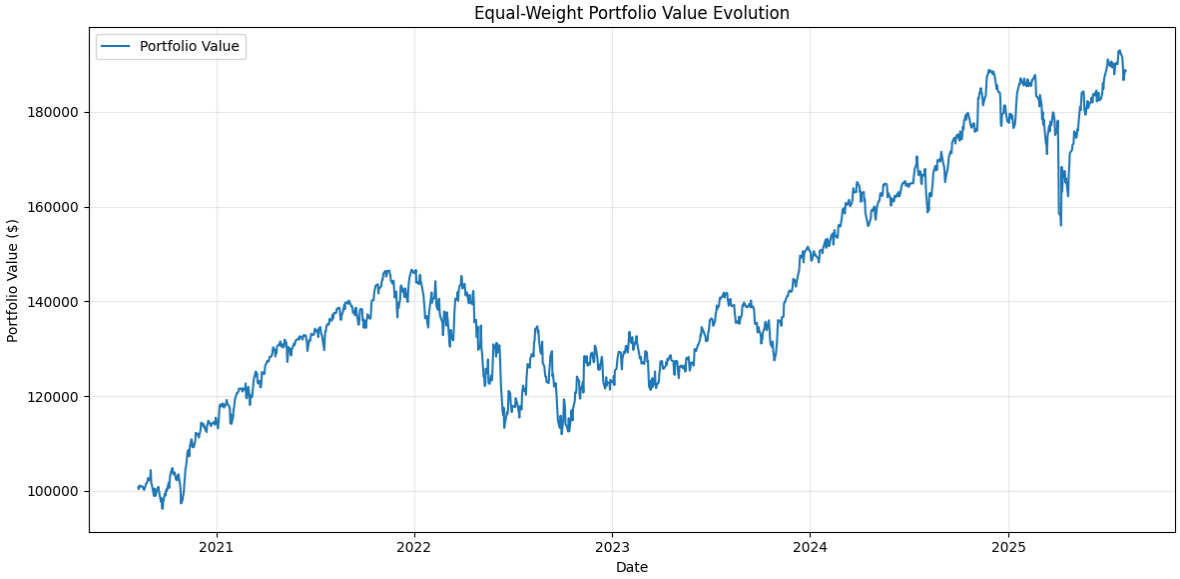
```
# Show first 5 rows
print("Displaying first 5 rows of portfolio returns:")
display(portfolio_returns.head())
```

```
Displaying first 5 rows of portfolio returns:
```

```
Date
2020-08-10    0.006132
2020-08-11   -0.002505
2020-08-12    0.007602
2020-08-13   -0.002229
2020-08-14    0.000762
dtype: float64
```

Deliverable 2: Portfolio Value Plot

```
plt.figure(figsize=(12,6))
plt.plot(portfolio_value, label='Portfolio Value')
plt.title('Equal-Weight Portfolio Value Evolution')
plt.xlabel('Date')
plt.ylabel('Portfolio Value ($)')
plt.legend()
plt.grid(True, alpha=0.3)
plt.tight_layout()
plt.show()
```


Equal-Weight Portfolio Value Evolution
Portfolio Value
180000
160000
140000
120000
100000
Portfolio Value ($)
2021
2022
2023
2024
2025
Date