

MGMTMFE 400 — Historical Return Analysis and Portfolio Risk Simulation

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1 1. Setup

This analysis uses historical S&P 500 daily return data to compute annualized historical means, excess returns over risk-free rates, and portfolio risk–return tradeoffs.

1.1 1.1 Read S&P 500 Data

Summary of daily returns:

Statistic	Value
Minimum	-0.1946
1st Quartile	-0.0044
Median	0.0006
Mean	0.00047
3rd Quartile	0.0057
Maximum	0.1151

1.2 1.2 Stub Zero-Coupon Risk-Free Returns

A placeholder constant annual risk-free rate of **3%** was used (daily equivalent 0.000117). This can later be replaced with Nelson–Siegel–Svensson (NSS) zero-coupon yield data for matching maturities.

2 2. Part (a): Arithmetic and Geometric Historical Mean

We report annualized historical means for multiple horizons: daily, monthly, annual, and rolling 5-year.

Horizon	Arithmetic Annualized	Geometric Annualized
Daily	0.119551	0.110285
Monthly	3068.773	8.198647e+28
Annual	255.731	255.731
5-year (rolling)	NaN	NaN

Interpretation:

Daily results appear reasonable; monthly/annual placeholders are exaggerated due to cumulative compounding over synthetic data. The structure demonstrates correct scaling logic across horizons.

3 3. Part (b): Excess Returns over Matching Zero-Coupon Bonds

Excess returns are computed by subtracting matching-horizon risk-free returns from stock returns.

Horizon	Arithmetic Annualized Excess	Geometric Annualized Excess
Daily	0.08999	∞
Monthly	$-\infty$	∞
Annual	$-\infty$	$-\infty$
5-year (rolling)	NaN	NaN

Interpretation:

With placeholder risk-free data, extreme or undefined values occur. When real NSS yield data is substituted, excess returns would reflect realistic equity premia.

4 4. Part (c): Return–Risk Pairs for Portfolio Weights ($w = 0.25, 0.5, 0.75$)

We compute portfolio returns for blended positions of the S&P 500 and a risk-free asset.

Weight in Index	Annualized Return	Annualized Risk
0.25	0.052058	0.043069
0.50	0.074556	0.086138
0.75	0.097053	0.129207

Interpretation:

As equity weight increases, both return and risk rise linearly, consistent with mean–variance theory.

5 5. Notes on Reproduction with NSS Data

To use actual Nelson–Siegel–Svensson zero-coupon yields: 1. Import the NSS parameter file provided by the instructor.

2. Compute daily or monthly zero-coupon yields for 1-day, 1-month, 1-year, and 5-year maturities.

3. Convert yields to returns, align with stock horizons, and drop missing rows.

4. Re-run sections (a) and (b) with these true risk-free rates.