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Project Progress Report 3

### Project Summary

CAPM is a fundamental model in finance used for asset pricing, portfolio management, and risk assessment. It is widely adopted by financial institutions, corporations, and investors to estimate expected returns and manage risk. The basic CAPM estimates expected returns based on systematic risk and serves as a benchmark for evaluating more advanced models. This project compares traditional financial models and machine learning models for equity valuation by assessing predictive accuracy using identical datasets and factors. The study also segments by industry sectors to evaluate model robustness and adaptability, ultimately identifying the best-performing approach for each.

### This Week

#### 1. Factor Engineering and Model Building

This week, I began the factor engineering and model-building phase by downloading a small sample dataset and initiating the coding process for feature creation. This involved writing functions to generate the required factors.

#### 2. Traditional Models and Factor Requirements

##### CAPM (Capital Asset Pricing Model)

Formula: E(R\_i) = R\_f + β\_i (E(R\_m) - R\_f)

Factors: R\_m = Market Return, R\_f = Risk-Free Rate, β\_i = Beta

##### Black CAPM

Formula: E(R\_i) = β\_i E(R\_m)

##### Fama-French Three-Factor Model

Formula: E(R\_i) = R\_f + β\_m (R\_m - R\_f) + β\_SMB + β\_HML

Factors: Size Factor (SMB), Value Factor (HML)

##### Carhart Four-Factor Model

Formula: E(R\_i) = R\_f + β\_m (R\_m - R\_f) + β\_SMB + β\_HML + β\_UMD

Factors: Momentum Factor (UMD)

##### Fama-French Five-Factor Model

Formula: E(R\_i) = R\_f + β\_m (R\_m - R\_f) + β\_SMB + β\_HML + β\_RMW + β\_CMA

Factors: Investment Factor (CMA), Profitability Factor (RMW)

##### Pastor-Stambaugh Liquidity Model

Formula: E(R\_i) = R\_f + β\_m (R\_m - R\_f) + β\_SMB + β\_HML + β\_LIQ

Factors: Liquidity Factor (LIQ)

##### Q-Factor Model

Formula: E(R\_i) = R\_f + β\_m (R\_m - R\_f) + β\_ME + β\_I + β\_ROE

Factors: ROE Factor

##### Consumption CAPM (CCAPM)

Formula: E(R\_i) = R\_f + β\_C E(ΔC/C)

Factors: Consumption Growth

##### Intertemporal CAPM (ICAPM)

Formula: E(R\_i) = R\_f + β\_m (R\_m - R\_f) + ∑ β\_k Z\_k

Factors: Additional State Variables (Z\_k)

##### Stochastic Discount Factor Models (Generalized Approach)

Formula: Various macroeconomic and financial indicators to be determined.

### Next Steps

- Finalizing sector and equity selection for factor portfolios for each sector.

- Expanding data collection to include full datasets required for model training.

- Continuing factor engineering, ensuring proper alignment with model specifications.

- Coding the machine learning pipeline for factor-based predictive modeling.

- Evaluating the consistency of factors across different time periods and industry sectors.