

Comparative Analysis of Asset Pricing Models: CAPM, APT, and Fama-French Factors Over Indian Stocks

Progress Report

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Introduction

Asset pricing models form the backbone of financial economics, helping investors and analysts understand the relationship between risk and expected return. This project aims to examine the practical effectiveness of three major asset pricing models—Capital Asset Pricing Model (CAPM), Arbitrage Pricing Theory (APT), and the Fama-French Three-Factor (FFF) model—within the Indian stock market. The project uses three representative stocks from different sectors: Infosys (IT), Reliance Industries (Energy), and HDFC Bank (Banking).

Objectives

The project's objective is to analyze the monthly returns of Infosys, Reliance, and HDFC Bank using CAPM, APT, and Fama-French 3-Factor models. These involves:

- Quantifying their risk exposures (market, macroeconomic, size, value).
- Determining if they generated "Alpha" (returns beyond expected risk compensation) for each stock across all three asset pricing models.
- Comparing which model best explains their returns.
- Providing insights for investors on risk management and performance evaluation.

Methodology

This project follows a structured methodology to analyze and compare the performance of three prominent asset pricing models—CAPM, APT, and the Fama-French Three-Factor model—using Indian equity market data. The following steps were undertaken:

1. **Selection of Stocks:** Three representative Indian stocks were selected from diverse sectors: Infosys (IT), Reliance Industries (Energy), and HDFC Bank (Banking).
2. **Data Collection:** Historical monthly stock prices (2012 - 2025,May) were obtained from Yahoo Finance. The NIFTY 50 index was used as a market benchmark. The risk-free rate was approximated using the monthly 10-Year Indian Government Bond Yield .
3. **CAPM Implementation:**
 - Monthly excess returns has computed for each stock.
 - A linear regression has performed between the stock's excess return and the market excess return to estimate beta.
4. **Fama-French Model:**
 - SMB (Small Minus Big) and HML (High Minus Low) factors has constructed based on market capitalization and book-to-market ratio of a wider stock universe.
 - A three-factor regression will be applied using market return, SMB, and HML factors.
5. **APT Model:**
 - Macro-economic factors such as inflation rate, interest rate, GDP growth, and exchange rate (USD/INR) will be selected based on economic relevance.
 - These factors will be collected monthly from official sources such as RBI, MOSPI, and World Bank.
 - Multiple linear regression will be used to relate stock returns to these macroeconomic variables.
6. **Comparative Analysis:**
 - Model performance will be evaluated using statistical metrics.
 - Interpretation focused on explanatory power, stability, and economic relevance.

Works Completed So Far

- Initially, a detailed study was conducted on mean-variance portfolio theory to understand the risk-return optimization framework. Following this, the theoretical structures and assumptions of CAPM, APT, and FFF were reviewed from books and papers.
- The stock data for Infosys, Reliance, and HDFC Bank were collected from Yahoo Finance along with NIFTY 50 index data and the risk-free rate which was approximated using the monthly 10-Year Indian Government Bond Yield to implement CAPM model.
- All required datasets for both CAPM and FFF models have been prepared and preprocessed, and CAPM model has been fitted on the selected stocks.
- CAPM was successfully applied using excess return calculations and regression analysis to estimate beta values and also initial results were generated.

Next Steps

The next phase involves fitting FFF model on the Preprocessed dataset for FFF model, collecting and preprocessing data for APT model and also implementing the APT model on the preprocessed dataset. These include:

- the FFF model will be implemented using market excess return, size (SMB), and value (HML) factors, which were constructed using Indian stocks data.
- Selecting relevant macroeconomic factors such as inflation rate, interest rate, exchange rate, and GDP growth.
- Downloading and cleaning monthly macroeconomic data.
- Aligning macroeconomic data with monthly stock returns to form the APT dataset.
- Fitting the APT model and conducting a comparative performance analysis across all three models.