Finance and Analytics Club

FAMA FRENCH AND BLACK LITTERMAN MODEL

A NOVEL INTEGRATION OF THE FAMA–FRENCH AND BLACK LITTERMAN MODELS TO ENHANCE PORTFOLIO MANAGEMENT .

TABLE OF CONTENT

INTRODUCTION TO THE

RESEARCH PAPER

KEYWORDS AND DEFINITIONS

1) **Black–Litterman portfolio model**: A Bayesian-based portfolio optimization framework that blends market equilibrium with investor views to enhance asset allocations.

2) **Fama–French three-factor model**: An asset pricing model incorporating three factors—market risk, size effect (Small Minus Big, SMB), and value effect (High Minus Low, HML)—to explain asset returns.

3) **Mean-variance portfolio model**: Introduced by Markowitz, it aims to optimize a portfolio's return against its risk by considering variances and covariances of asset returns.

4) **Estimation error**: Errors that arise from predicting asset returns based on historical data, impacting portfolio optimization models.

5) **Asset allocation**: The distribution of investments across various asset classes to optimize return-risk trade-offs.

6) **Asset pricing**: The method used to determine the fair value of an asset based on expected returns and risk factors.

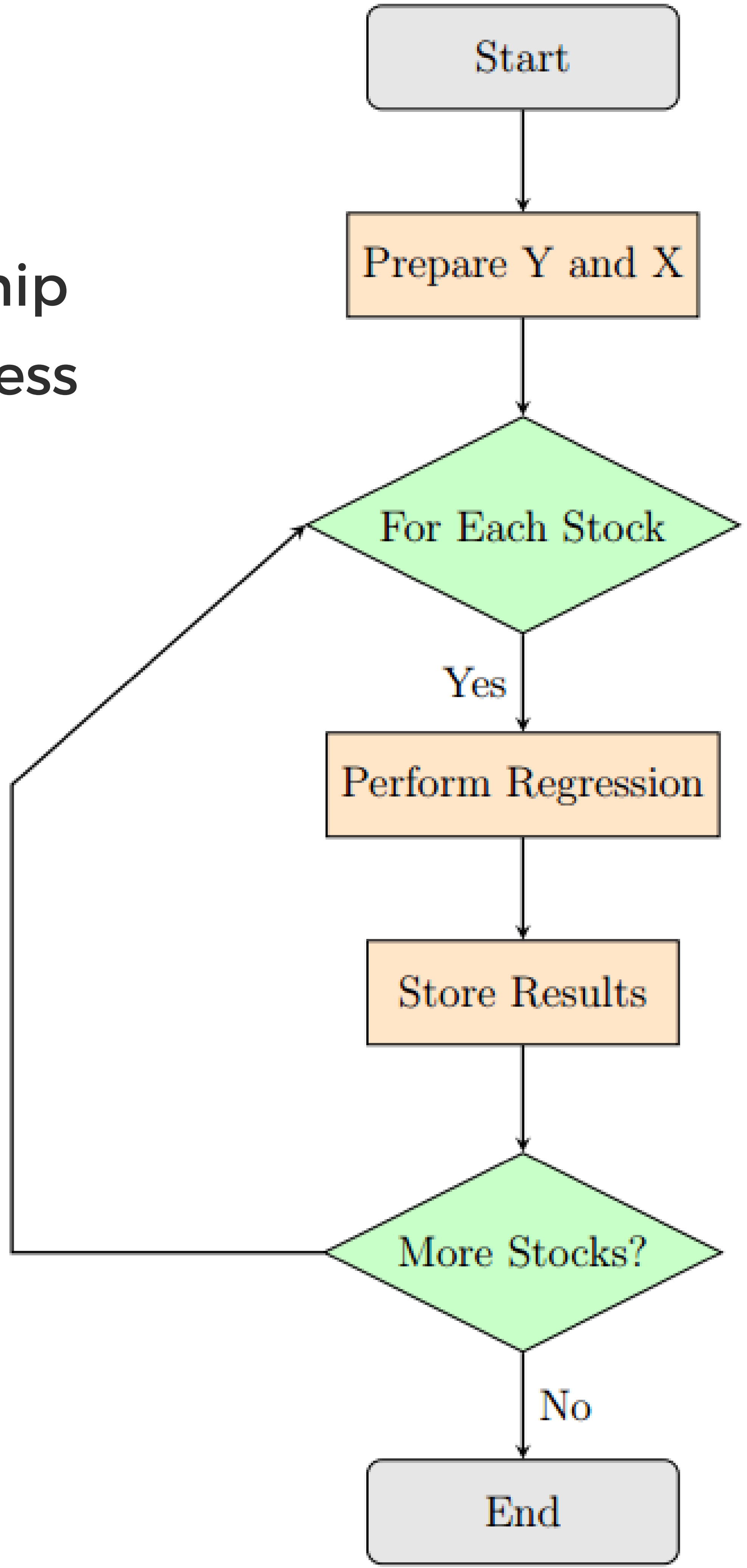
FAMA FRENCH 3 FACTOR MODEL

The Capital Asset Pricing Model (CAPM) describes the relationship between the expected return of an investment and its risk. It assess the expected return on assets, particularly stocks, given the risk relative to the market.

The Fama-French Three-Factor Model extends the traditional Capital Asset Pricing Model (CAPM) by adding two additional factors—size (SMB) and value (HML)—to explain stock returns more effectively than using market risk alone.

Formula Overview

$$Rp - Rf = \alpha + \beta m\,(Rm - Rf) + \beta smb \cdot (SMB) + \beta hml \cdot (HML)$$

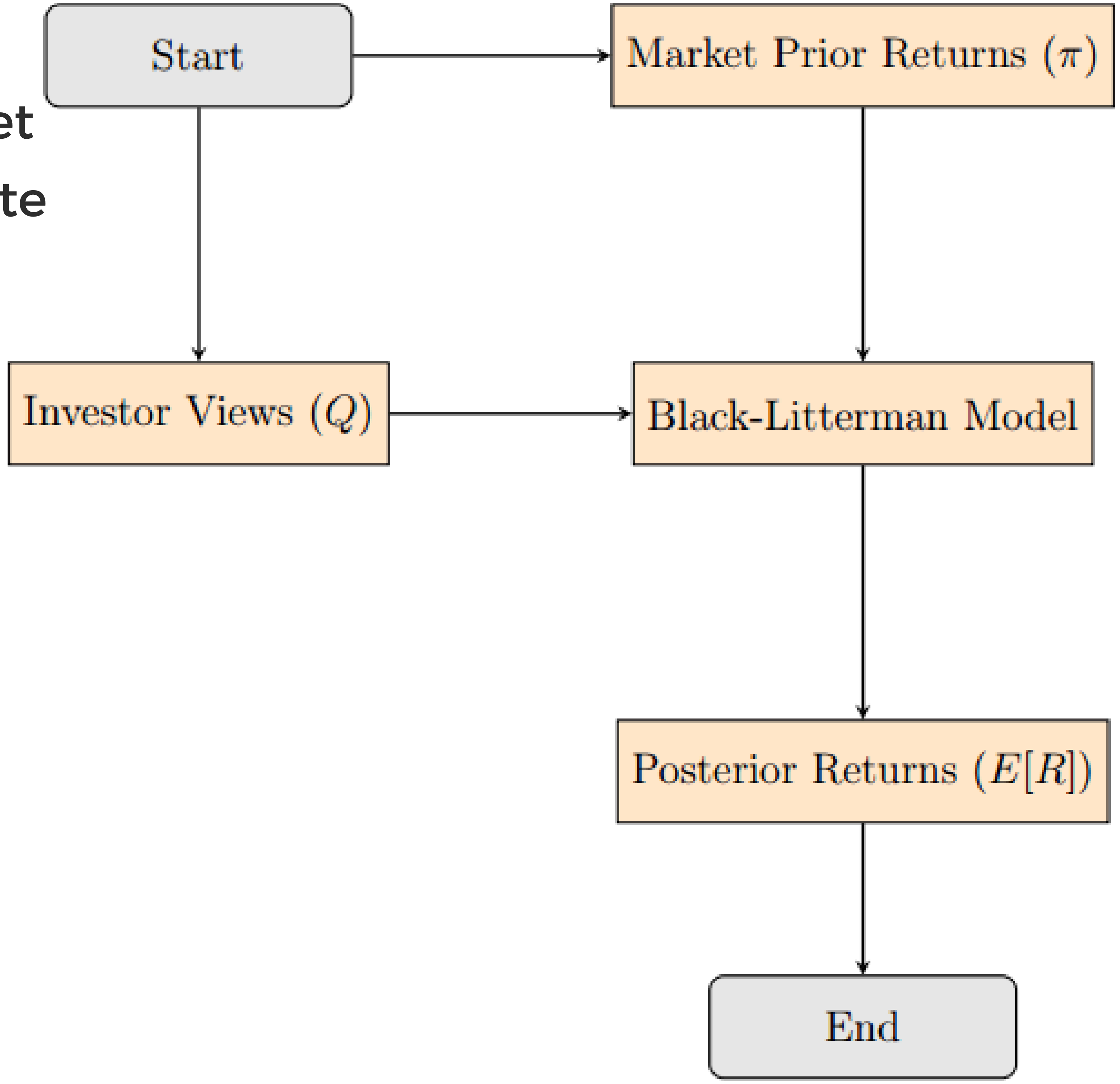


BLACK LITTERMAN MODEL

The Black–Litterman model is a sophisticated asset allocation framework that combines the (CAPM) market equilibrium with the investor's subjective views to create a more robust portfolio optimization method.

Formula Overview

- Implied Equilibrium Returns:
  $\Pi = \lambda \Sigma w_m$
  where:
  - Π is the vector of implied equilibrium excess returns,
  - λ is the risk aversion coefficient,
  - Σ is the covariance matrix of returns,
  - w_m is the market capitalization weight vector of assets.
- Posterior Returns (after incorporating views): $\mu_{BL} = \left((\tau\Sigma)^{-1} + P^T\Omega^{-1}P\right)^{-1}\left((\tau\Sigma)^{-1}\Pi + P^T\Omega^{-1}Q\right)$ where:
  - μ_{BL} is the posterior expected returns,
  - τ is a scaling factor (usually a small positive number),
  - P is the matrix of views,
  - Ω is the covariance matrix of the views,
  - Q is the vector of view returns.

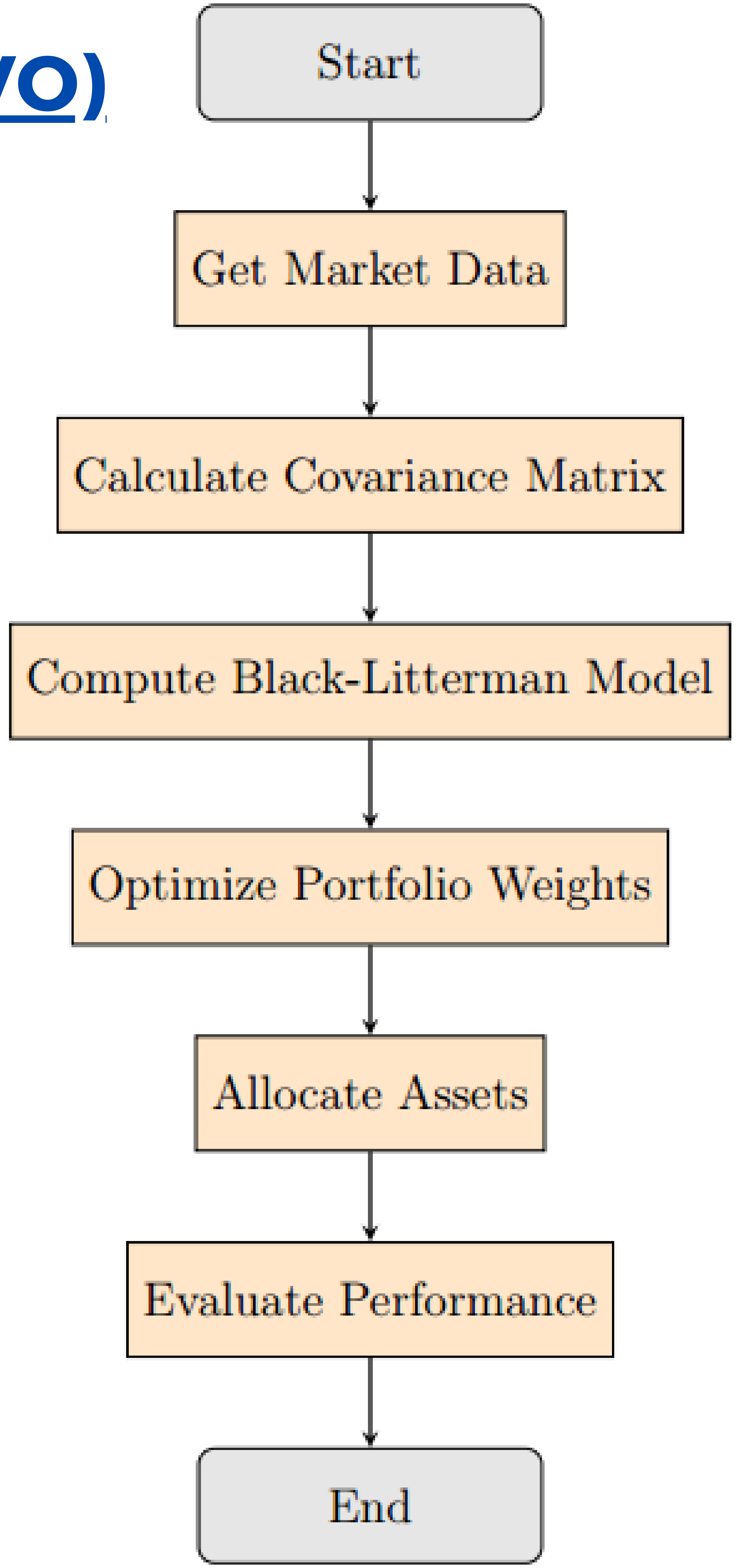


MARKOWITZ'S MEAN-VARIANCE OPTIMIZATION (MVO)

MVO is a mathematical framework to construct an optimal portfolio by maximizing expected return for a given level of risk or equivalently, minimizing risk for a given expected return. The model uses the expected returns, variances, and covariances of assets to balance risk and return .

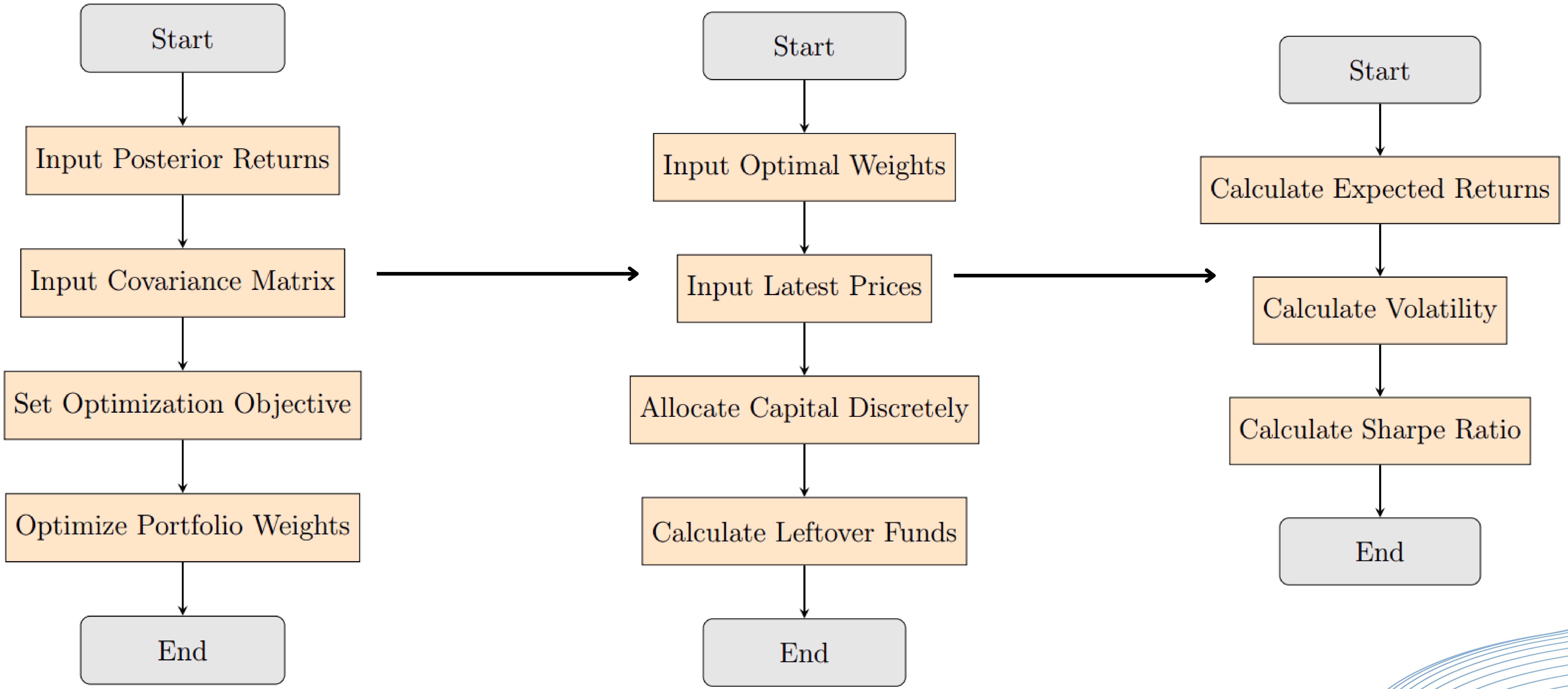
Formula Overview

- Minimize portfolio variance:
  $\sigma_p^2 = w^T \Sigma w$ where:
  - σ_p^2 is the portfolio variance,
  - w is the vector of portfolio weights,
  - Σ is the covariance matrix of asset returns.
- Subject to an expected return constraint: $E(r_p) = w^T E(r)$ where:
  - $E(r_p)$ is the expected portfolio return,
  - w is the vector of portfolio weights,
  - $E(r)$ is the vector of expected asset returns.



METHODOLOGY

PROCESS FLOWCHART



EMPIRICAL RESULTS

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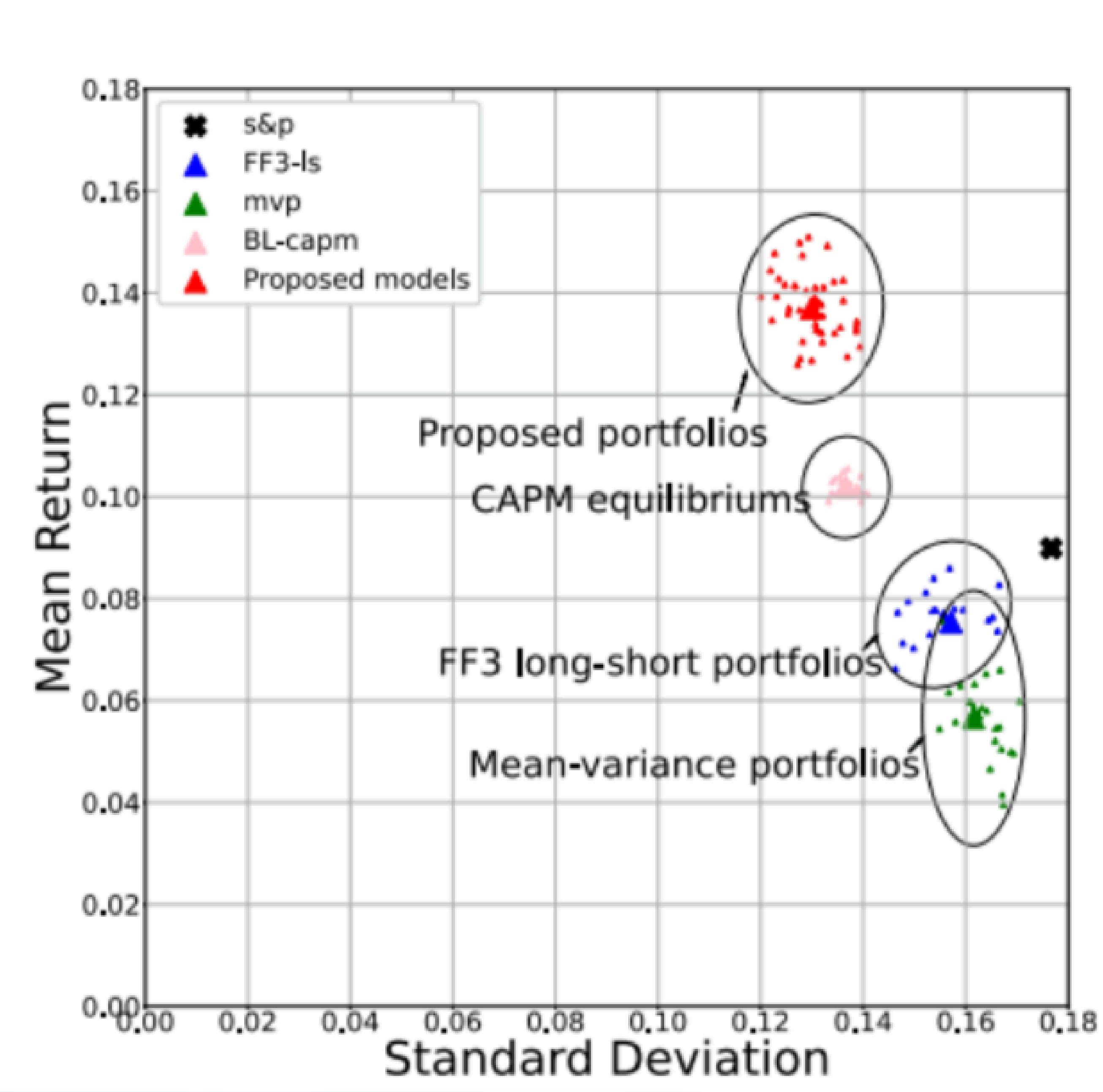

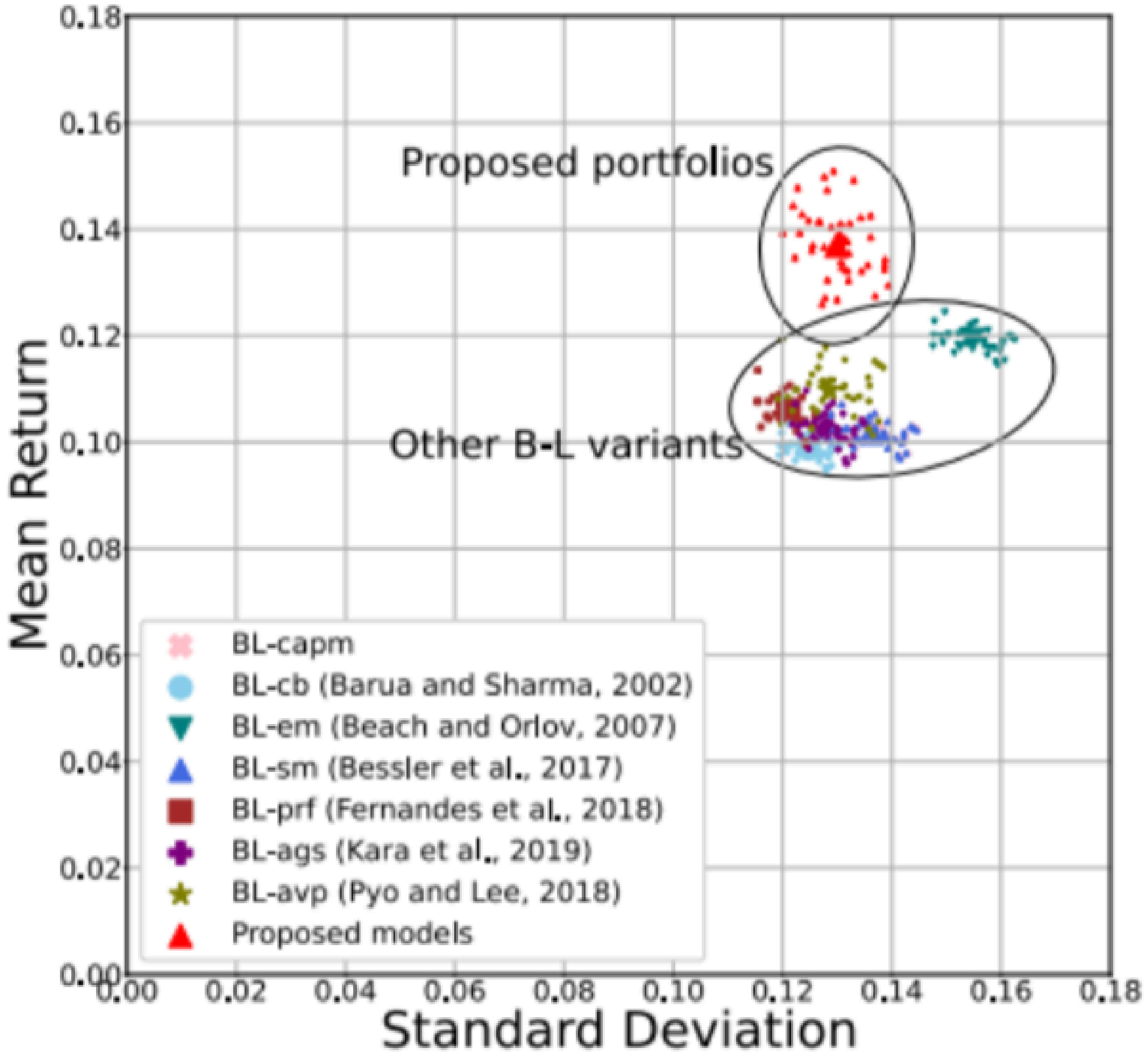

Portfolio Models	Mean Ret.	Std.	Skew.	Kurto.	SR	CER	α
Panel A: Classical models							
s&p	0.090	0.177	−1.39	1.915	0.395	0.074	–
FF3-ls	0.075	0.157	0.352	0.873	0.360	0.063	0.043
mvp	0.057	0.162	−1.669	3.242	0.231	0.043	0.035
mvp (in-sample)	0.285	0.041	0.190	−1.398	6.641	0.284	0.288
Panel B: B–L models							
BL-capm	0.102	0.137	−1.246	1.760	0.599	0.092	0.040
BL-cb	0.099	0.125	−1.052	1.179	0.631	0.091	0.043
BL-em	0.119	0.155	−1.304	1.780	0.641	0.107	0.049
BL-sm	0.102	0.136	−1.249	1.768	0.600	0.092	0.040
BL-prf	0.106	0.120	−1.412	2.694	0.717	0.099	0.053
BL-ags	0.102	0.128	−1.018	1.474	0.643	0.094	0.045
BL-avp	0.110	0.129	−0.944	1.701	0.699	0.101	0.055
Proposed (FF3 view)	0.137	0.130	−0.903	1.817	**0.902**	**0.128**	**0.099**

ROBUSTNESS CHECKS

Model	SR			CER		
	Low volatility	High volatility	Total	Low volatility	High volatility	Total
FF3-ls	0.743 (−5.8***)	−0.438 (−8.4***)	0.360 (−9.3***)	0.105 (−1.2)	−0.038 (−9.0***)	0.063 (−12.9***)
mvp	1.105 (−1.7)	−0.181 (−10.1***)	0.231 (−13.2***)	0.095 (−6.5***)	−0.047 (−9.3***)	0.043 (−14.2***)
BL-capm	1.193 (0.0)	0.419 (0.0)	0.599 (0.0)	0.115 (0.0)	0.073 (0.0)	0.092 (0.0)
BL-cb	1.291 (2.9**)	0.379 (−3.0***)	0.631 (2.1*)	0.123 (4.8***)	0.065 (−5.3***)	0.091 (−1.4)
BL-em	1.276 (4.3***)	0.443 (2.2**)	0.641 (2.6**)	**0.132** (10.8***)	0.081 (5.5***)	0.107 (12.4***)
BL-sm	1.208 (0.7)	0.415 (−0.4)	0.600 (0.0)	0.116 (0.3)	0.072 (−0.6)	0.092 (−0.1)
BL-prf	1.458 (8.4***)	0.626 (7.5***)	0.717 (5.5***)	0.118 (2.2**)	0.087 (7.6***)	0.099 (4.5***)
BL-ags	1.408 (6.6***)	0.419 (0.0)	0.643 (2.5**)	0.121 (4.2***)	0.071 (−1.1)	0.094 (1.3)
BL-avp	1.375 (4.2***)	0.551 (2.8**)	0.699 (4.8***)	0.109 (−2.8**)	0.083 (1.9*)	0.101 (5.4***)
Proposed	**1.461** (3.1***)	**0.956** (28.8***)	**0.902** (11.3***)	0.124 (3.0***)	**0.151** (27.6***)	**0.128** (15.9***)

CONCLUSION

The paper presents a great integration of the Fama–French three-factor model with the Black–Litterman framework, effectively addressing key challenges in portfolio management such as estimation errors and market volatility sensitivity. The proposed model outperforms traditional benchmarks, significantly increasing the Sharpe ratio and providing more stable and diversified portfolios. This research contributes a novel methodology for view construction in the B–L framework, offering a practical and theoretically sound tool for real-world financial portfolio management.

THANK YOU