THE FF 3-Factor Model

\[ E(R^e) = \beta_1 E(t) + \mu \]

\[ R^e_t = \alpha + \beta_1 f_e + \epsilon_t \]

MODEL

"Many Patterns" - E(R^e), CAPM Failures

Anomalies are captured... E(R^e) is explained by sensitivity (\beta)

\[ E(R^e_t) - R^f_t = \beta_t [E(R^m_t) - R^f_t] + \gamma_t E(SMB) + \psi_t E(HML) + \epsilon_t \]

WHERE [\beta, \gamma, \psi]

\[ R^e_t - R^f_t = \alpha_t + \beta_t (R^m_t - R^f_t) + \gamma_t SMB_t + \psi_t HML_t + \epsilon_t \]

DATA

VALUE (BOOK/PRICE-SHARES)

SMB

25 Portfolios

3 Factors
TABLE 1A

2. THE FF MODEL

TABLE 1B - REGRESSION (2)

*$E(R)$ HIGHER $E(R)$

$\Rightarrow \beta$ DOES NOT WORK $E(R)$

$\Rightarrow \text{"ASSET PRICING" } \beta$

$b, h$ RISE WHERE $E(R)$ RISE (GRAPH)

$\Rightarrow \beta$ ARE SMALL (?) [MOSTLY, ECONOMICS STATISTICAL SIZE]

$Y = xb + \epsilon \Rightarrow \text{STAT ON $b, \epsilon$ ARE HUGE: IMPORTANT?}$

$R^2$ IS HUGE! IMPORTANT?

P.56 "A PARADOXIOUS DESCRIPTION OF RETURNS" AVERAGE RETURNS

$R^2$ "EXPLAIN VARIATION OVER TIME IN RETURNS"

2. "EXPLAIN VARIATION ACROSS PORTFOLIOS IN AVERAGE RETURNS"

$\Rightarrow \text{"CROSSSECTIONAL } R^2"$

$\Rightarrow \text{C DANGER} \Rightarrow \text{"FACTOR STRUCTURE"}$

$R^2: R^2 = n \cdot \beta \Rightarrow \text{CONCAVE} < \beta \geq \text{"FACTOR STRUCTURE"}$

$\Rightarrow \text{MODEL "EXPLAINS" CORRELATION NOT MEAN}$

$\Rightarrow \text{INPUT APT ASSUMPTION GOOD}$

$\Rightarrow \text{Table 1B IS DATA FOR MAIN ER POINT: NOT RESULTS!}$

P.57 "YES" $\Rightarrow \epsilon_1^2 = 0$?

- THE MOST FAMOUS MODEL OF THE LAST 40 YEARS IS
  DECISETIVELY REJECTED!

- "GLASS IS 90% FULL" SHOW THE DATA STYLE!
3. USING THE 3 FACTOR MODEL

TAUTOLogy? AA? \rightarrow OTHER PUZZLes

TABLE II

- Buy stocks with STRONG sales growth (Google) OR DISASTROUS sales decline (Seals)?

- \beta should EXPLAIN FAILS

TABLE III

- 3F b, h, s, \ldots, \ldots
- Have we shown SLOW sales are VALUE stocks?
- SLOW SALES BEHAVELIKE VALUE stocks - THEIR \( \hat{E}(r) \) gives no advantage over NH
- "EXPLAIN" SALES anomaly (given \( E(\text{HML}) \))

4. HINEMANN REVERSAL

TABLE VI

- Do stocks show MOMENTUM, REVERSAL, or RANDOM WALK?

- TVI
- CAPM FAILS
- FF REVERSAL - "EXPLAIN" (given HML, E(\text{HML}))
- FF MOMENTUM - DISASTER

- Since FF: 0 "UMD" Winner-Loser "Explains" 1-10 MOMENTUM.
  (2) Did not go away (yet)

- 4F RAROR (routine), R\text{ARF}, H\text{ML, S\text{NB}, U\text{HD,}}
What is the FF 3F Model

CAPM: \[ E(R^i) = (R_f, \beta, \mu) \]

\[ E(R^i) = (R_f, \beta, \mu): E(R^M) + \beta \cdot \left[ E(R^M) - E(R_f) \right] \]

- **Objective:** Explain new given known. Evaluate managers.
- **Practical Applications:** p76
- **Models:** APT, CAPM, ICAPM, Multifactor, etc.
- **Deeper Explanation:** Which is F3F

"Parsemian Description of \( E(R^i) \)

\[ \beta \equiv APT, R^2 \text{ rule!} \]

Portfolios close to MML: \[ MVe = E(R^i) = \beta \]

We have not identified state variables. Mimicking portfolio theorem.

- **Story of State Variables:** Human capital multifactor model
- **Point:** Why does \( E(MHL) \) go?

"Rules of the game"/Avoid fishing.

Why so reluctant to call MML a factor? - desire to "explain"

Final Thought:

- FF Style Model
  - Anomaly Organization
  - Data Reduction: 3 (4) premiums, many gusts
  - Theory only needs to explain \( E(MFL), E(MHL) \) etc.
Most important rule

\[ E(R) = \alpha + \beta \text{SIZE} + \gamma \text{BM} \]

* Fama-French model says small value stocks get higher returns!

Description vs Explanation
- Characteristic vs Beta
- Who you are vs How you behave
  - If so fortunate to be made!
- "Explanation" must have R's

\[ E(R) = \beta_1 E(R_{MKT}) + \beta_2 E(R_{SMI}) \]

Options 1 Intro and Payoffs
- Object: Option Price \( P \to \text{Stock} + \text{Bond} \): "Relative Pricing" not "Explaination"
- Method: \( P = E(M) \) Learn about them from S&P
- Was "Arbitrage" now less so

**Payoffs**
- \( C_t = \max(S_t - K, 0) \)
- \( P_t = \max(K - S_t, 0) \)
- \( X_t = \max(S_t - X, 0) \)

\( C_t = X_t \) Value at \( t \)

\( P_t \) Write Call

\( C_t = X_t \) Payoff (Price Profit)

\( P_t \) Write Put

\( C_t = X_t \) Asset Pricing

\( P_t \) \( S > 100 \) Put

"Buy disaster insurance"
- Stock, Call, Put
- Habits? Bank, expensive?