Predictive versus Explanatory Models in Asset Management

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Predictability versus Explanatory Models

Predictive model (example): [Model 1]

\[ r_{it} = a_{i0} + a_{i1} YS_{t-1} + e_{it} \]

Here the lagged Yield Spread predicts returns

• The residuals are \( e \)
• Models have low \( R^2 \)s
Predictability versus Explanatory Models

Factor models are explanatory (example):

[Model 2]
\[ r_{it} = \alpha_{i0} + \beta_{i1} F_t + \nu_{it} \]

Here the contemporaneous factor, say MSCI world, explains returns.

• Let \( r \) represent “excess” returns
• Models have high \( R^2 \)s
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Factor models are explanatory (example):

\[ r_{it} = \alpha_{i0} + \beta_{i1} F_t + v_{it} \]

\( \beta_{i1} \) represents factor “loading”, “sensitivity”, or “beta”

- For a given change in the factor, how much should the return on asset i move?
Asset pricing models link the betas to expected returns - across many assets:

Hope to see a positive relation between beta and expected return.
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4) When betas are assumed fixed, the CAPM does a poor job of explaining expected returns.
5) When betas are allowed to change through time, the CAPM does a better job of explaining expected returns.
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How can we get betas to change?

A) Estimate rolling model, five-year window of data
B) GARCH (ratio of covariances to variances)
C) Dynamic linear factor model (make assumption on how beta changes)
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Dynamic linear factor model:

\[ r_{it} = \alpha_{i0} + \beta_i F_t + v_{it} \]

Assume beta is a function of something, say, lagged interest rate.

\[ \beta_{it} = c_{oi} + c_{i1} I_{t-1} \]

Substitute this for the usual beta
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Dynamic linear factor model:

\[ r_{it} = \alpha_{i0} + [c_{oi} + c_{i1} I_{t-1}] F_t + v_{it} \]

Rewrite

\[ r_{it} = \alpha_{i0} + c_{oi} F_t + c_{i1} I_{t-1} F_t + v_{it} \]
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Dynamic linear factor model:

\[ r_{it} = \alpha_i + c_{oi} F_t + c_{i1} I_{t-1} F_t + v_{it} \]

Now regression has two coefficients: \( c_{oi} \)
which is like the old constant beta

The \( c_{i1} \) is the coefficient on a new variable,
\((I_{t-1}F_t)\), which is just the product of the
MSCI world and lagged interest rates.
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Dynamic linear factor model:
Given we estimate $c_{oi}$, $c_{i1}$, we have our dynamic beta function

$$\beta_{it} = c_{oi} + c_{i1} I_{t-1}$$

Here the beta changes through time as $I_{t-1}$ changes through time. If $c_{i1}$ is positive, then betas are higher for this firm when interest rates are high.
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Asset pricing and dynamic betas:

We know risk changes through time. Hence, to give the asset pricing model the best possible shot, we should allow the betas to be dynamic.
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Predictability and Asset Pricing

**Unconditional CAPM**

Links average returns to average risk (fixed beta) - does not do a good job.
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Predictability and Asset Pricing

**Conditional CAPM**

Links predicted returns (across different assets) to conditional risk (dynamic betas) - does a better job.
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Predictability and Asset Pricing

Note:

Both unconditional and conditional models can be cast with multiple factors. I am using one factor only for presentation purposes.
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Predictability and Efficiency

Some of the predictability we document in model (1) could be due to risk shifting or risk premia shifting through time. This part of predictability is “rational”.
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Predictability and Efficiency

Some of the predictability we document in model (1) may **not** be explained risk premia shifting through time. This part of predictability is due to one of two things:
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Predictability and Efficiency

i) market inefficiency

ii) asset pricing model is misspecified
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Predictability Models in Asset Management

**Predictability Model 1:**

- Simple to use
- Predict returns, volatility, correlations and feed into asset allocation model
- No role for asset pricing model
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Explanatory Models in Asset Management

Explanatory Model 2:

- Forecast or take a stand on the Factor that will be realized, e.g. Factor is MSCI world. If you think it will go up, load up your portfolio with high beta stocks
- Sometimes called “tilt.”
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Explanatory Models in Asset Management

**Explanatory Model 2:**
- This model may work better if we model the betas to be dynamic. That is choose the stocks whose forecasted betas will be higher.
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What about the alpha?

Explanatory Model 2:

- There is another way to use the Explanatory Model (without forecasting the factors).
- The explanatory model has an alpha and a residual.
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What about the alpha?

Explanatory Model 2:

• The expected value of the alpha and residual is zero.
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What about the alpha?

Explanatory Model 2:
• Suppose beta=1 and market excess return increases by 10%. Suppose the stock excess return only goes up by 4%.
• The “alpha” (both the traditional alpha plus the residual) is 6%
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What about the alpha?

Explanatory Model 2:

- The “alpha” might have valuable information that could be incorporated into trading strategies.
- Will this stock “catch-up” 6% - or is there a reason it did not move with the market as it was expected based on the beta