TA Review 5

Portfolio and Risk Management

October 30, 2024

Tentative Schedule

Pricing Factors

Pricing Models vs LFD

Testing a Pricing Model

Other Important Points

AQR Value Spread

Midterm 1 Review

Unconditional vs Conditional Sorting

Homework 5

Pricing Factors

- Pricing Models are models about expected returns.
- Pricing Models claim that they can estimate the expected return of any asset with a set of factors.
- In the CAPM:

$$\mathbb{E}[\tilde{r}^i] = \beta_{i,m}\mathbb{E}[\tilde{r}^m]$$

- $\beta_{i,m}$ shows the relation between the factor and the expected return of asset i.

Pricing Factors

- If we our model is about expected returns, why are we using historical returns?
  - Because we need to estimate $\hat{\beta}_{i,m}$
  - Because it gives us the possibility to test the assumption.

Pricing Factors

- If we our model is about expected returns, why are we using historical returns?
  - Because we need to estimate $\hat{\beta}_{i,m}$
  - Because it gives us the possibility to test the assumption of the pricing model.

Pricing Factors

- In the CAPM,

$$\mathbb{E}[\tilde{r}^i] = \beta_{i,m}\mathbb{E}[\tilde{r}^m]$$

becomes:

$$\tilde{r}^i_t = \beta_{i,m}\tilde{r}^m_t + \varepsilon_t, \quad \text{where} \quad \mathbb{E}[\varepsilon_t] = 0$$

Which finally allows us to estimate $\hat{\beta}_{i,m}$

- But... should I care about the $\hat{\beta}_{i,m}$ of the model?

Factor Model User

- But... should I care about the $\hat{\beta}_{i,m}$ of the model?
- Model User
  - If I am an user of the model (if I believe the model is well specified) I mainly care about the $\hat{\beta}_{i,m}$. The $\hat{\beta}_{i,m}$
  - The $\hat{\beta}_{i,m}$ gives the expected return for ANY asset.

Factor Model Tester

- But... should I care about the $\hat{\beta}_{i,m}$ of the model?
- Testing the Model
  - If I am testing the model, I mainly care about knowing if it is well specified.
  - Our specification for the CAPM:

$$\tilde{r}_t^i = \beta_{i,m}\tilde{r}_t^m + \varepsilon_t, \quad \text{where} \quad \mathbb{E}[\varepsilon_t] = 0$$

Meaning, that any other parameter added should not be significant (for a large enough unbiased sample) to explain returns for asset i. Specially an intercept...

Factor Model Tester

- We can test if the data generating process assumed by the CAPM holds in the data by running the regression with an intercept:

$$\tilde{r}_t^i = \alpha_i + \beta_{i,m}\tilde{r}_t^m + \varepsilon_t$$

- If the CAPM holds, what should α_i be?

Factor Model Tester

- α_i should be zero in population (or statistically non-significant in the sample).
- If α_i is not zero, it means that there is excess return not explained by the model.
- **Show linear regression animation.**

Factor Model Tester

- Recap: as a tester of the factor model, I worry about assuring that the suggested model holds.
- Adding an α_i allows us to check if there is, on average, excess return not related to the factor(s).

Factor Model Tester

- Factor Pricing Models claim to price every single asset (bold claim, right?).
- Therefore, we should test them broadly (not for a single asset).

Pricing Models vs LFD in the Time-Series

- We use regression for Pricing Models and LFD.
- LFD is about historical returns.
- Pricing Models are about expected returns.

Pricing Models vs LFD in the Time-Series

What should we care about R^2 in LFD and Pricing?

- In the time-series analysis of a factor model, is it a problem to have $R^2 = 0$ when we are testing it?
- What about when we are using it?
- In the LFD, is it a problem to have $R^2 = 0$?

Pricing Models vs LFD in the Time-Series

- In the time-series analysis of a factor model, is it a problem to have $R^2 = 0$ when we are testing it? **No. It means that your $\beta_{i,m} = 0$. As long as the asset expected return is the risk-free rate (there is no excess return for the asset, $\alpha_i = 0$), the model does not present issues.**
- What about when we are using it? **No. It means that your $\beta_{i,m} = 0$. It means that the expected return of the asset is the risk-free rate, meaning that you do not have a very attractive asset at hand.**

Pricing Models vs LFD in the Time-Series

- In the LFD, is it a problem to have $R^2 = 0$? **Yes. It means that your regressors are not able to capture variability of the target asset. If you are hedging, you are not able to hedge any risk. If you are tracking, your tracking instrument is expected to have a very poor performance**

Pricing Models vs LFD in the Time-Series

Should we care about α_i in LFD and Pricing?

- In the time-series analysis of a factor model, is it a problem to have $\alpha_i \neq 0$ when we are testing it?
- What about when we are using it?
- In the LFD, is it a problem to have $\alpha_i \neq 0$?

Pricing Models vs LFD in the Time-Series

- In the time-series analysis of a factor model, is it a problem to have $\alpha_i \neq 0$ when we are testing it? **Yes. it means that the asset is, on average, getting compensated more/less than the risk-free due to risk non-associated with the factor(s).**
- What about when we are using it? **You should not use an alpha in your regressor.**
- In the LFD, is it a problem to have $\alpha_i \neq 0$? **No. But the meaning you give to this α_i will help you decide how to use it in the regression.**

Pricing Models vs LFD in the Time-Series

Should we care about $\beta_{m,i}$ in LFD and Pricing?

- In the time-series analysis of a factor model, should I care about $\beta_{m,i}$ when we are testing it?
- What about when we are using it?
- In the LFD, should I care about $\beta_{m,i}$?

Pricing Models vs LFD in the Time-Series

- In the time-series analysis of a factor model, should I care about $\beta_{m,i}$ when we are testing it? **No, only** α_i
- What about when we are using it? **Yes. It will give you the expected return of the asset.**
- In the LFD, should I care about $\beta_{m,i}$? **Yes. It will give you exposure when assessing performance and positions when tracking and hedge**

Testing a Pricing Model

- All that was mentioned before holds for multifactor models.
- ...Now, how to properly to test a factor model?
  1. Select n test assets.
  2. Run n time-series regressions.
  3. From here, you can either:
     - Check the α_i values.
     - Run 1 cross-sectional regression.

To the board...

Testing a Pricing Model

Consider a factor model with p factors

Estimated by the regression in red

- Time-Series:

$$\tilde{r}_t^i = \alpha + \beta^{i,1}\tilde{r}_t^1 + \beta^{i,2}\tilde{r}_t^2 + \ldots + \beta^{i,p}\tilde{r}_t^n + \varepsilon_i$$

- Cross-Section:

$$\mathbb{E}[\tilde{r}^i] = \eta + \beta^{i,1}\lambda_1 + \beta^{i,2}\lambda_2 + \ldots + \beta^{i,p}\lambda_n + \nu_i$$

Metric	**Time-Series**	**Cross Sectional**
R^2	not important	important
Intercept	(α_i) important	(η) important
MAE	$\frac{1}{n}\sum_{i=1}^{n}\lvert\alpha_i\rvert$	$\frac{1}{n}\sum_{i=1}^{n}\lvert\nu_i\rvert$
Estimated	$\beta_{i,m}$	λ_m
Risk-Premia of Factor	$\bar{\tilde{r}}_m$ (avg)	λ_m

Table: Importance of Metrics for Pricing Model Tests

Other Important Points

- **Go to report**

AQR Value Spread

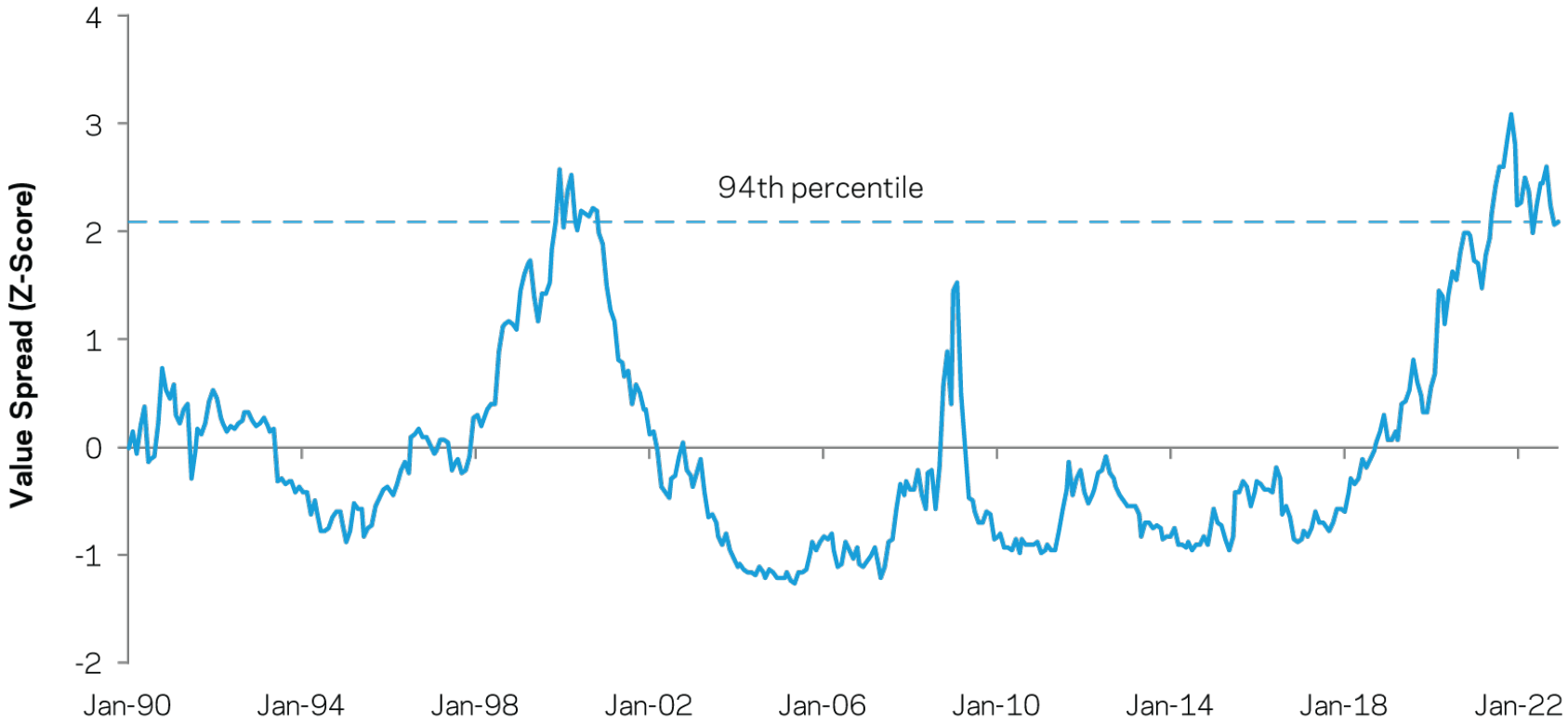

Figure: Value Spread: Avg Valuation of "Growth" Stock - Avg Valuation of "Value" Stock

- Unconditional vs Conditional Expected Return of a Factor?

AQR Timing?

- Market Timing: Sin a Little
  https://www.aqr.com/Insights/Research/Journal-Article/Market-Timing-Sin-a-Little

Midterm 1 Solutions Review

- **Go to midterm solutions**

Unconditional vs Conditional Test Assets

- Forest Through the Trees: Building Cross-Sections of Stock Returns
  https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3493458
- Replication
  https://github.com/Fernando-Urbano/forest-through-the-trees/blob/main/README.md

Homework 5

- **Go to homework 5**