

ASAM Performance Evaluation

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The Problem

- ▶ You have established an investment portfolio based on a quantitative trading strategy.
- ▶ You are receiving daily stock and portfolio performance updates from your broker.
- ▶ How do you assess how your stocks and portfolio have performed?

Important Questions

- ▶ Has your portfolio beaten the risk-free rate?
- ▶ Has it outperformed the market / benchmark?
- ▶ Has it outperformed the market *adjusted* for your market- / benchmark-beta?
- ▶ Was your performance due to (or the same as) another known regularity?

Factor Models

- ▶ It is easiest always to work with “excess rates of return above the risk-free rate.”
- ▶ Call X the excess rate of return on stock I :

$$X_I = R_I - R_F$$

- ▶ Ergo,

$$X_M = R_M - R_F$$

$$X_P = R_P - R_F$$

- ▶ **So, what are your stock and portfolio alphas?**

0-Factor Model

- ▶ You can think of a “0-Factor Model” as the (average) rate of return *above* the risk-free rate.

$$X_I = \alpha_I + \epsilon$$

- ▶ You can obtain alpha by calculating the mean of the X_I time-series.
- ▶ An alpha of zero means the same rate of return as the risk-free rate.

1-Factor Model

- ▶ You can think of a “1-Factor Model” as the (beta-adjusted) rate of return above the market, i.e., the CAPM

$$X_I = \alpha_I + \beta_I \cdot X_M + \epsilon$$

- ▶ You can obtain alpha and beta by running a simple time-series regression.
- ▶ An alpha of zero means asset I had the same rate of return as a same-beta-hedged investment in the overall stock market.

3-Factor Model

- ▶ You can think of this 3-Factor “Fama-French” model as

$$R_I - R_F = \alpha_I + \beta_I \cdot (R_M - R_F) + s_I \cdot \text{SMB} + h_I \cdot \text{HML} + \epsilon$$

- ▶ SMB is the small-minus-big factor.
- ▶ HML is the high-minus-low (value-growth) factor.
- ▶ You can obtain alpha, beta, s, and h by running a simple time-series regression.
 - ▶ PS: This market-beta is similar to but different from the 1-factor-model market-beta.

Obtaining Alphas and Betas

- ▶ Time-series regressions (or historical averages) are quick and easy to obtain.
- ▶ Any stats package will give you
 - ▶ the portfolio realized alphas;
 - ▶ the portfolio realized exposures (such as β_I).
- ▶ What do they mean?
- ▶ Do you want to use your ex-ante historical beta or this ex-post for assessing performance ?

Realized vs. True Statistics

- ▶ We never get to see the true underlying statistics.
- ▶ We only see samples from the true distribution.
 - ▶ True exp (avg) returns are very difficult to estimate.
 - ▶ True factor exposures/volatilities are easier to estimate.

- ▶
 - ▶ PS: There is a philosophical question what realized risk is. After all, you only have one draw of history.

Ex-Ante vs. Ex-Post Statistics

- ▶ When you chose your investment strategy, you presumably already calculated some historical average returns, alphas, and exposures.
 - ▶ you can also look up many historical statistics (recent performance, volatility, market-betas) from websites, such as Bloomberg.
- ▶ You will have both ex-ante realized statistics
 - ▶ when you chose your strategy;
- ▶ ... and ex-post realized statistics
 - ▶ now that your real money is at stake.
- ▶ You care more about ex-post realized statistics.

- ▶ Just like ex-ante realized average rate of return performance will not be the same as ex-post realized rate of return average performance,
- ▶ ... so will ex-ante realized exposures not be the same as ex-post realized exposures.
- ▶ The time-series regression on your realized returns will give you the realized exposures.
 - ▶ You probably care about realized exposures.
 - ▶ you can hedge exposures via factor portfolios, in effect committing yourself ex-ante to ex-post exposures!

Implementation

- ▶ Obtain the time-series of (daily) rates of return
 - ▶ on your individual portfolio components,
 - ▶ on your overall portfolio,
 - ▶ and on the risk-free and factor portfolios.
- ▶ Must be rates of return (including dividends), not just percent price changes!
- ▶ Your portfolio rate of return is always the **investment-weighted** rate of return.

- ▶ **But** your buy-and-hold investment weights are changing every day with stock returns.
 - ▶ This will have consequences for alpha calculations.
 - ▶ The investment-weighted alpha is not the pfio alpha!
 - ▶ The investment-weighted beta is not the pfio beta!
 - ▶ unless you constantly rebalance your portfolio.

2-Stock Example

Table 1: Portfolio Holdings

Stock	Day 1	Ret_12	Day 2	Ret_23	Day 3	Ret_13
A	\$100	-50%	\$50	-50%	\$25	-75%
B	\$200	+100%	\$400	18.75%	\$475	137.5%
Pfio	\$300	+50%	\$450	11.11%	\$500	66.7%
w_A	1/3		1/9		1/20	
w_B	2/3		8/9		19/20	
w_Pfio	1.0		1.0		1.0	

0-Factor Model Alpha

For argument's sake, assume the $R_F = 0\%$.

- ▶ A: $\alpha_A = (-50\% + -50\%)/2 = -50\%$.
- ▶ B: $\alpha_B = (+100\% + 18.75\%)/2 \approx 59\%$.
- ▶ P_{fio}: $\alpha_P = (50\% + 11.11\%)/2 \approx 31\%$.
 - ▶ obtained from table above
- ▶ The time-0 investment-weighted alpha

$$\alpha_P \neq 1/3 \cdot (-50\%) + 2/3 \cdot (59.38\%) \approx 23\%.$$

- ▶ **The (time 0-) investment-weighted alpha (or beta) is not the portfolio alpha (or beta)!**
- ▶ Ergo, this will also be so for other factor models.
- ▶ This is due to time-changing investment weights.
 - ▶ If you traded every day to bring back the investment weights, it would work.
 - ▶ Typically, weights change slowly,
 - ▶ so “approximately” it’s ok.

Benchmark (B) Models

- ▶ Often assumes that pfio loading on B is 1.0.
 - ▶ You then just calculate $r_P - r_B$.
- ▶ If B (say Russell) loads on some factor (say SMB), it implicitly adjusts for your own pfio loading.
- ▶ You should also at least look at your pfio's B loading:
 - ▶ Is pfio loading on B close to 1?
 - ▶ Is pfio highly correlated with B?
 - ▶ Have you chosen a good B?

What Now?

- ▶ You want to assess your performance relative to different models.
 - ▶ if only to attribute where performance came from.
- ▶ You want to calculate individual stock alphas.
- ▶ You want to calculate the overall portfolio alpha.
 - ▶ Typically, the investment-weighted stock alpha is similar to but not the same as the portfolio alpha.

Why Use A 3-Factor Model?

- ▶ You can find out whether your portfolio performance overlaps with that of the SMB and HML factors.
- ▶ What kinds of risks are you taking?
- ▶ What kinds of stocks are you holding?
- ▶ It is easy to hedge out many large factor pfios with ETFs or MFs.
- ▶ This is called “performance attribution.”

- ▶ Say you have a positive 0-factor alpha and a negative 1-factor alpha.
 - ▶ b must be different from zero.
- ▶ Let's say $\beta_P = 1.0$.
 - ▶ Your portfolio was tilted towards stocks (not fixed-income)
 - ▶ Your stocks went up (pos 0F α), but not as much as the market (neg 1F α).
- ▶ Let's say $\beta_P = 2.0$.
 - ▶ Your portfolio tilted highly towards stocks.
 - ▶ Did you borrow to double up stock bet?
 - ▶ Your stocks went up, but not twice the market.

- ▶ Say you have a positive 1-factor alpha and a negative 3-factor alpha.
 - ▶ s or h must be different from zero.
- ▶ Let's say $s_P = 0.5$ and $h_P = 0.0$.
 - ▶ Your portfolio tilted towards more SMB-like (small) stocks.
- ▶ A lower 3F alpha means your small stocks did not outperform large stocks as much as French's S stocks outperformed his B stocks.
- ▶ It means some of your positive 1-factor alpha was due to (your portfolio loading on) SMB
 - ▶ due to the types of stocks you held.

Explaining Performance Narratively

- ▶ Only news should matter.
- ▶ Already known “stuff” should have already been incorporated in the market price.
 - ▶ otherwise, beating the market would have been easy.
 - ▶ for example, expected earnings realizing is not news.
 - ▶ or expected dividends being paid is not news.
 - ▶ . . . though some part of actual happening may still be news if there had been doubt.

- ▶ Look for sharp stock price movements (relative to a sector or model or market) to determine what news were price-important.
- ▶ If price movements are more “just generic drift,” be careful:
 - ▶ don't read too much into events;
 - ▶ lots of stuff may have happened at the same time;
 - ▶ it's usually too difficult and unreliable.