STRATEGY RISK AND THE CENTRAL PARADOX FOR ACTIVE MANAGEMENT

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STATEMENT OF THE PROBLEM

- Within asset management, the risk of benchmark relative performance is typically expressed by measures such as "tracking error", which describes the expectation of times-series standard deviation of benchmark relative returns. This is useful for index fund management, where the expectation of the mean for benchmark relative return is fixed at zero. The active management case is problematic, as tracking error excludes the potential for the realized future mean of active returns to be other than the expected value.

- *All active managers must believe their future returns will be above benchmark (or peer group average) in order to rationally pursue active management, yet it is axiomatically true that roughly half of active managers must produce below average results.*

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QIAN AND HUA

- Tracking error alone is sufficient under the EMH because true alpha is zero for all managers

- Qian and Hua (2004) defines "strategy risk". In essence, it is the risk created because the skill level of the active manager is not constant over time, as evidenced by the mean return being other than expected. They use the terms "active risk" to describe the combination of the tracking error and strategy risk. They formulate active risk as:

$$\sigma_{active} = \sigma_{IC} * n^{.5} * \sigma_{TE}$$

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QIAN AND HUA 2

- This formulation arises directly from the Grinold (1989) Fundamental Law of Active Management. If the manager's skill level is constant over time, any variation in IC must arise purely from sampling error, making the standard deviation of IC equal to the reciprocal of the square root of breadth. The product of the two factors is therefore unity, and active risk is equal to tracking error.

- If the manager's skill level is time-varying the dispersion of IC will be greater than the square root of breadth, and active risk be scaled upward as a multiple of tracking error. **In a simple conceptual sense, tracking error represents the risks that external events will impact our investment result, while strategy risk represents what we can do to ourselves to contribute to an adverse outcome relative to expectations.**

QIAN AND HUA 3

- There are some serious practical problems with this approach to active risk. The first is that we actually have to be able to observe the time series variation in the information coefficient. This limits the set of possible users to active managers who make formal alpha forecasts for each investment period. It cannot be used by more fundamental managers, nor by "outsiders" such as pension funds who employ the managers.
- The second is that the property of breadth is notoriously difficult to actually measure, as it represents a complex function of the number of assets in the prediction universe, the correlation among those assets, portfolio turnover and the extent to which the active strategy in question seeks to exploit information about the correlated or independent portions of asset returns.
- Finally, there are typically unrealistic assumptions inherited from the FLAM which include that transaction costs are zero, and there are no constraints on portfolio composition

AN IMPROVEMENT

- One way to improve this formulation is to replace the use of the information coefficient (IC) with the Effective Information Coefficient (EIC) as defined in diBartolomeo (2008). Rather than measure the variation in the correlation of forecasts and outcomes, we measure the variation in the correlation between "implied alphas" and outcomes.

$$\sigma_{active} = \sigma_{EIC} * n^{.5} * \sigma_{TE}$$

Where

EIC = the effective information coefficient, the correlation between implied alphas and outcomes

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IMPROVEMENT #1, PART 2

- The benefit of this substitution is that we can eliminate two the problems associated with Qian and Hua method. EIC can be estimated by an "outsider" or by a fundamental manager whose investment process does not involve the expressing security level return expectations in a numerical form. The implied alphas are obtained by inference from the portfolio positions that are observable for all portfolios.

- In addition, the estimation of EIC incorporates the effect of constraints on portfolio position size and turnover.

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IMPROVEMENT #2, BREADTH

- We need simple expression for “breadth”, the number of independent bets per year
  - Ask yourself, “How many equal weighted uncorrelated stocks of average volatility would give me the same volatility as my portfolio? This the number of effectively independent positions in your portfolilio
  - How many times per year do you make the bets? Just divide annual percentage turnover by 100

$$N = (\sigma_{iMean} / \sigma_p)^2 * (T / 100)$$

σ_{iMean} = average volatility of individual portfolio stocks

σ_p = portfolio volatility

T = annual percentage turnover

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VARIATIONS ON QIAN AND HUA

- Ye (2008) reconciles Grinold and Qian and Hua as:

  $IR = IC / (1/N + \sigma_{ic}^{2})^{.5}$

- Ding (2010) addresses the distinction between time series definition of IC in Grinold and cross-sectional definition of IC in Qian and Hua

- Both still require detailed information about the time series variation in IC that only a quantitative asset manager could possess
- **Redefining IC as EIC and estimating breadth our way makes this all the approaches accessible to fundamental managers and asset owners**

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A MORE GENERAL APPROACH

- A more general conception of the problem would be to think of active risk as the square root of total active variance

$\sigma_{active} = (\sigma_{mean}{}^2 + \sigma_{TE}{}^2 + 2 * \sigma_{mean} * \sigma_{TE} * \rho)^{.5}$

Where

σ_{mean} = uncertainly of the true mean relative to expectation of the mean

ρ = correlation between uncertainty and tracking error

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A RULE OF THUMB

- One way to approach this problem is to consider a binary distribution for the active return of a manager.
- We assume that each manager has a benchmark relative return expectation of portfolio alpha α_p with a probability w of being correct.
- If the manager's forecast is wrong, they have a probability of (1-w) of realizing $-\alpha_p$.

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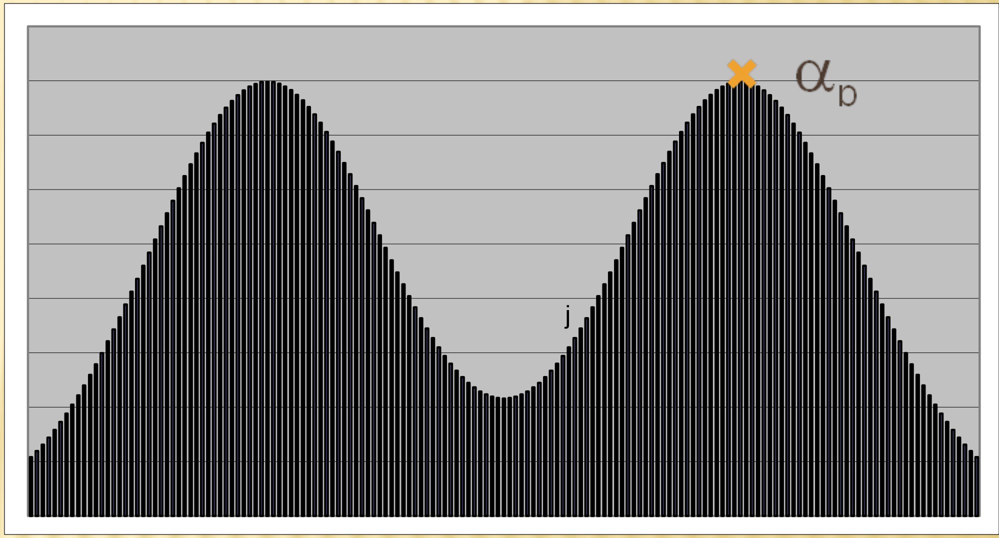
A Picture for Uncertainty of Mean

- The resulting distribution is bimodal with modes at α_p and – α_p
- Distribution has skew and kurtosis relative to the manager's expectation of α_p
- Adjust uncertainty of mean for higher moments using Cornish-Fisher expansion



A RULE OF THUMB 2

- With this framework, the value of σ_{mean} is

  $$\sigma_{mean} = ((1-w) * 4 * \alpha_p^{2})^{.5}$$

  Where

  w = is the probability of realizing the expected alpha
  α_p = manager's expectation of portfolio alpha

  For w = .5 we obtain the simple expression

  $$\sigma_{mean} = 2^{.5} * \alpha_p$$

THE RULE OF THUMB AND THE INFORMATION RATIO

It is the frequent custom of the asset management industry that the information ratio is used as a proxy for manager skill.

$IR = (\alpha_p / \sigma_{TE})$

$\alpha_p = IR * \sigma_{TE}$

$\sigma_{mean} = ((1\text{-}w) * 4 * (IR * \sigma_{TE})^{2})^{.5}$

For w = .5

$\sigma_{mean} = 2^{.5} * IR * \sigma_{TE}$

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A TALE OF TWO MANAGERS

- Let's make the simplifying assumption that $\rho = 0$ and consider two managers, K and L.
- Both managers have TE = 5.
- Manager K is a traditional asset manager that purports to clients that their IR = .5
- Manager L is a very aggressive fund that purports to it's investors that their IR = 3
- Manager L's IR is **six times** as good as Manager K.

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HOISTED BY ONE'S OWN PETARD

- For w = .5 we obtain:

  For Manager K we get:

  $$\sigma_{active} = (2 * .25 * 25 + 25)^{.5} = 6.125$$

  About 23% greater than original TE, revised IR about .4

  For Manager L we get

  $$\sigma_{active} = (2 * 9 * 25 + 25)^{.5} = 20.61$$

  More than four times the original TE, with adjusted IR = .73

RULE OF THUMB-IMPLICATIONS

- However, if more aggressive managers with higher tracking errors tend to also have more uncertainty in their means (i.e. $\rho > 0$), then it is entirely possible that the adjusted IR for Manager L will actually approach the lower value of the much more conservative manager K.
- The lesson for asset owners and particularly "fund of fund" managers is that their hiring of high IR managers must be predicated on the belief that the probability that the managers is skillful must be far above one half despite the obvious constraint on the aggregate value of w.

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RELATION OF UNCERTAINTY OF MEAN AND TRACKING ERROR

- Let us now turn to the estimation of ρ, the correlation between the uncertainty of mean return of any particular active manager, and their tracking error. Both of these properties arise from related underlying causes, the volatility of security returns, the correlation of security returns and the size of the manager's active position weights (i.e. bets).
- diBartolomeo (2006) provides a broad discussion of the relationship between volatility in financial markets and cross-sectional dispersion (aka variety).

RELATED LITERATURE

- Numerous studies have shown that security correlations tend to rise during periods of market volatility, suggesting that the correlation between variety and volatility should be positive, but less than one.

- In deSilva, Sapra, Thorley (2001), they derive an expression for the expectation of the cross-sectional variance (variety squared) of security returns, and show that it is linearly related to the realized market return in each period. They also show that the variety in active manager returns should be linearly related to the variety of security returns. These results suggest that the there should be a positive, but not linear relationship between our σ_{mean} and σ_{te} measures.

- Akrim and Ding (2002) provides an extensive empirical study confirming that the cross-section of active manager returns is very closely related to the cross-section of security returns, implying that active managers have relatively constant "bet" sizes over time.

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AN EMPIRICAL APPROACH

- We can also use empirical data to statistically estimate σ_{mean} and ρ for any particular category of active manager. Let us work through an example.
- Our sample is 1957 US Large Cap Growth Managers. We observe monthly returns for the 60 months ending November 30, 2009
  - Compute the monthly cross-sectional average and subtract from each observation to put observations in "peer relative excess" unit
  - Calculate the cross-sectional standard deviation for each month
  - Calculate the 60 month annualized excess return
  - Calculate 60 month realized annual tracking error (standard deviation of excess returns)

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EMPIRICAL RESULT

- Average annualized cross-sectional dispersion is 5.76%
- Average time series tracking error is 5.70%.
- The cross-sectional correlation between the absolute value of annualized excess returns (as a proxy for dispersion of mean) and corresponding tracking errors is .21.

$\sigma_{active} = (5.76^2 + 5.70^2 + 2 * .21 * 5.76 * 5.70)^{.5} = 8.91$

This represents an increase of 56% in risk as compared to tracking error alone, implying that investor expectations for the IR of a typical fund should be reduced by at least one third.

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RELATIONSHIP TO ESTIMATION ERROR IN RETURNS

- Some approaches typified by Black and Litterman (1991) impose Bayesian scaling on return forecasts
  - In active return space we're scaling our point forecasts closer to zero but don't explicitly address the potential for negative outcomes

- Robust optimization schemes penalize the objective function based on an ex-ante distribution of return forecast errors
  - Goldfarb and Ivengar (2003), Haldorsson and Tutuncu (2003) and Ceria and Stubbs (2004)
  - *Requires estimating covariance matrix of forecasting errors which will always be undetermined for large numbers of assets*
  - *If we understood our future errors well enough to reliably forecast their covariance, we would change our strategy and not make the errors*

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OPTIMIZATION AND RISK BUDGETING

- Our new measure of active risk can easily be incorporated in risk budgeting and manager evaluation exercises by asset owners.
- For asset managers, portfolio optimizations can be organized as a conventional mean-variance process, subject to a constraint on the value of active risk.
  - As active risk rises rapidly with expected IR, this sort of optimization procedure reduces bet sizes in an intuitive fashion, much like a Bayesian process or robust optimization
  - *Our approach can be thought of as a simplification of robust optimization where alpha errors are correlated at one, and are proportional to the magnitude of alpha in size.*
- Has the advantage of explicitly considering the potential for alphas to be of the wrong sign, rather than being just overstated in magnitude

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CONCLUSIONS

- Tracking error is an inadequate measure of risk for active managers
- Redefining IC as EIC and estimating breadth our way makes the procedures of Qian and Hua, Ye and Ding accessible to fundamental managers and asset owners
- Alternatively active risk can be formulated as the aggregate of tracking error and the uncertainty of the mean return over time
- The estimation of active risk can be reasonably parameterized either from empirical data for defined manager styles or from a simple "rule of thumb"

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