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# Managing Multiple Managers 2.0*

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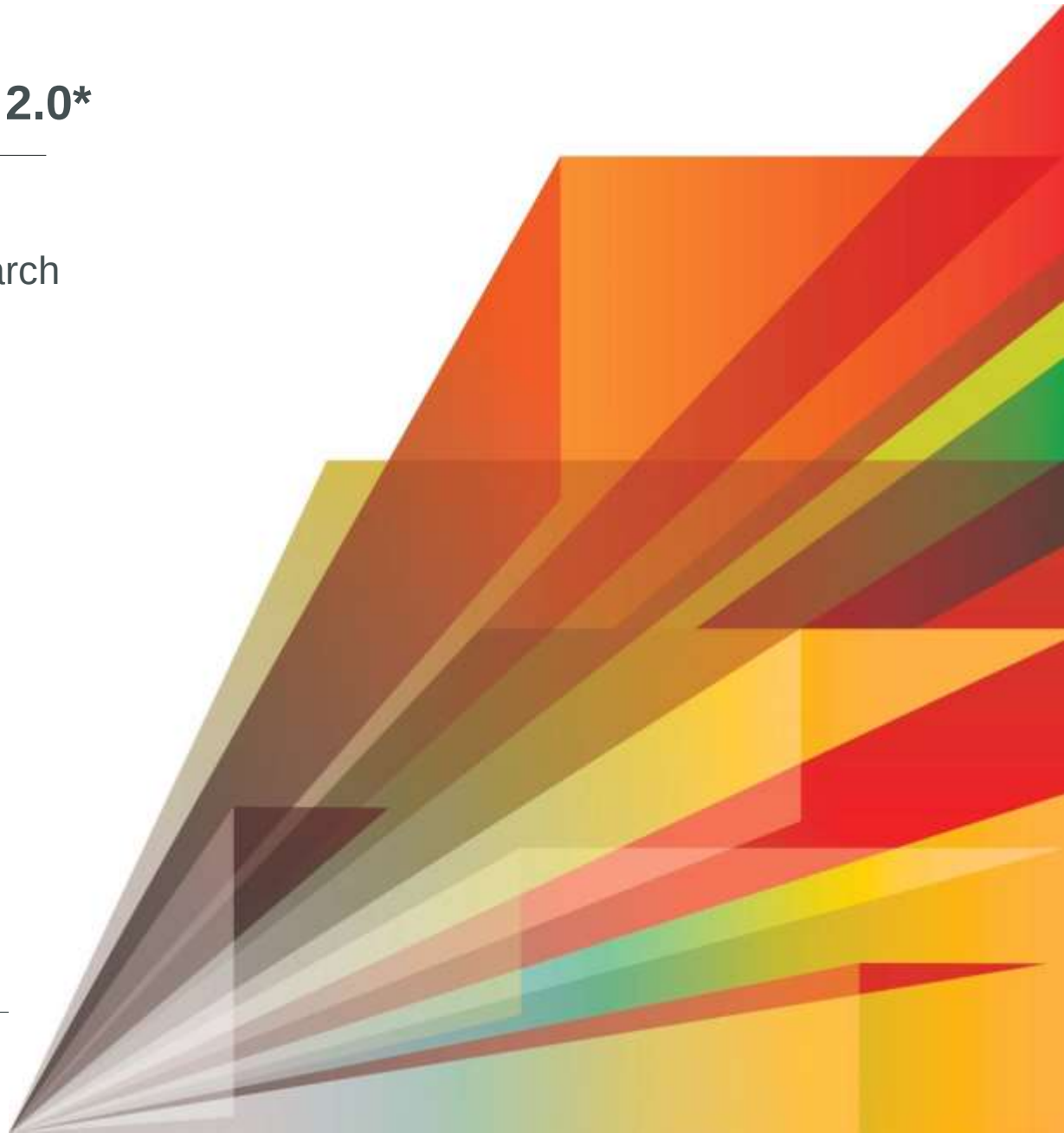
***joint work with Gerry Garvey and Raffaele Savi**





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# Managing Multiple Managers and Multiple Funds

**Central Issue facing Pension Funds, Endowments, Funds-of-Funds, Managers of Multi-Strategy Funds, Consultants**

**Our insights developed as managers of a quant Multi-Strategy fund through the financial crisis and beyond, but they apply broadly.**

## Standard Approach

- Just focus on assets (i.e. ignore liabilities)
- Set up as a standard optimization problem
- Set of funds characterized by expected return and risk
- To understand covariance matrix among the fund returns, also need
  - Factor exposures
  - Specific risk
- Leverage can also play a role

**This is not a new problem. But there are issues with the old solutions.**

# Barr Rosenberg: MULMAN

Rosenberg could see no reason why Markowitz's ideas about individual stocks would not apply equally well to a stable of individual portfolio managers. A properly diversified portfolio of risky stocks would have a high expected return but would be far less risky than any of the single holdings considered alone. Why not hire a group of high-risk, aggressive managers with distinctly different management styles to achieve the same result?

Rosenberg's sermons began to include parables for the pension funds among his clients and students at Pebble Beach. He berated them for favoring managers who were excessively cautious about making big bets against the market and who as a result were "closet-indexers." There was no point, he insisted, in paying full management fees for results that closely tracked an index fund that would itself be far less costly to maintain. To justify the fees they charged, managers should be willing to take on more risk, to have the courage of their convictions—just as long as the client employed a diversified group of managers.

The idea took hold. Today, it is a rare fund that has only one equity manager, and many have multiple managers for fixed-income investments and international securities as well. Clients ride herd on their active managers to stick to their appointed style and show a willingness to take on higher risks to bring in improved rates of return.

When I reminded Rosenberg that MULMAN had changed the world, he replied, with typical understatement, "That's interesting. Well, I don't know. It did improve the dialogue between the more thoughtful clients and their managers."

??

**From Peter L. Bernstein, *Capital Ideas*, 2005**

# Issues with the Standard Approach

## Focus on the Quant Multi-Strategy Context:

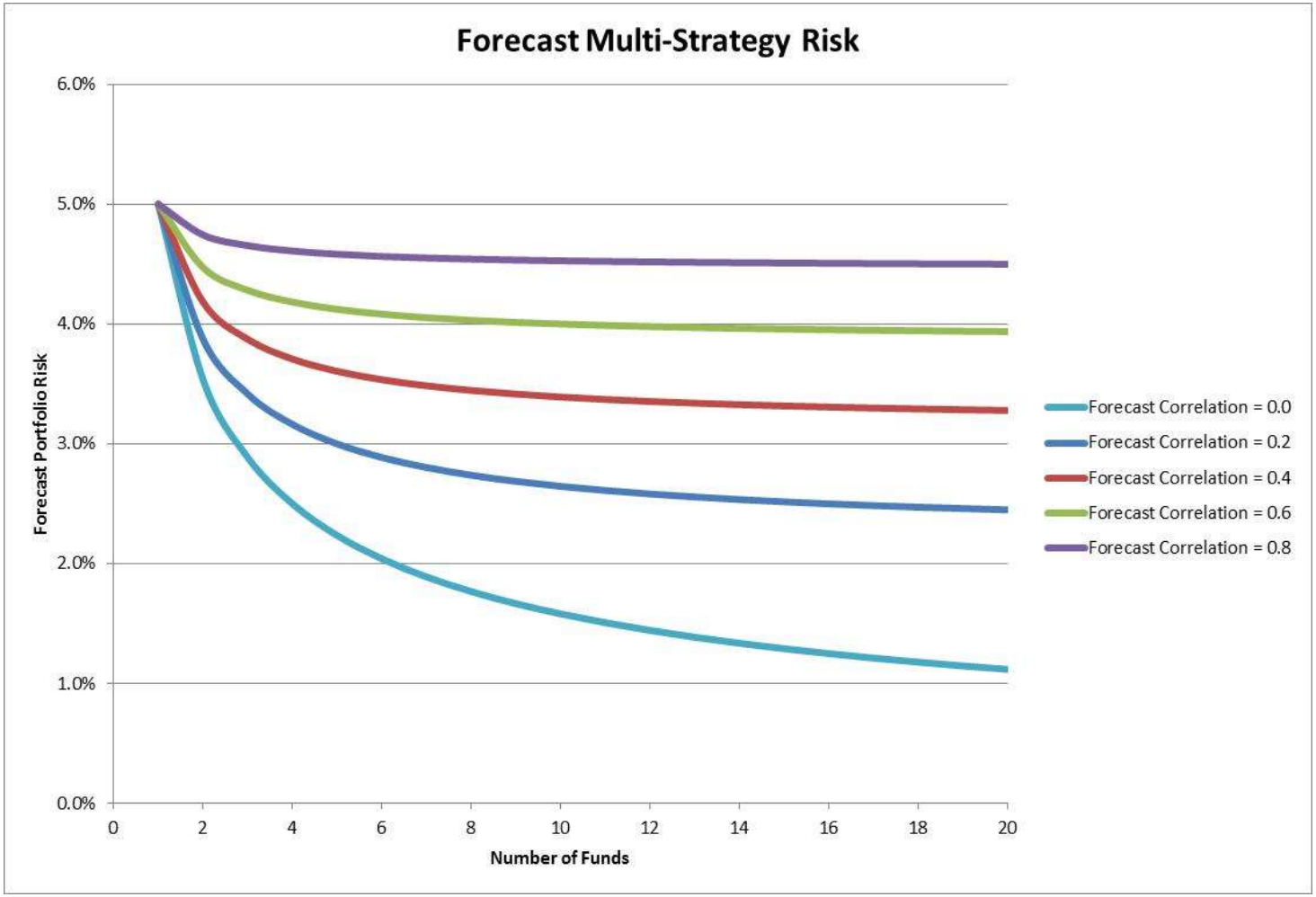
- Combine different quant strategies in one hedge fund.
- We control the allocations.
- We control the different strategies—especially in their levels of risk and leverage.
  - This is better than the situation facing, e.g. pension sponsors, who choose among existing funds.

## Observations:

- We are combining many seemingly uncorrelated strategies
- We are very sensitive to errors, especially in correlation forecasts.
- Forecast Multi-Strategy fund risk is low.
  - Information Ratios look good, but we can't eat *IR*s.
  - In principle, we can use leverage to achieve the desired risk level, but post the financial crisis we are uncomfortable with high leverage.
  - During the crisis, Multi-Strategy risk levels rose significantly.
- The fund has more of its risk in generic factors than do the underlying strategies.
  - During the crisis, generic factor correlations spiked, as did generic factor risk. This was the source of the significant rise in Multi-Strategy risk.
  - This leads to higher correlation to generic quant funds.
- We run the strategies as if they are stand-alone funds, rather than parts of a multi-strategy fund.

# Sensitivity to Forecast Correlations

- Equal-weight *N* funds, each with 5% risk
- Assume all pairwise correlations identical




**Sensitivity increases with the number of funds**

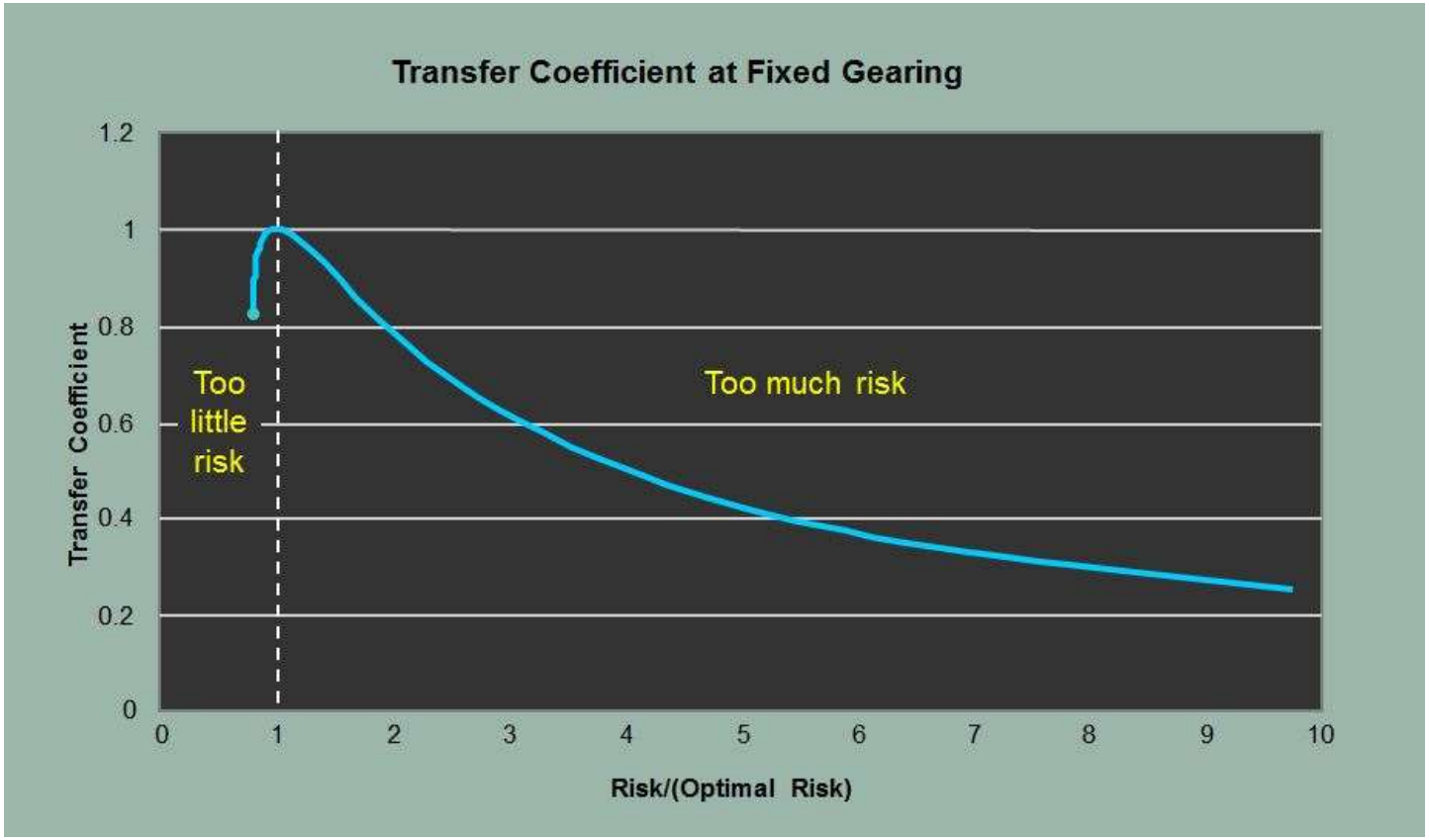
# Is Leverage the Answer to Low Risk?

## Financial theory says yes.

- Idea goes back to Tobin (1958)
- But how much real world experience do academics have with leverage?

## Optimal Gearing (Kahn, Kim, Petrich; 2007):

- Looks at the fund level.
- Sub-optimal to fix risk level and leverage.



# Is Leverage the Answer?

## Do we want to make a leveraged bet that our risk and correlation forecasts are correct?

- Post the financial crisis, most managers use limited leverage
- Jacobs and Levy have proposed leverage aversion as an additional utility function term

## We should not try to lever our way out of this problem.

# Orthogonal versus Generic Insights

## Lesson from the Quant Crisis:

- Avoid (i.e. manage) correlations with other quant managers (or at least with generic quant)
  - Pre-crisis View: No reason for Value in the US, Value in Europe, and Value in Japan to be correlated.
  - Post-crisis View: They can quickly become correlated in a crisis, if the same managers invest in all of them.

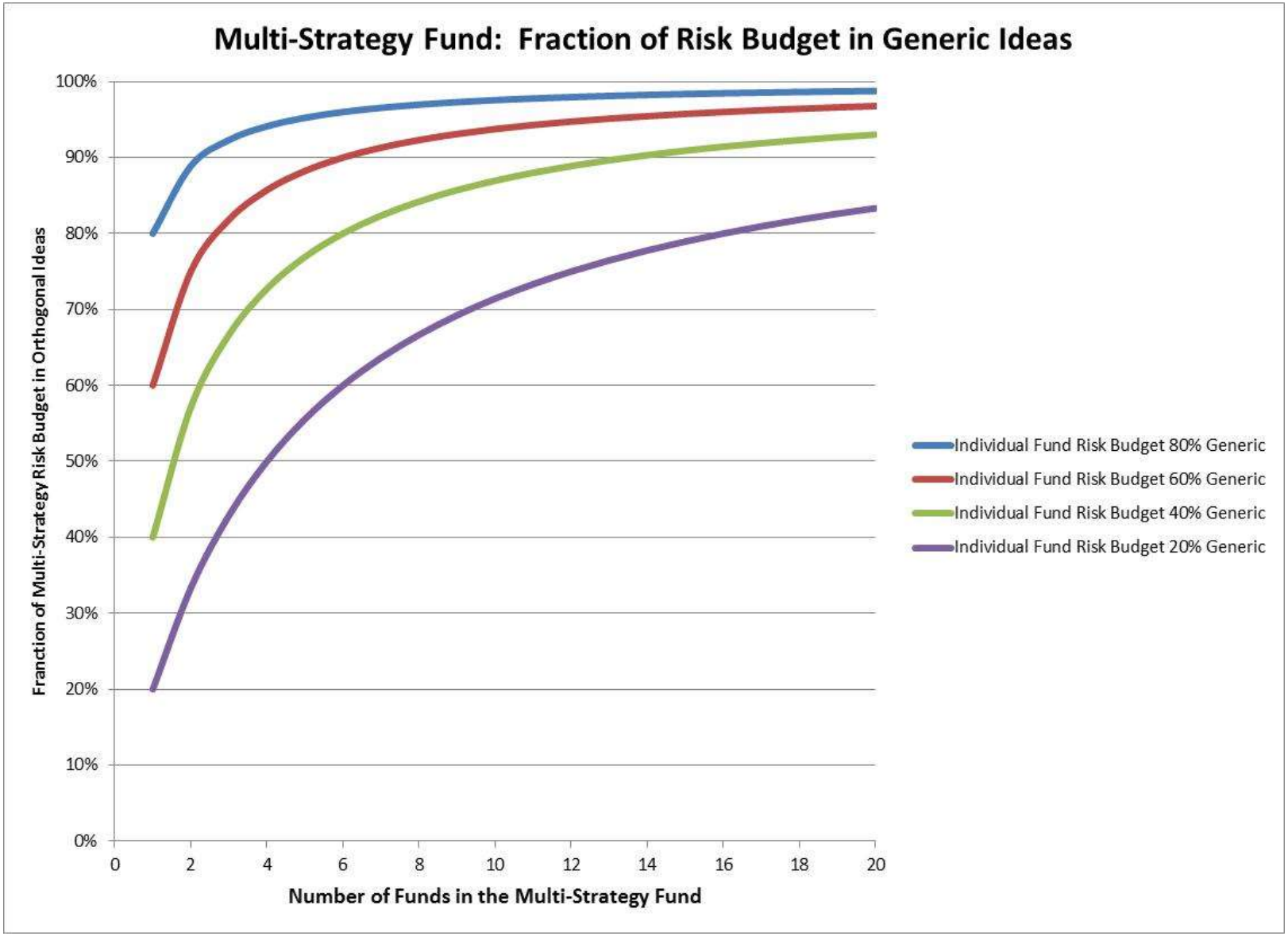
## Simple Model for this:

- Orthogonal Insights:
  - Collection of ideas not widely known or used
  - Ideas not always usable in every region (perhaps due to data availability)
  - Ideas uncorrelated across funds
- Generic Insights:
  - Ideas widely known and used
  - Typically applicable across regions
  - Sometimes highly correlated across funds

## The Multi-Strategy View:

- Each underlying fund combines Orthogonal and Generic insights.
- We can capture this as the fraction of each fund's risk budget devoted to generic insights.
- What fraction of the Multi-Strategy Fund's risk budget is devoted to generic insights?
  - We assume generic insights are correlated across funds, and orthogonal insights are not.

# The Downside of Diversification




**Note that we assume the generic component is 100% correlated across funds. In an upcoming slide, we will show a more nuanced treatment of this issue.**

# Empirical Test of the Downside of Diversification

## Goal: Verify that funds-of-funds will have higher risk allocation to generic factors that their underlying funds.

## Data:

- eVestments
- 862 Active US Largecap funds (long-only) with data from 1/11 – 12/13

## Analysis:

- Underlying Funds: Regress returns against Fama-French-Carhart 4-factor model over 3-year period 1/11-12/31.
- This 4-factor model explains ~40% of risk on average.

## Simulation:

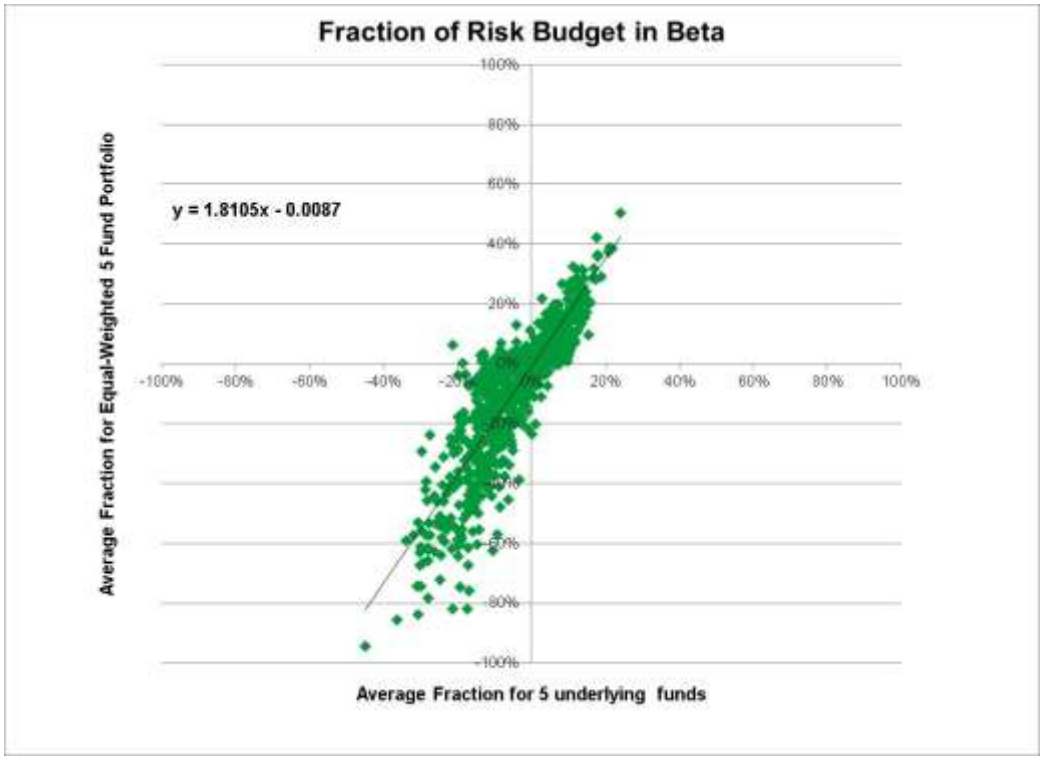
- Define a fund-of-funds as an equally-weighted portfolio of 5 underlying funds chosen at random.
- Generate 1,000 such funds-of-funds
- Analyze risk allocation factor-by-factor
  - Note the signs of the exposures, and display them with the results

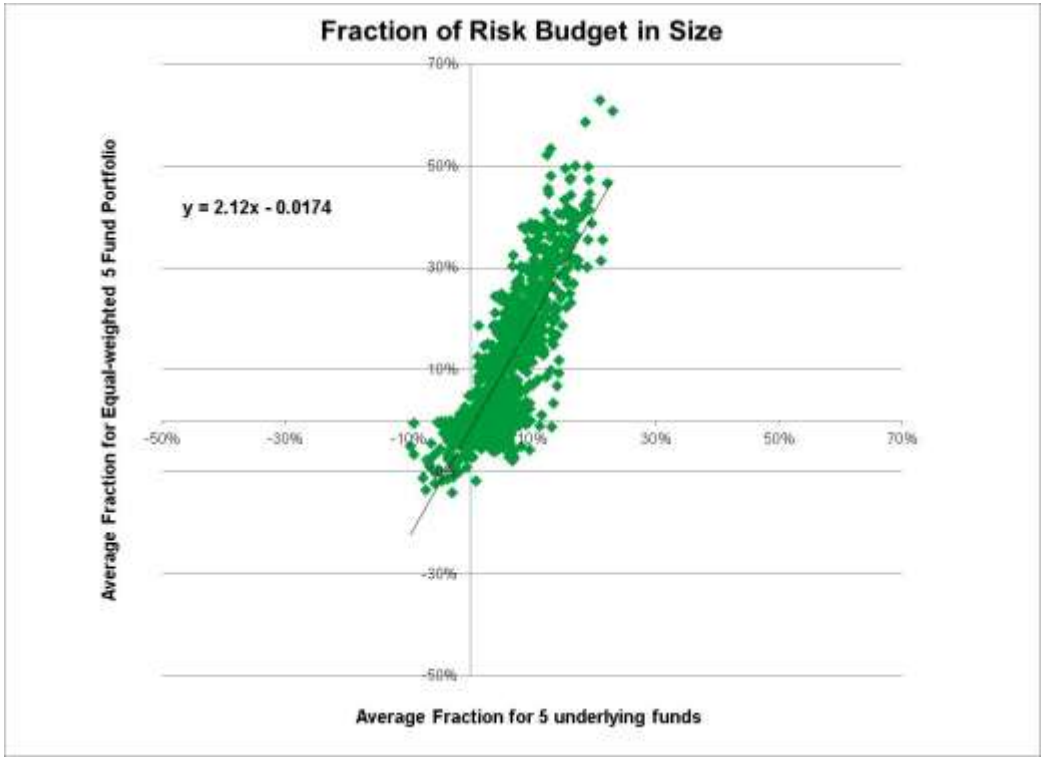
## Observation:

- In fact, funds-of-funds do have higher risk allocation to generic factors than their underlying funds. And by roughly the amount you would expect from the simple theory.

# Empirical Results: Beta and Size

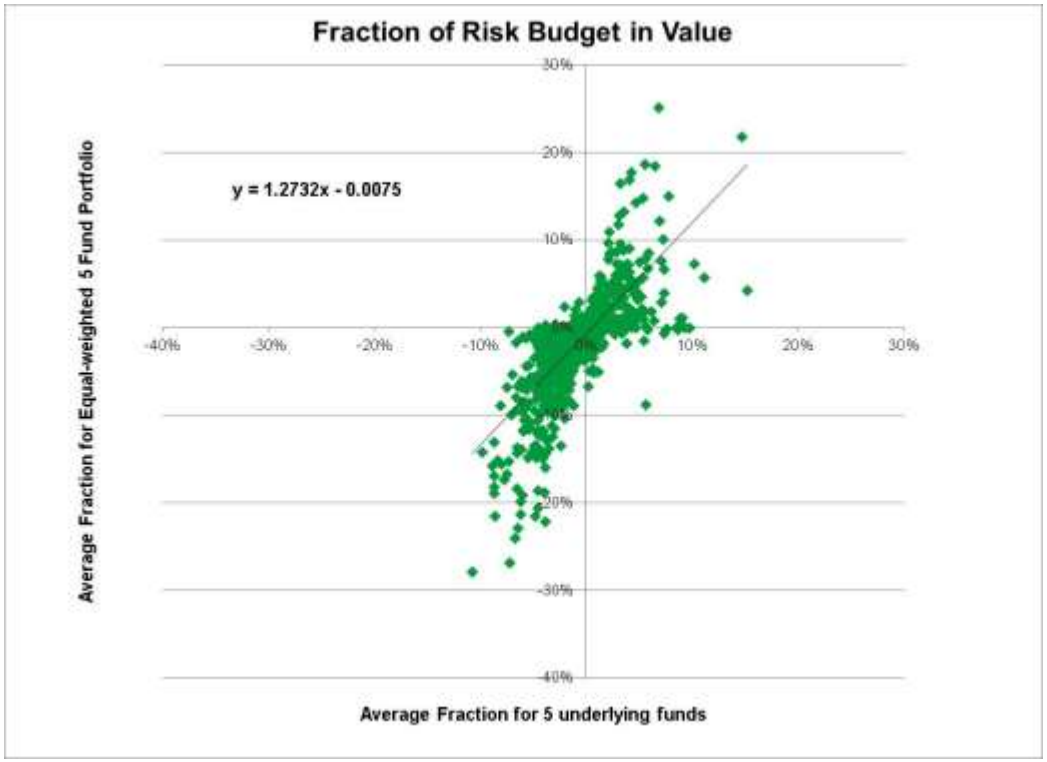
Negative numbers denote negative factor exposures. Risk budget fractions are positive.

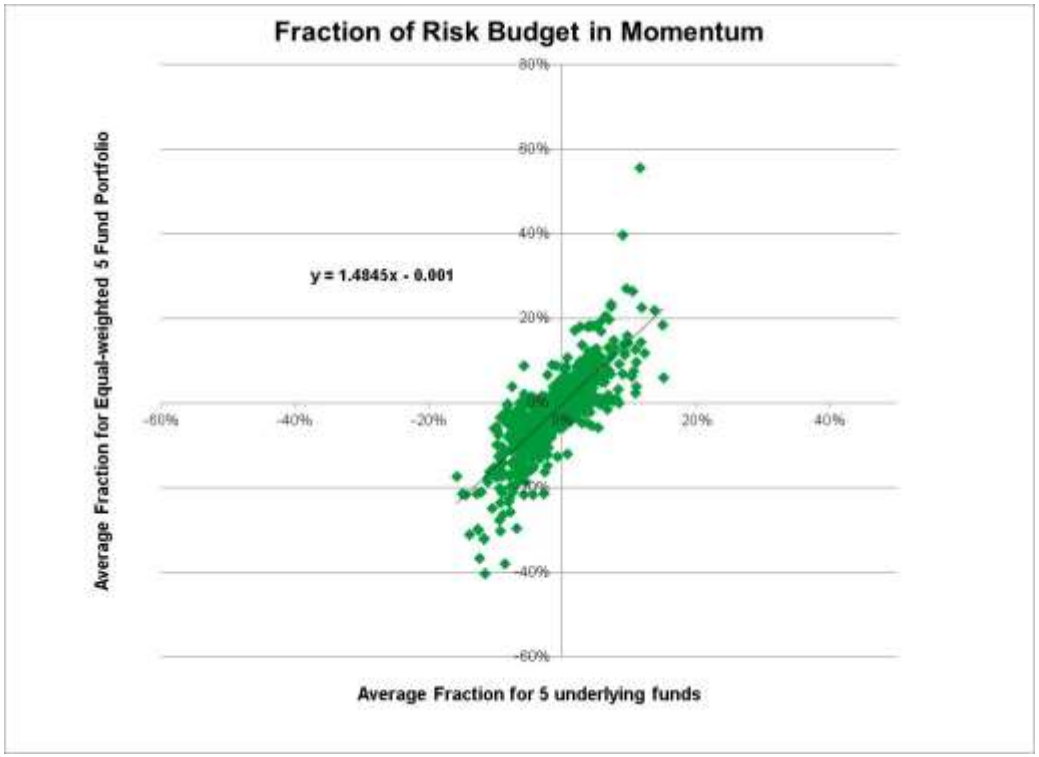


# Empirical Results: Value and Momentum

Negative numbers denote negative factor exposures. Risk budget fractions are positive.



# Example: Pre-Crisis

**Multi-Strategy Fund consists of 5 underlying funds, equally-weighted, each run at 5% risk. Want to run the Multi-Strategy Fund at 10% risk.**

**Each fund contains both generic and orthogonal factors**

- Think of Value in different regions

$$r_n = g_n + o_n$$

$$\sigma_n^2 = \sigma_g^2 + \sigma_o^2$$

**The orthogonal factors are uncorrelated. The generic factors are somewhat correlated across the funds. Each fund has the same risk. The orthogonal and generic factors have the same risk across funds. For example, Value in the US has the same risk as Value in Europe.**

**Pre-Crisis:**

- Each underlying fund is 40% generic, 60% orthogonal.
- The generic factors have pair-wise correlations of 0.1.

$$\frac{\sigma_g^2}{\sigma_g^2 + \sigma_o^2} = 0.4$$

$$Corr\{g_n, g_m\} = 0.1 \quad n \neq m$$

$$\sigma_g = 3.2\%$$

$$\sigma_o = 3.9\%$$

$$Corr\{r_n, r_m\} = 0.04 \quad n \neq m$$

$$\sigma_{MS}(unlevered) = 2.3\%$$

$$L = 4.35$$

# Example: Crisis

**Generic Factor Risk Increases Significantly. Generic Factor Correlation Spikes:**

$$\sigma_g: \quad 3.2\% \Rightarrow 11.1\%$$

$$Corr\{g_n, g_m\}: \quad 0.1 \Rightarrow 0.5$$

**Orthogonal Risk unchanged.**

**Each underlying fund goes from 40% generic to 89% generic.**

$$Corr\{r_n, r_m\}: \quad 0.04 \Rightarrow 0.45$$

$$\sigma_n: \quad 5\% \Rightarrow 11.8\%$$

$$\sigma_{MS}(unlevered): \quad 2.3\% \Rightarrow 8.8\%$$

$$\sigma_{MS}(levered): \quad 10\% \Rightarrow 38\%$$

**Risk level is almost 4 times the level predicted prior to the crisis.**

- This is another demonstration of the danger of leverage.
- This type of analysis could possibly help set bounds on acceptable leverage.

# Increasing Fund Risk and Orthogonality without Leverage

## The Challenges to Managing a Multi-Strategy Fund:

- The Multi-Strategy Fund looks more diversified than it is.
- Correlations increase during crisis periods.
- The Multi-Strategy Fund over-emphasizes Generic ideas.
- Leverage by itself is too dangerous a solution to the problem of low risk.

## The Path Forward:

- Increase risk at the underlying fund level, without leverage.
- Focus much of that risk into orthogonal ideas.

## To increase orthogonal fund risk without leverage, we must:

- Increase concentration
- Increase fraction of risk budget focused on orthogonal ideas

## This seems good for the Multi-Strategy Fund, even if sub-optimal at the underlying fund level.

- Misalignment of incentives

## How much does concentration impact the Transfer Coefficient at the fund level?

# The Impact of Concentration on a Fund

## Mean/Variance Optimized Portfolio

- Ignore Trading Costs and Constraints
- Assume Residual Returns Uncorrelated
  - This is only important for analytical results.

## Forecast alphas have the form:

$$a_n = IC \times w_n \times z_n$$

## We will assume $z_n$ are normally distributed

## So holdings are:

$$h_n = \left(\frac{IC}{2l}\right) \cdot \left(\frac{z_n}{w_n}\right)$$

## And portfolio risk is:

$$w_P^2 = \left(\frac{IC^2}{4l^2}\right) \cdot \sum_{n=1}^{N} z_n^2$$

# Contribution to Risk

**Each asset's contribution to risk* is therefore:**

$$Contribution(n) = \left(\frac{IC^2}{4l^2}\right) \cdot z_n^2$$

**We can rank stocks by their contribution to risk.**

**The least impactful way to concentrate the portfolio is to eliminate positions that contribute the least to risk.**

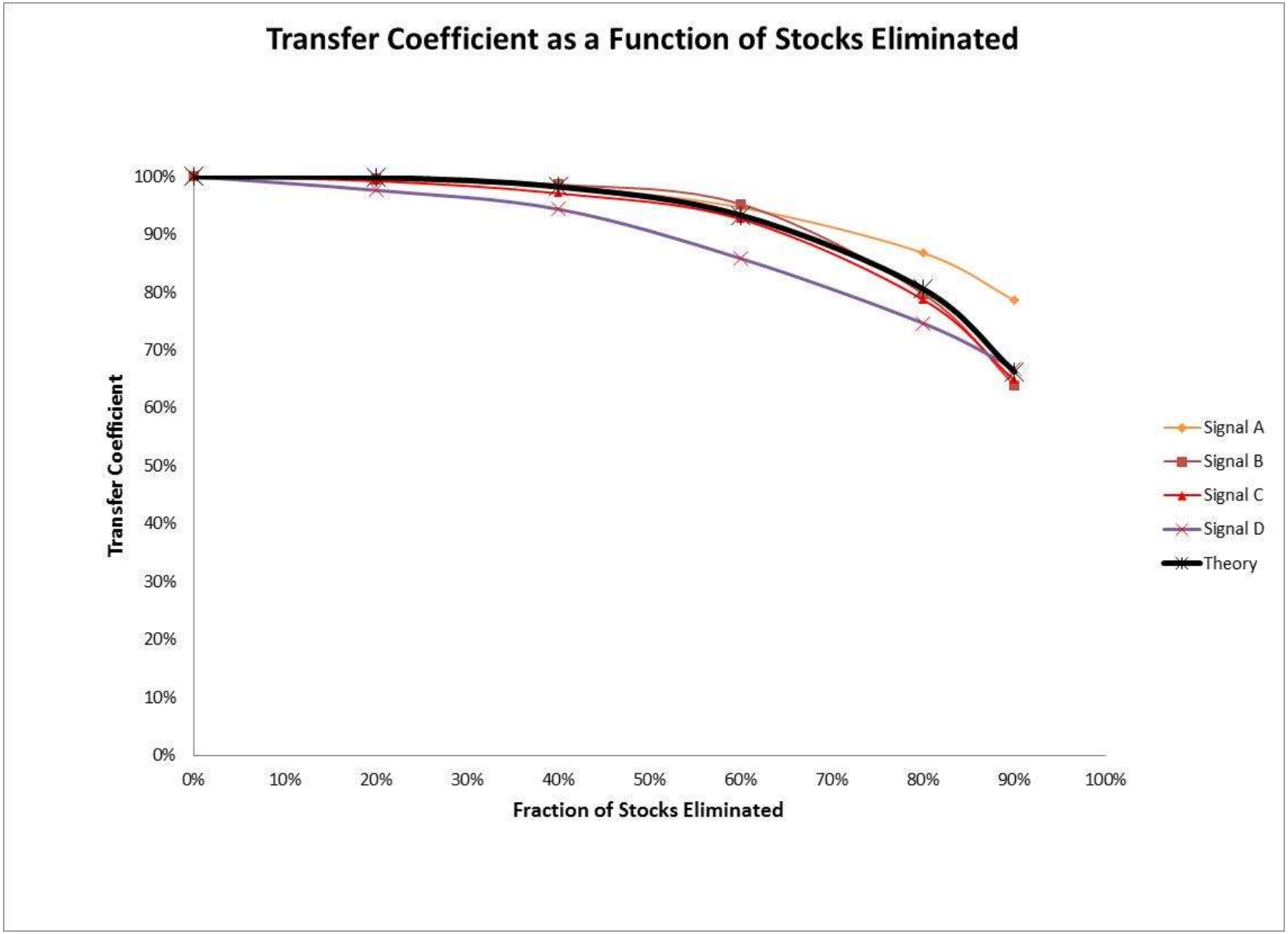
**As we start eliminating positions in this way, what happens to the Transfer Coefficient, and what happens to Portfolio Risk?**

**We will show both the theoretical result, and sample empirical results**

- Empirical results based on analysis of four different BlackRock SAE signals.

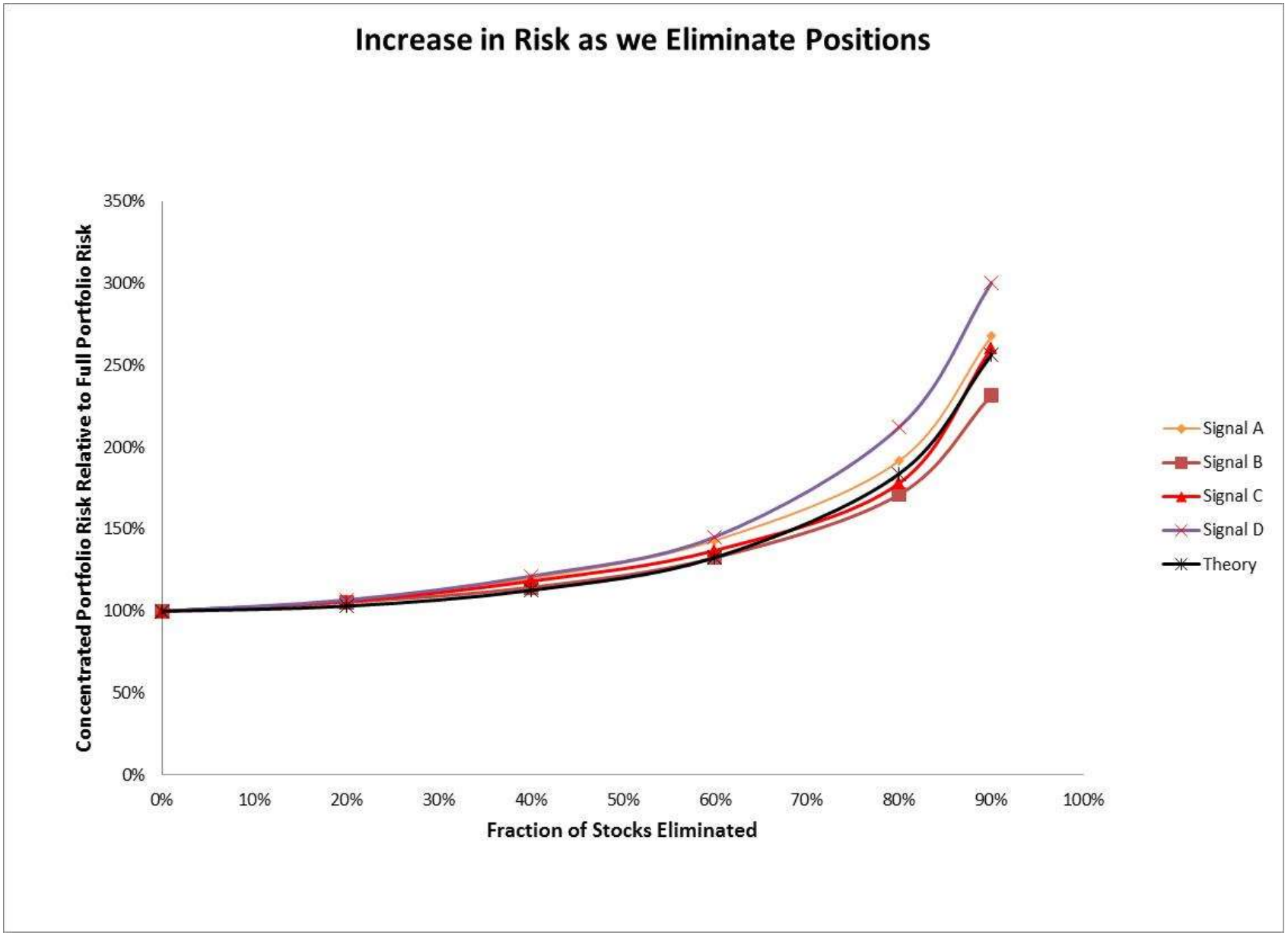
*We thank Vinod Chandrashekaran for early work on this topic.

# How Does Concentrating the Portfolio Impact the Transfer Coefficient?

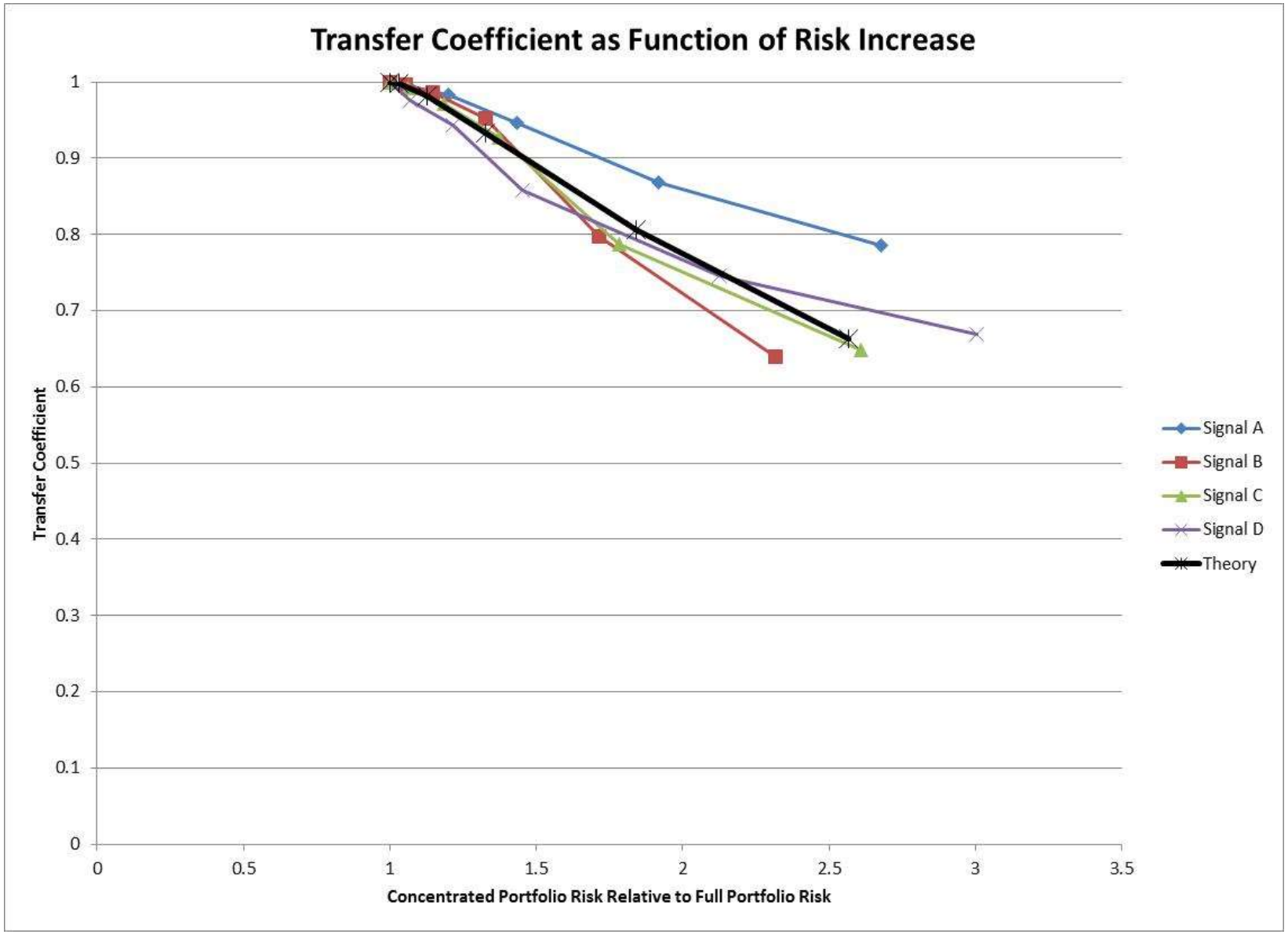



**We only see meaningful degradation when we eliminate >75% of positions**

# How Does Concentrating the Portfolio Increase Risk?



# The Concentration Trade-Off Between Transfer Coefficient and Risk



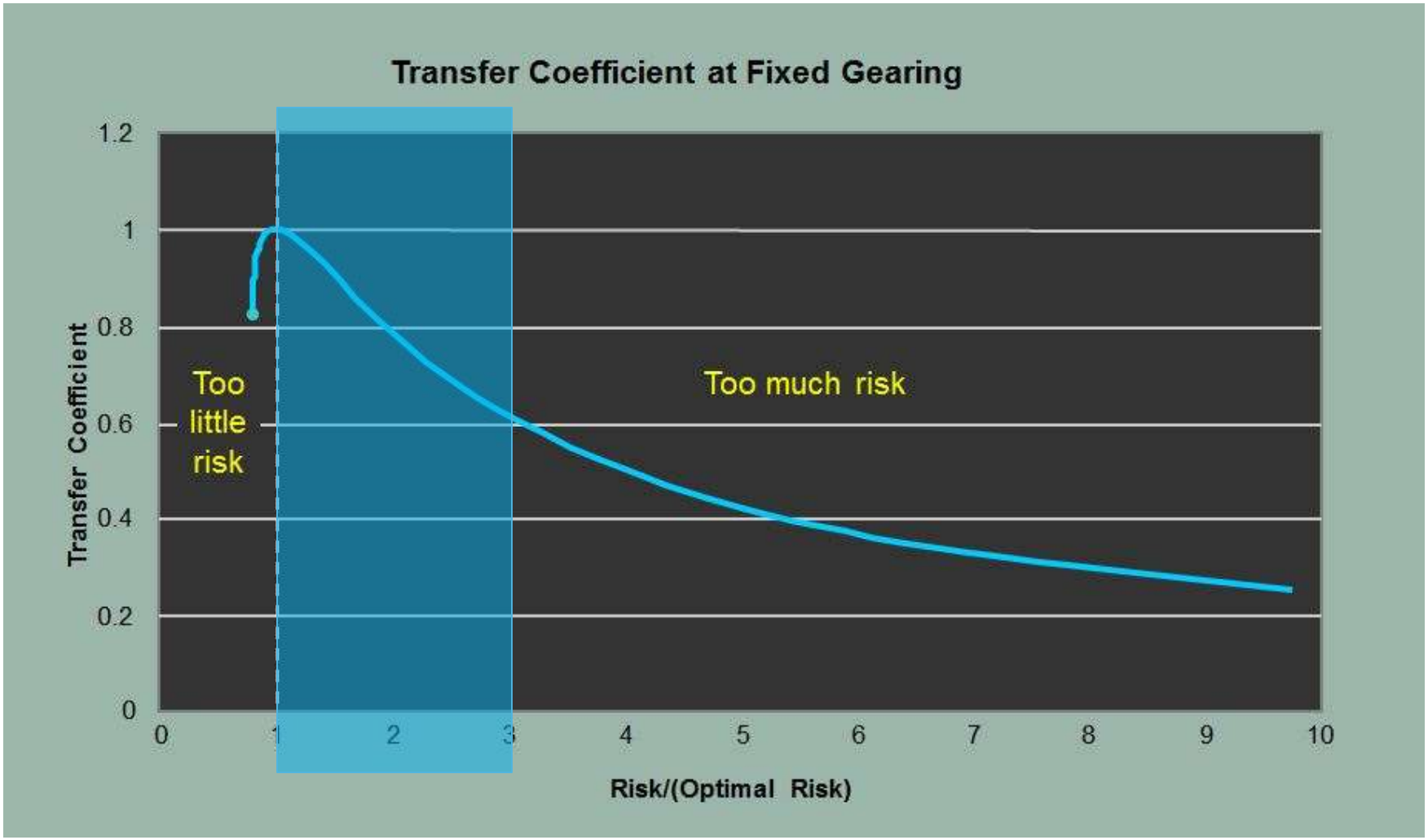

This essentially reproduces results from Kahn, Kim, Petrich.

Doubling risk through concentration drops the TC to ~75%.

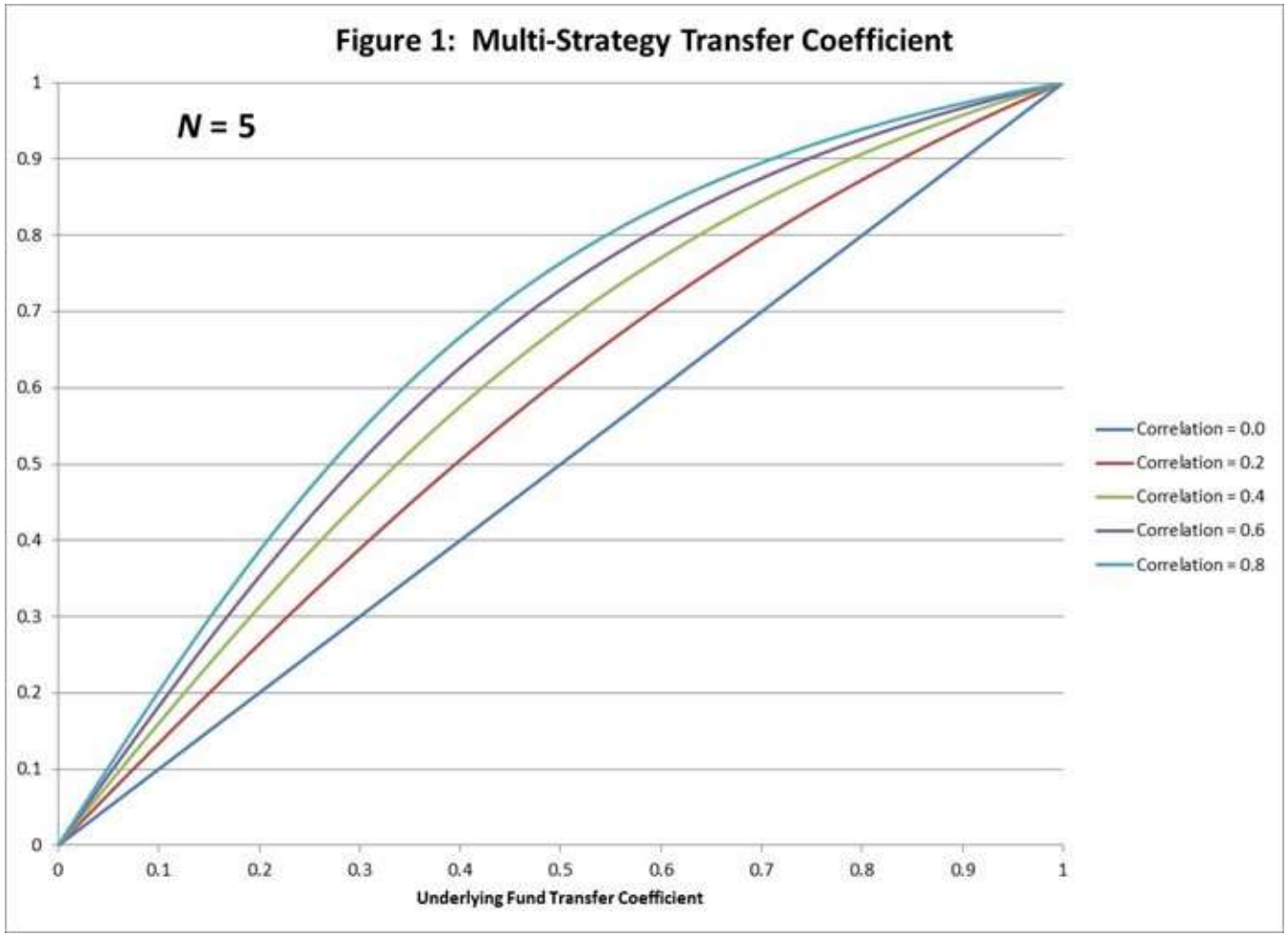
Tripling risk through concentration drops the TC to ~60%.

# Optimal Gearing Result

**Previous Slide focused on increasing risk up to factor of 3.**



# Multi-Strategy versus Underlying Fund Transfer Coefficient




- The multi-strategy *TC* exceeds the underlying fund *TC* if the funds are correlated. So fund correlations can boost the *TC*.
- An insidious aspect of this is that correlations increase in bad states of the world. So the multi-strategy *TC* is higher in those states where we would prefer it to be lower.
- The maximum boost occurs around fund *TC*=0.5.

# Optimal Multi-Strategy Funds

**The standard approach pre-crisis used leverage to attain risk levels of interest to investors.**

**Post-crisis, the better approach appears to be using concentration to increase underlying fund risk (and focus it more on orthogonal ideas). This has an impact on the Transfer Coefficient—dropping it by 25% to 40%. But in exchange, we can avoid exposure to very significant risk spikes during crises. And we can limit our correlation with generic quant funds.**

# Beyond Multi-Strategy Funds

## Pension Funds, Endowments, Funds-of-Funds, Consultants—anyone allocating to funds they do not completely control—have a greater challenge:

- The asset allocator would like more risk and more concentration than optimal from the underlying fund perspective.
  - Misalignment of incentives
  - Issue flagged by Rosenberg and Roll.

## They face an additional challenge especially in the case of hedge fund allocations:

- Lack of the fee netting that comes with Multi-Strategy funds.

## They need a level of skill in manager selection that can more than overcome these hurdles.

# Conclusions

**Managing Multiple Managers looks like an optimization problem solved decades ago.**

**But experience through the financial crisis has taught us that the standard approaches are sub-optimal, in that they:**

- Significantly under-estimate risk in a crisis.
- Concentrate generic ideas relative to the underlying funds.

**We are better off increasing risk at the fund level through concentration—particularly into orthogonal ideas**

- We take a hit on the Transfer Coefficient, but this is better than just relying on leverage, given the underestimation of risk issue.

**Beyond Multi-Strategy funds, fund allocators face the same challenges and more, but with fewer controls to address them.**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