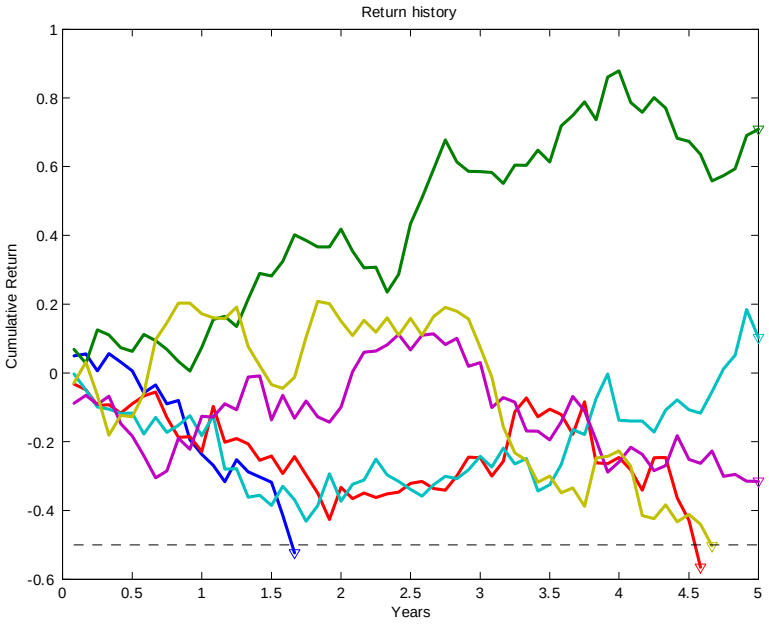
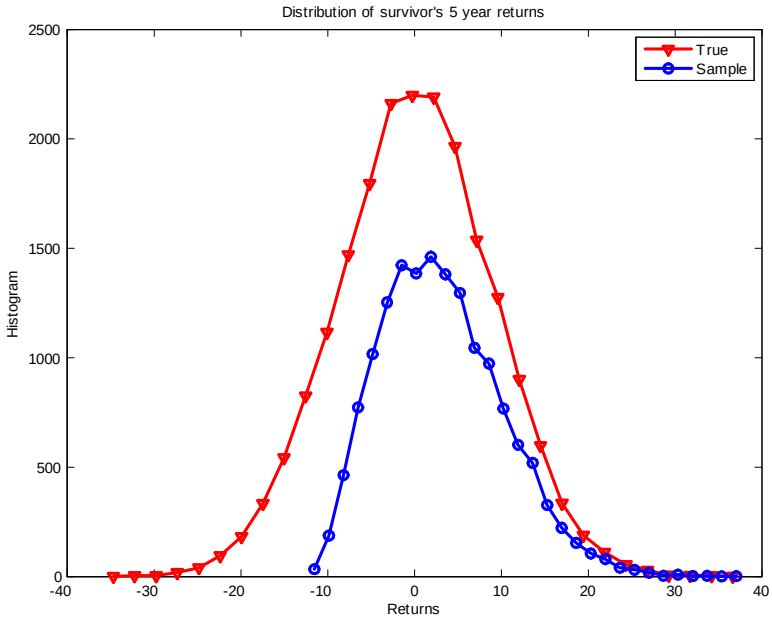
1 Funds and Performance Evaluation

1.1 Carhart

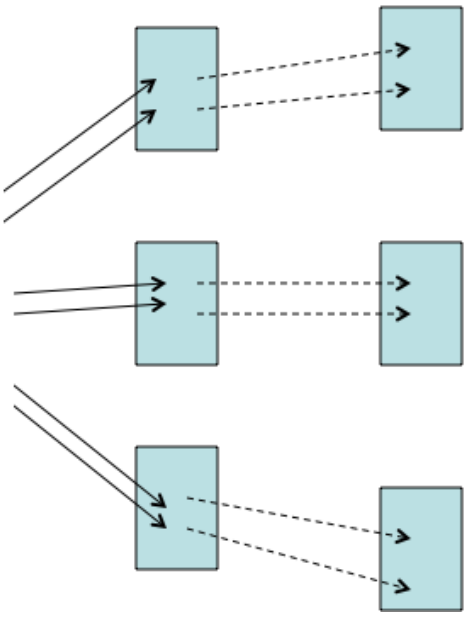




Statistics across funds	Raw	Selected
Mean	0.05%	3.12%
Std. Dev	8.87%	7.00%

$$r_{it} = \alpha_i + b_i RMRF_t + s_i SMB_t + h_i HML_t + p_i PR1YR_t + e_{it}$$
$$t = 1, 2, ...T$$

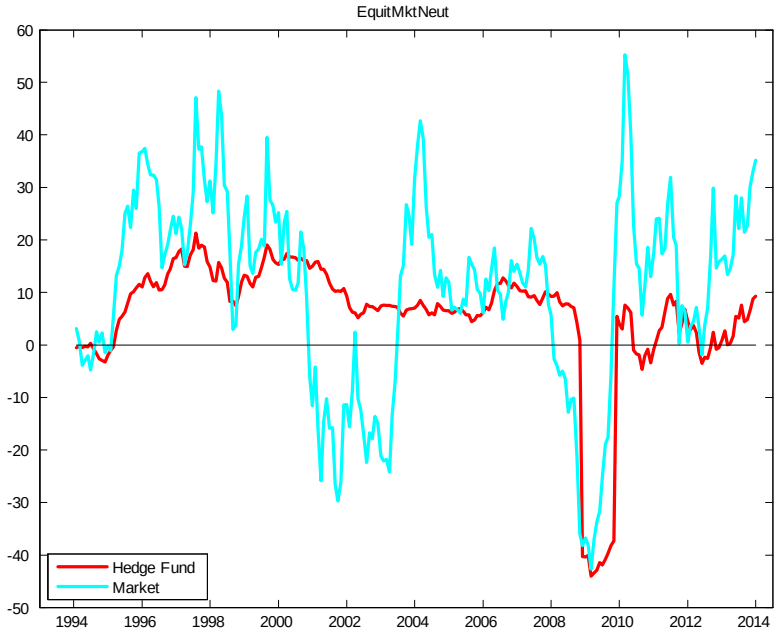
Carhart Story



Momentum in stocks leads to momentum in funds

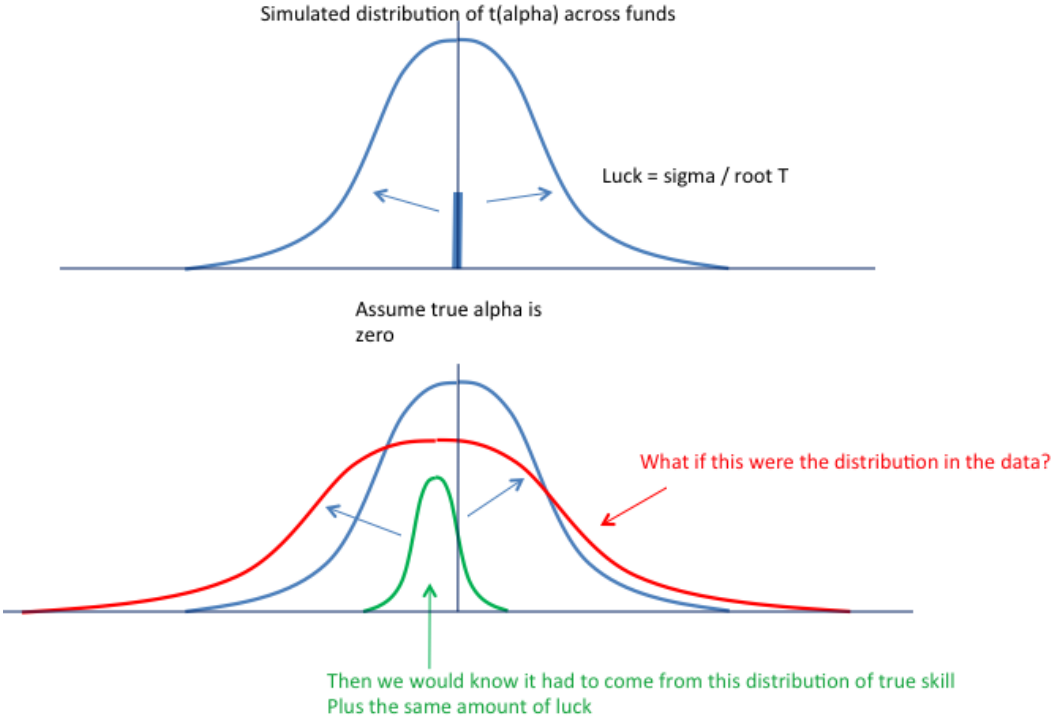
Risk! In the 45% of years that momentum stocks go down, so do momentum funds!

$$R_t^{ei} = \alpha_i + b_i rmrf_t + h_i hml_t + ... + u_i umd_t +$$
$$+ (\text{write put options, carry trade, yield curve, default spread}) ... + \varepsilon_{it}$$

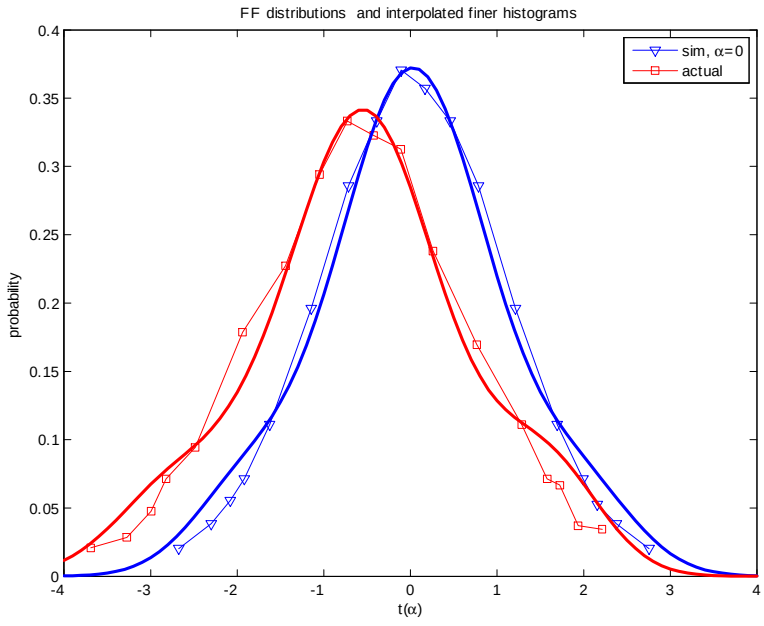


1.2 Fama and French

$$R_t^{ei} = \hat{\alpha}_i + \hat{b}_i rmrf_t + .. + e_{it}$$
$$\sigma(\hat{\alpha}_i) = \sigma(e_{it})/\sqrt{T}$$
$$t_i = \hat{\alpha}_i/\sigma(\hat{\alpha}_i)$$



Fama French Table III in graphical form



1.3 Berk and Green

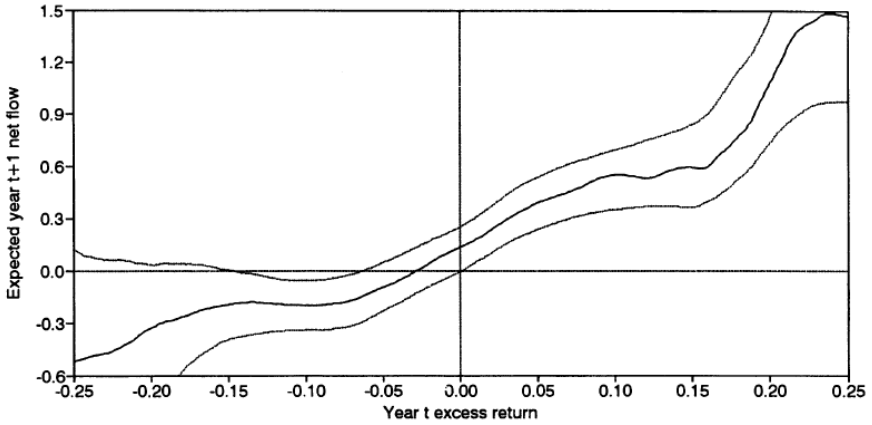


FIG. 1.—Flow-performance relationship $\hat{f}$ for young funds (age 2) with 90 percent confidence bands.

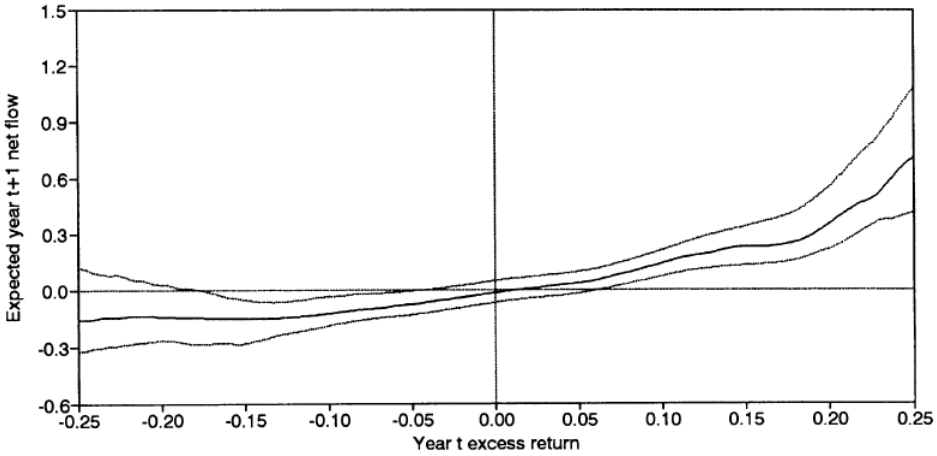


FIG. 2.—Flow-performance relationship $\hat{f}$ for old funds (age > 10) with 90 percent confidence bands.

- A manager has 6% alpha and can run $10m. Manager indexes any additional money. The fund charges 1% of AUM

  1. Year 1: Fund has $10m AUM, earns 6%, returns 5% to investors.
     - Fund earns $600k. Manager gets $100k, investors get $500k
  2. Year 2: Fund has $20m AUM. Earn 6% α on first $10m, 0% α on the second $10m. The fund charges 1%×$20m=$200k.
     - The fund still earns $600k, gives the manager $200k, returns $400k to investors.
  3. Where does this stop? Year 3. The fund has $60m AUM, *still earns 6%* α on the first $10m, indexing the remaining $50m. The fund charges *1% of $60m.* Investors now get 0% α. No reason to leave.
     - Equilibrium: Fund earns $600k; Manager gets $600k, investors get 0 – fees balance α.

- "5 Hypotheses that we have taken for granted p. 2."

  1. Returns (alpha) to investors measure skill.
  2. Average returns (alpha) do not beat the market so the average manager is not skilled.
  3. If a manger has skill, returns (alpha) should persist.
  4. Since returns don't persist, investors who follow past returns are irrational.
  5. Compensation based on assets under management doesn't reward performance.

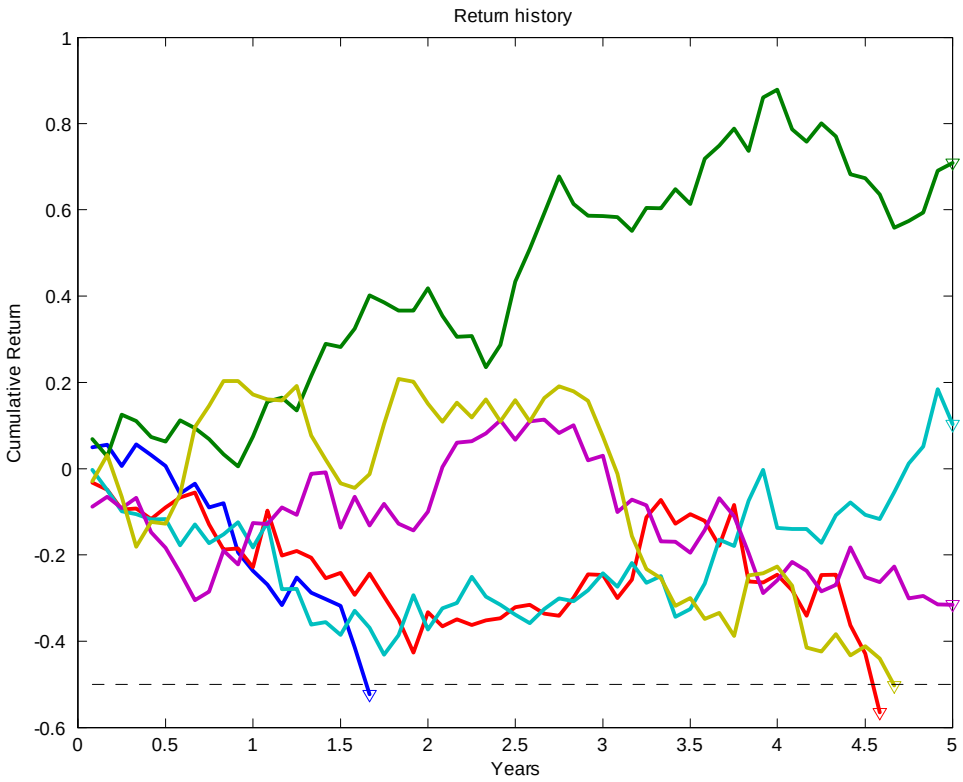
- What do we see in this example

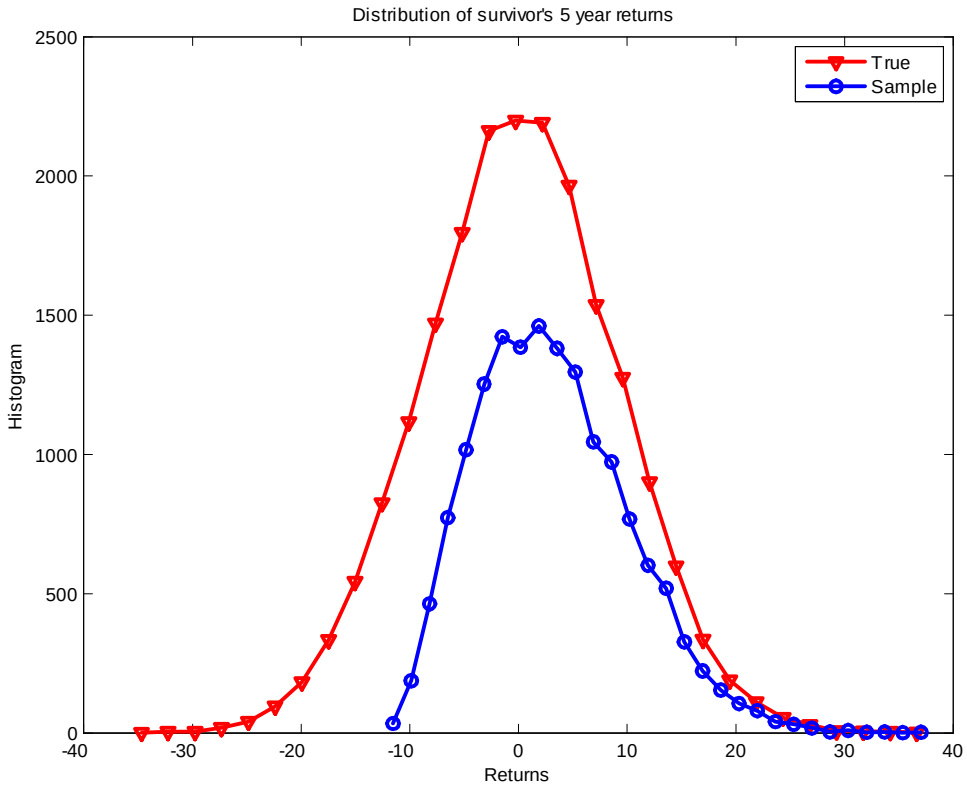
  1. Skill lasts forever.
  2. Alpha to investors dies out after 2 years. (weeks?)
  3. In equilibrium, fund alpha is uncorrelated with skill.
  4. Skillful managers get paid a lot.
  5. Investors are perfectly rational to chase past performance.
  6. The manager is able to "raise his fee" to 5%, even though the stated fee is always 1%
  7. Alpha times assets under management measures skill, not alpha. 0.10% ×100 billion is a lot of skill, not much alpha! ?

2 Funds and Performance Evaluation

2.1 Carhart

1. We will see the issues by reading one classic paper. The results and methods are still used.
2. Classic fund evaluation question: Does this manager have "skill," information about asset values not already reflected in prices? Or can I replicate his performance using easily tradeable indices?
3. What do we expect?
   (a) It would be natural, and completely sensible, (and good marketing for MBA programs) if funds outperform darts! Pros outperform in any other field.
   (b) Except for... competition and free entry.
   (c) Still, though the *marginal* fund will be worthless, and the *average* fund may not be very good, surely the *good* funds are good, no? Let's find out.
4. Table III p. 64.
   (a) Column 1: Sort funds to portfolios based on last year's performance. Then look at portfolio performance over the next year. Statistics are about these fund portfolios over the whole sample. *Carhart sorts funds into portfolios, then examines portfolio returns, just as Fama and French sorted stocks into book/market and size portfolios and examined portfolio returns. All of Carhart's evidence is about* **portfolios** *of funds* (or average behavior of funds of a given type)*, not individual funds.*
   (b) Why do it this way? *To distinguish luck from skill.* We *cannot answer* "What about Warren Buffet?" As medicine does not answer "how did you get so old?"
      i. Luck vs. skill 1: Survivor bias. *Include all the dead funds.* Lots of hard work by Carhart (p. 58). If you look at the history of funds alive now, you get a biased picture of mean and variance. If you just look at the best fund you really get a biased view!





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ii. Luck vs. skill 2: "good funds?" Form a portfolio based on an indicator you could see at the time, watch *all* funds after that. Just like Fama and French evaluating value and small portfolios, not "why did Google give such great returns?"

(c) Column 2: Last year's funds do better this year! (p. 57 too).

i. Why didn't we know this? Like momentum, by forming portfolios we see the effect even though only (say) 52% of the last year's winner funds win again.

ii. So is this "skill," "Hot hands?" Or have we found higher beta funds?

(d) CAPM alpha, beta. Betas are all 1.0, average returns translate to alphas.

(e) 4-factor *performance attribution* model.

i. p.61 description

$$r_{it} = \alpha_i + b_i RMRF_t + s_i SMB_t + h_i HML_t + p_i PR1YR_t + e_{it}$$
$$t = 1, 2, ...T$$

PR1YR is a momentum factor, stocks winners - losers.

ii. Why is it OK to use a "momentum factor" even if that is not a "state variable for investment opportunities?"

iii. To measure *stock picking ability*, performance relative to mechanical portfolios. Can you get the same returns mechanically, even if momentum itself is "irrational?"

iv. Absolute pricing vs. relative pricing. Almost all applied finance is relative pricing.

A. Absolute: "is this asset pricing model right, does it predict the prices (expected returns) of all assets?"

B. Relative: "Is this security priced correctly given the prices of all the other securities?"

v. Results: some SMB at the high end – more volatile funds are more likely to end up in the extremes. But the pr1yr slopes account for all variation in average returns. The alphas are all about -.1% per month. The remaining puzzle, negative alphas in the bottom end. Carhart works hard on this. Later work removed it with a better constructed PR1YR.

5. Table V p. 68

   (a) Do fees and turnover help or hurt investors? (Summarizes a long classic literature).

   (b) The answer is not obvious:

      i. Fund manager: "No. We charge fees to support our research team which generates great performance. We turn over the portfolio to buy new good stocks. After fees and turnover you do better."

      ii. Cynical Chicago Economist: "Investors get the same return they could get anywhere else. Just as funds don't over pay the janitors. More fees generate only enough alpha to cover the fees. Prediction: no relation between fees and returns to investors."

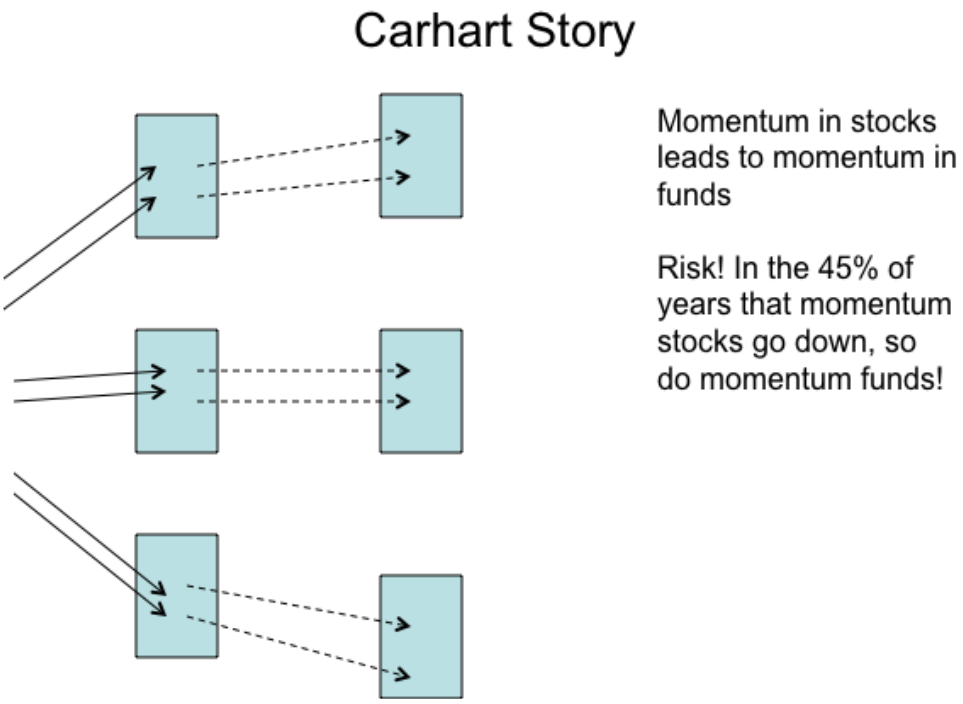
      iii. Facts? It's amazing that it's worse than Cynical Chicago Economist.

   (c) Table V. A good case to make sure you understand FMB regressions!

      i. 1% fees means 1.54% less to investors!

      ii. More turnover means less to investors, roughly 0.95% roundtrip transaction cost.

6. Carhart Story:



   (a) p. 72 Figure 2. Returns die after one year. Skill does not. (We hope)

   (b) p. 73 Its' not momentum *funds.* Momentum funds don't even earn higher returns. (A warning on transactions cost in momentum!)

   (c) p.73 Story: There is momentum in stocks. Funds that did well last year have stocks that by chance went up last year. Those stocks will (on average, with lots of risk!) continue to go up next year. So if the fund doesn't sell the stocks, the fund continues to rise.

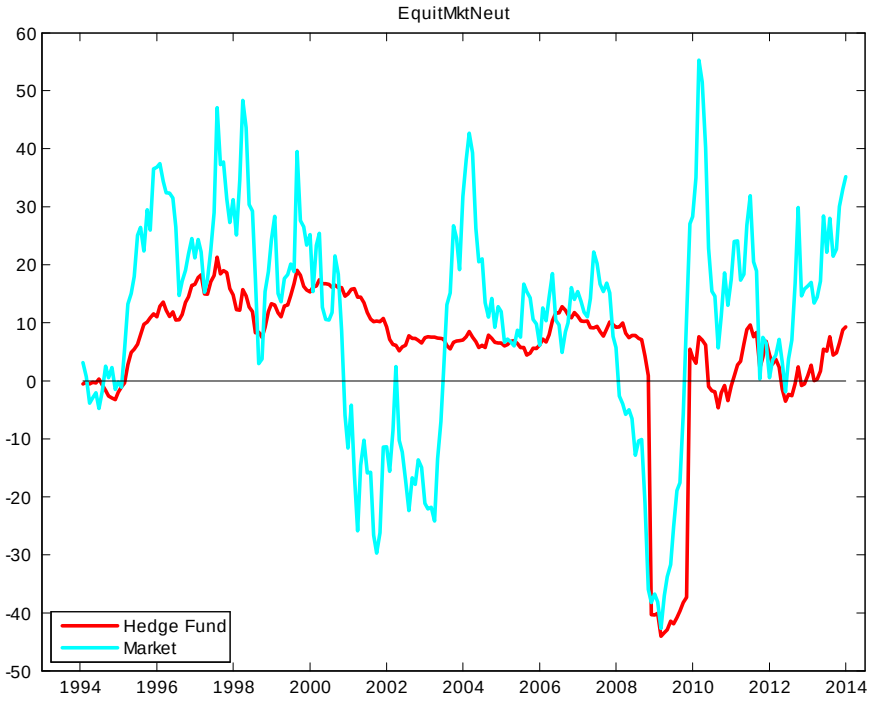
7. Big picture: Performance Attribution models for manager skill.

   (a) Asset pricing model type regressions, but any tradeable portfolio that you the investor understand, can get at zero cost, goes on the right hand side. If "irrational," well irrationalities you can trade for free. You do not need any "theory" (CAPM, ICAPM, etc.) on the right hand side.

$$R_t^{ei} = \alpha_i + b_i rmrf_t + h_i hml_t + ... + \varepsilon_{it}$$

   (b) The average fund is average. How do we test that the "good" funds might be good? Form portfolios on characteristics known ahead of time that might indicate skill. (Don't do this too many times!) Then follow *all* funds with that characteristic.

   (c) Applied to modern funds, and hedge funds especially, the number of "factors" has exploded! Example: "equity neutral" hedge funds turn out to have performance you can replicate by writing put options.



   (d) Hedge fund manager: "That *is* my alpha. My clients don't know what momentum is, they don't know how to trade momentum." Maybe we've just quantified "skill." Maybe there is no alpha/beta, skill/selection, there is just beta you understand and beta you don't understand.

2.2 Fama and French Mutual Fund Performance

1. So far, we have been looking for "skill" by guessing some characteristic associated with skill – past returns, MBA by manager, etc. – and looking at the return of a sorted portfolio going forward.

2. This paper tells us whether there is any skill at all, *without* us taking a stand on what characteristic can be used to find good funds. It answers the question "sure the average fund is mediocre, but there are some good funds." Plus "You just haven't found a good measure of skill. Last year's returns or five year returns are noisy." (Read 1916 top to understand why they're different than persistence tests – if there is skill, lagged returns are a very noisy measure of that skill.) Good: We don't have to be smart. Bad: We will learn *whether there are* any skilled funds, but not *who* they are.

3. "Equilibrium Accounting? (p. 1915 top). A: The average investor must hold the market. Anything else is a zero sum game. (p. 1915) The average alpha relative to market portfolio must be zero. If I am to "win" you must lose. Big puzzle: Who agrees to be the loser! A pure indexer will never lose! (It is not true that smart funds can win and the indexer loses. The smart funds only win by active traders willing to underperform the index)

4. Method

   (a) Suppose all funds had zero true alpha. Due to luck some will win and some will lose. How many? A good measure, the alpha t statistic. Dividing by $\sigma(\hat{\alpha})$, you avoid the fact that funds that live shorter times, or have more idiosyncratic risk, are more likely to have big alphas due to luck.

$$\begin{aligned} R_t^{ei} &= \hat{\alpha}_i + \hat{b}_i rmrf_t + .. + e_{it} \\ \sigma(\hat{\alpha}_i) &= \sigma(e_{it})/\sqrt{T} \\ t_i &= \hat{\alpha}_i/\sigma(\hat{\alpha}_i) \end{aligned}$$

   (b) So, roughly, If there is no alpha at all, we should still see5% of funds with alpha t statistic greater than 1.64, and 2.5% of the funds with alpha t statistics greater than 1.96. If there is some skill out there, we will see more good funds than just due to chance.

   (c) What if e_{it} are correlated across i? Across t? Not normal? etc? That's why they do a big bootstrap.

5. Table 3 Result:

   (a) 5% of funds should have t stat more than 1.68. (Very close to t distribution of 1.64) about 4.5% actually do. There are *less* good funds than due to chance.

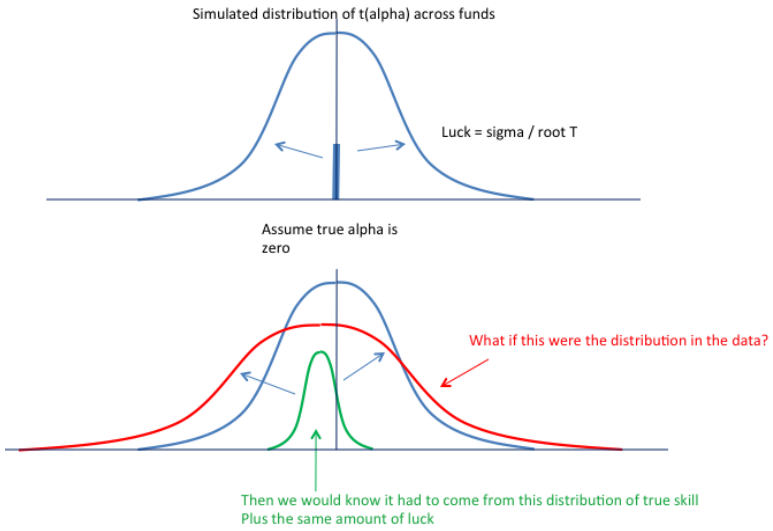
   (b) 5% of funds should have a t stat less than -1.71. 20% of funds actually have t stat less than 1.74 There are far more bad funds than just due to chance.

   (c) The median fund has a -0.62 alpha t statistic.

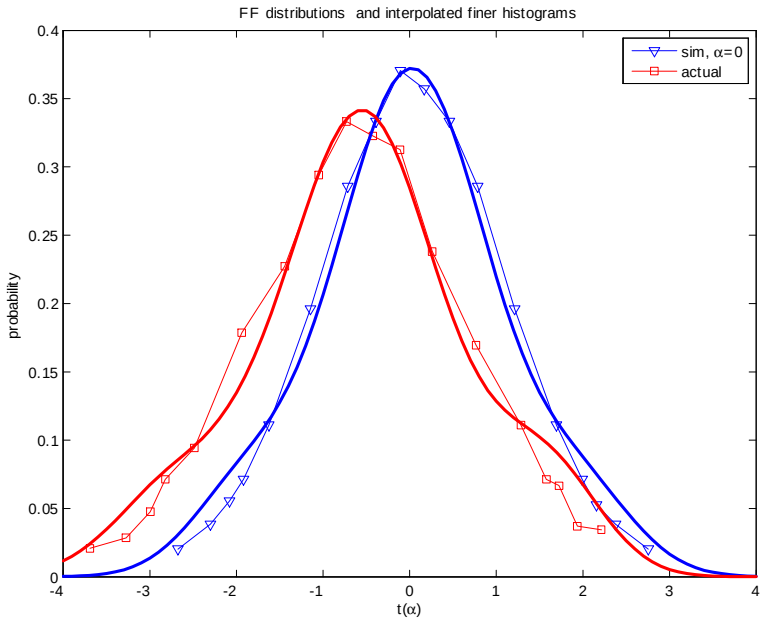
   (d) It's worse in large funds. It's worse with 4 factor alphas

   (e) Table III next page. There is a tiny bit of skill in gross (before fees) returns at the very top end! Medians are still pretty bad.

6. What have we done? We can back out the distribution of true alpha from the if-alpha-is-zero simulation and the data. Alas, the true distribution of alpha is tightly clustered around zero, and negative by just the amount of fees.



Fama French Table III in graphical form



It looks grim - the actual looks just like simulation shifted to the left. But look hard, the actual is just a bit wider – there is some skill out there!

7. Table A1. Relative to CAPM, medians and left tail are still bad. But there is some alpha at the top end. These are the value funds!

8. (This leads to an obvious answer to the question "why are there good and bad funds" in the main table, especially "why are there bad funds?" There are additional factors such as industry. It is likely that the "good" and "bad" funds in the main tables were just lucky with respect to additional factor bets. That view helps me to understand what negative alpha – before fees – means.)

9. (For comparison with FF, here is are the normal distribution cutoffs.

```
>> x = [1 2 3 4 5 10 20 30 40 50 60 70 80 95 96 97 98 99]';
```

```
>> fprintf( '%6.0i %6.2f \n',[x norminv(x/100)]')
     Pct  Normal
      1  -2.33
      2  -2.05
      3  -1.88
      4  -1.75
      5  -1.64
     10  -1.28
     20  -0.84
     30  -0.52
     40  -0.25
     50   0.00
     60   0.25
     70   0.52
     80   0.84
     95   1.64
     96   1.75
     97   1.88
     98   2.05
     99   2.33
```

2.3 Berk and Green

- Facts:

  1. Performance at best persists a year, and even that is "explained" by momentum. (Carhart)
  2. Investors not only choose active managment, but they chase past returns. (Chevalier and Ellison)

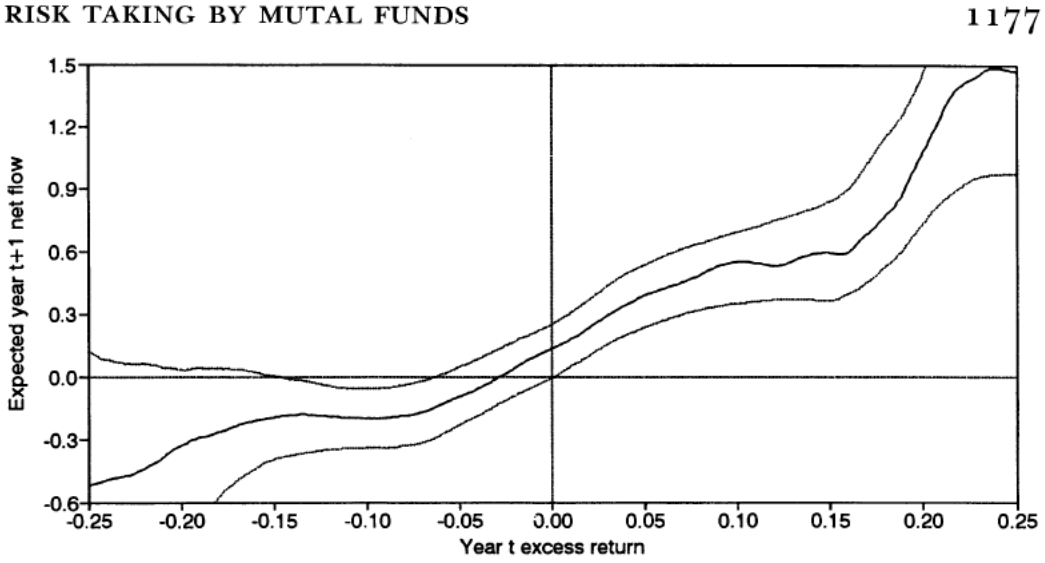


FIG. 1.—Flow-performance relationship $\hat{f}$ for young funds (age 2) with 90 percent confidence bands.

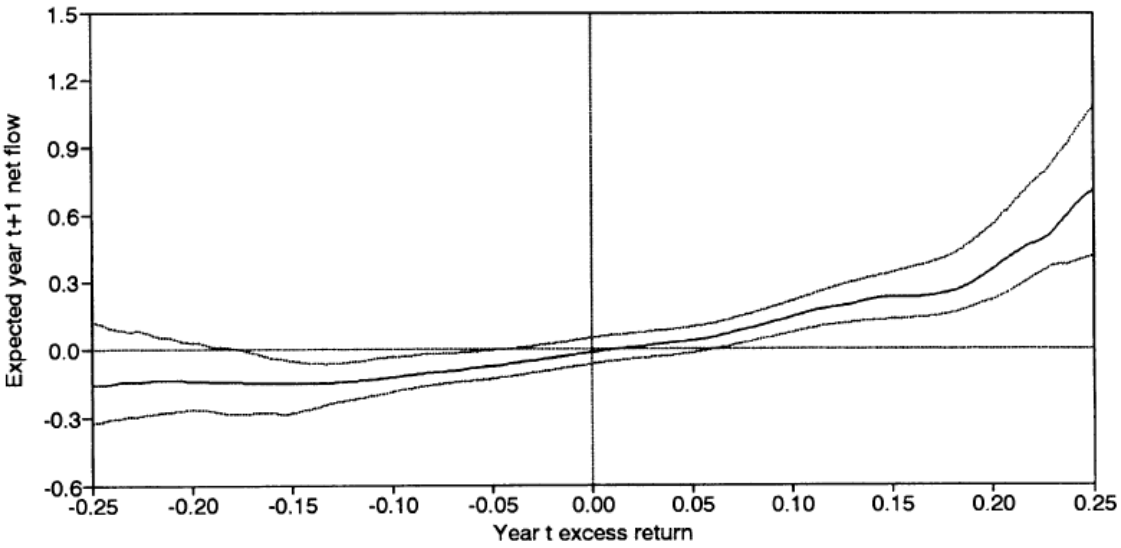


FIG. 2.—Flow-performance relationship $\hat{f}$ for old funds (age > 10) with 90 percent confidence bands.

(Source: Judith Chevalier and Glenn Ellison, "Risk Taking by Mutual Funds as a Response to Incentives," The Journal of Political Economy, Vol. 105, No. 6. (Dec., 1997), pp. 1167-1200.)

3. Managers are paid a lot, in a competitive market.
4. Academia discovered awful performance 50 years ago. Index funds were invented in the 1970s. "Sophisticated investors" (like university endowments, sovereieng wealth funds) are becoming *more* high-fee, active.

- Instead of saying "folly" let's try to explain this as a normal competitive market!
- Paper in a nutshell: Suppose the manager has skill,with 6% alpha and can run $10m. Above that, the manager has to index because the strategy can only work at a $10m scale. The fund charges 1% of AUM

1. Year 1: Fund has $10m AUM, earns 6%, returns 5% to investors.
   - Fund earns $600k. Manager gets $100k, investors get $500k
2. Investors see the good return and flock in. Year 2 Fund has $20m AUM and earn 6% α on first $10m, 0% α on the second $10m. Thus overall the fund earns 3% α, charges 1%, returns 2% to investors.
   - The fund still earns $600k, gives the manager $200k, returns $400k to investors.
3. More investors join. Where does this stop? Year 3. The fund has $60m AUM, *still earns 6%* α on the first $10m, indexing the remaining $50m. The fund charges *1% of $60m.* Investors now get 0% α (The index). Still, there is no reason for them to leave. If any do, returns rise again, drawing them back in.
   - Equilibrium: Fund earns $600k; Manager gets $600k, investors get 0 – fees balance α.

- "5 Hypotheses that we have taken for granted p. 2."

1. Returns (alpha) to investors measure skill.
2. Average returns (alpha) do not beat the market so the average manager is not skilled.
3. If a manger has skill, returns (alpha) should persist.

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- What do we see in this example

1. Skill lasts forever.
2. Alpha to investors dies out after 2 years. (weeks?)
3. In equilibrium, fund alpha is uncorrelated with skill.
4. Skillful managers get paid a lot.
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6. The manager is able to "raise his fee" to 5%, even though the stated fee is always 1%
7. Alpha times assets under management measures skill, not alpha. 0.10% $\times$100 billion is a lot of skill, not much alpha!

- Berk Vs. Fama and French:

1. FF: The BG model means we should see positive alpha before fees, and zero alpha after fees.
2. BG: No, as that alpha gets swamped by the indexing. In my example, the 6% alpha before fees gets diluted with all the indexing until it's 1% alpha.
3. FF: Still, BG's model means net alphas should be zero on average. Net alphas are negative.
4. Berk and Van Binsbergen: Only if you take out factors like value that nobody knew about. Measuring skill as alpha times assets under management, and only using factors people knew about at the time, alpha to investors is zero.
5. JC: Resolution: FF are measuring the question "do fund managers have skill beyond just buying the market, value and small stocks?" Their main question is, are stocks themselves efficient? For that question, indices like value that were not traded, indices that don't include transactions costs, and indices that most investors might not have heard of are appropriate. BG/ BVB are asking fundamentally different questions. Is it rational for investors to follow performance even though performance doesn't persist? For that quesiton, indices that investors knew about, could trade, and with transactions costs are appropriate. When there is an unsettled argument it is often because people are implicitly asking different questions.

- Quibbles. Many.

1. Note the model depends on the fixed 1% fee. Why not charge a higher fee? Answer: become a hedge fund! Another contract quibble: Why don't old investors block new investors?
2. Does the full B & G model match quantitatively? Do fund flows match Bayesian learning about skill in a noisy environment?
3. But... Finally we have a model with some promise to explain the puzzling data! For 45 years we have been railing about the wasted money on active management. Yet it persists. Everywhere else, economists say "if something persists, it must be serving a function," not "Active management persists because investors are dumb." We don't allow the "investors are dumb" story for price movements, how do we allow it for active management? Fees mean that active management is valuable – people are paying voluntarily. We just don't know for what!

- The future: What are we asking here, really? Once upon a time, mutual fund performance was a test of "semi-strong form" efficiency – can you do better with public, but hard to get information? In this analysis, the *question* is, implicitly, do funds have "stock picking ability" to find "undervalued stocks," i.e. "inefficiencies," "information not reflected in market prices," and the alternative is "can I replicate fund returns by passive or mechanical portfolio formation strategies (without paying high fees)?" I think this *question* is really passé. The real issue for most active management is that the managers may understand multifactor betas you don't understand. But nobody knew multifactor betas existed in 1970, and old habits die hard.