Lecture 4: Performance Evaluation

Investments

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Introduction

- In the US, the size of financial assets under institutional management is over 75 trillion as of 2007.
- Substantial fraction is invested in active funds.
- Active funds have considerably higher fees than passive funds.
  - ↪ Vanguard S&P 500 Index fund has expenses of 0.20% per year.
  - ↪ Fidelity Magellan Fund has initial load of 3%, expenses of 0.95%.
- The average expense ratio of active funds is 130 basis points. (Carhart (1997))

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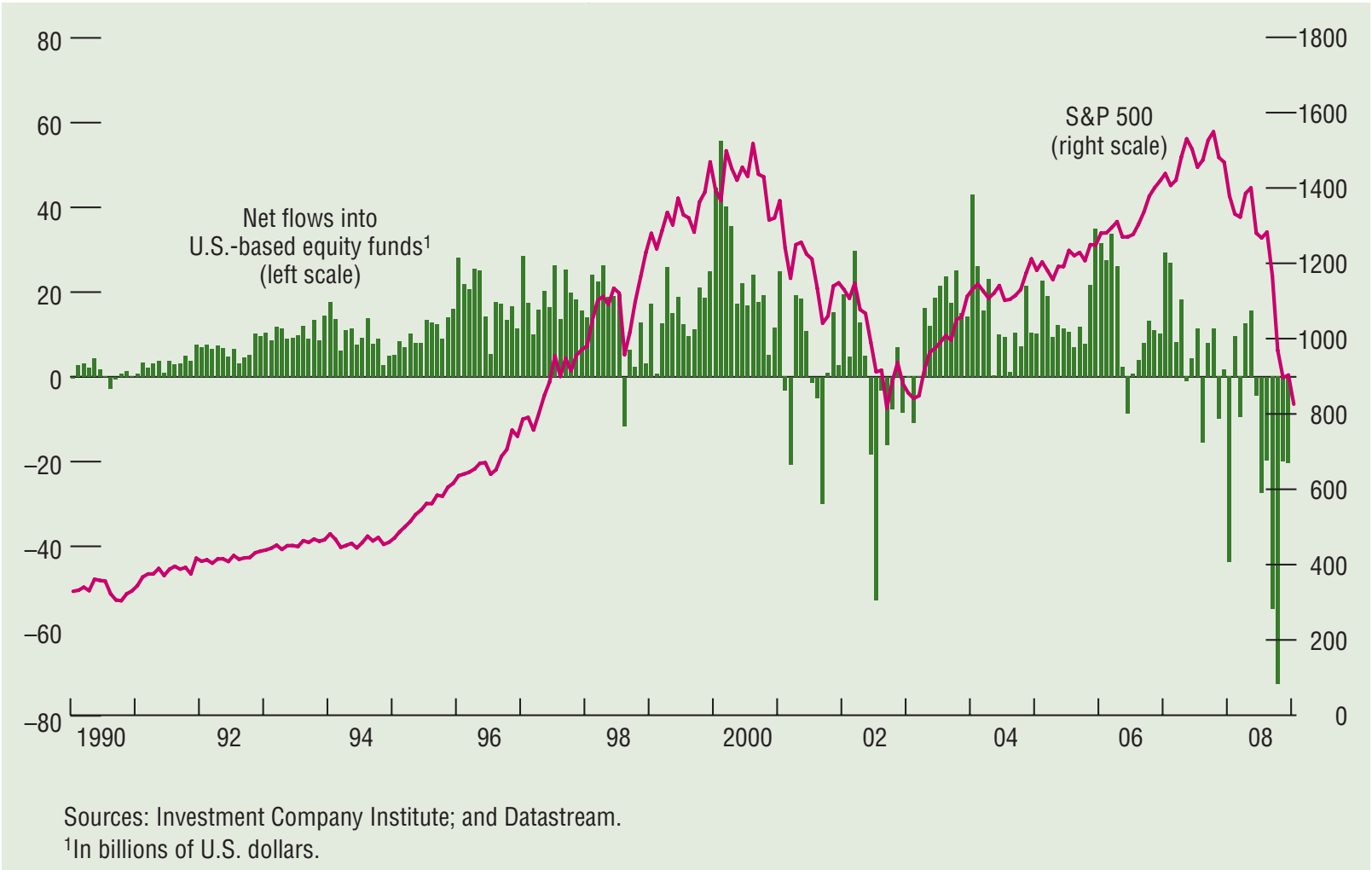
Equity Flows in US Mutual Funds



Sources: Investment Company Institute; and Datastream.
[1]In billions of U.S. dollars.

Introduction

- In deciding where to invest money, and how much to pay the fund, it is crucial to be able to determine how much fund managers add.
- We should only pay a manager for getting high returns if we could not have gotten those returns with an implementable *ex-ante* strategy.
  - ↪ If we could have levered up an index fund and gotten those returns, we should not pay the manager
  - ↪ If we could have used other *ex-ante* rules and gotten the same returns, we should not pay the manager:
- We should only pay the manager for generating *abnormal* returns with respect to what we can trade ourselves (alpha).
- This is an ideal setting in which to apply the CAPM

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Return Based Performance Measures

- We can evaluate the manager's performance using historical returns:
  1. Sharpe ratio.
  2. (Jensen's) alpha.
  3. Appraisal ratio/Information ratio.
- The original measures used the CAPM as the benchmark model.
- The APT-based measures are virtually identical.

A Risk-Adjusted Measure for Diversified Portfolios

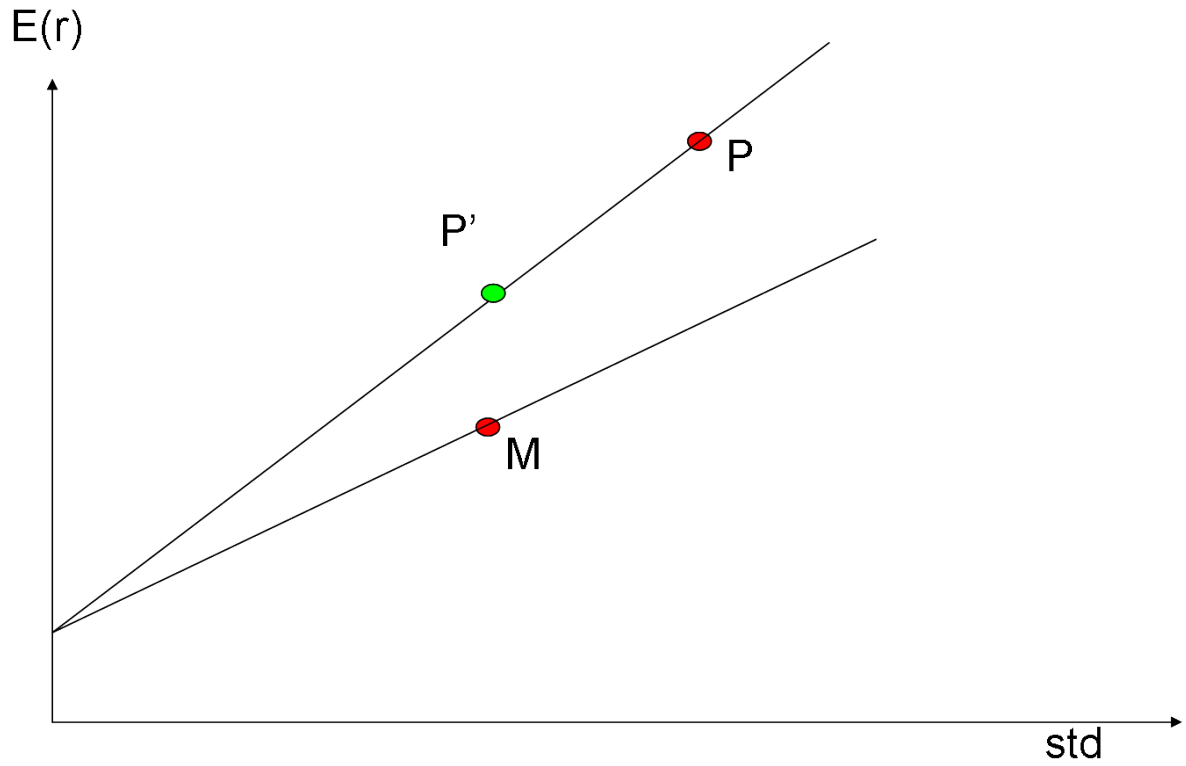
- Sharpe Ratio
  - ↪ If the mutual fund represents our entire wealth, we should use the Sharpe Ratio of a portfolio.
  - ↪ **Definition:** The Sharpe Measure is the reward to variability ratio for the portfolio "p" (*i.e.*, the slope of the CAL for security p)

$$S_p = \frac{E[R_p] - r_f}{\sigma_p}$$

  - ↪ The Sharpe Ratio compares performance to the *total risk* of the portfolio.

The Sharpe Measure

- If the CAPM fails, then managers can achieve a higher Sharpe ratio than the market:



The Sharpe Measure - Example

- Some Sharpe Ratios for large funds ($> \$4$ billion)

-- Risk-return Analysis --

Primary Asset: SPC S&P 500 Composite Risk-free ROR: 0.34%
Holding Period: 1 Months Horizon: 7/84 - 6/94 95% Confidence

Asset Code	Name	ROR %	STD %	Min. ROR %	Sharpe Ratio
SPC	S&P 500 Composite	1.20	4.55	-7.71	0.19
DWDVX	DEAN WITTER DIV GRTH SEC	1.14	3.79	-6.29	0.21
DREVX	DREYFUS FUND	0.87	3.69	-6.36	0.14
FMAGX	FIDELITY MAGELLAN FUND	1.48	5.12	-8.55	0.22
JANSX	JANUS FUND	1.22	3.99	-6.61	0.22
PIOTX	PIONEER II	1.05	4.59	-7.95	0.15
PGRWX	PUTNAM GROWTH & INCOME	1.18	3.61	-5.89	0.23
TEMWX	TEMPLETON WORLD FUND	1.16	4.26	-7.18	0.19
TWCIX	TWENTIETH CENT SELECT	1.09	5.17	-9.04	0.15
VFINX	VANGUARD INDEX TR 500	1.18	4.56	-7.75	0.18
VWNDX	WINDSOR FUND	1.23	4.40	-7.40	0.20

Risk-Adjusted Measures for Non-diversified portfolios

- The Sharpe measure is not appropriate for funds that you are considering as part of a larger portfolio, or when you are deciding how much to compensate managers.
- In this case, you will want to use a measure which looks at the value added relative to the portfolio you are currently holding.
- Two alternative measures are useful in this case:
  1. Jensen Measure
  2. Appraisal Ratio

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Jensen measure

- How to compute value added?
- Remember that
  - ↪ If the CAPM holds, you should be holding the market portfolio.
  - ↪ If the APT holds, you should be holding a portfolio of the factors *only*.
- In general, suppose that your current portfolio is a linear combination of portfolios R_1, R_2,...
- The Jensen measure is just the α of the fund with respect to those portfolios:

$$\alpha_p = E(r_p^e) - \beta_{p1} E(R_1^e) - \beta_{p2} E(R_2^e) + \ldots$$

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Jensen measure

- Empirically, the best estimate of α_p is the intercept from the following regression:

$$r_{p,t} - r_{f,t} = \alpha_p + \beta_{p,1}(R_{1,t} - r_{f,t}) + \beta_{p,2}(R_{2,t} - r_{f,t}) + \ldots + \varepsilon_{p,t}$$

- The Jensen measure is the most popular measure, perhaps because it is so easy to calculate.

  ↪ Example 1: suppose you believe the CAPM holds, and therefore you hold the market portfolio. Then you should be holding the market portfolio and can estimate Jensen's alpha by:

$$r_{p,t} - r_{f,t} = \alpha_p + \beta_{p,m}(R_{m,t} - r_{f,t}) + \varepsilon_{p,t}$$

  ↪ Example 2: suppose you do not think the CAPM works. You are currently holding three portfolios: the market portfolio, and two trading strategies, titled SMB and HML. Then, you can estimate Jensen's alpha by:

$$r_{p,t} - r_{f,t} = \alpha_p + \beta_{p,m}(R_{m,t} - r_{f,t}) + \beta_{p,s}R_{smb,t} + \beta_{p,h}R_{hml,t} + \varepsilon_{p,t}$$

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Jensen measure

- Thus, it all depends on what the alternatives are, i.e. what you can invest in *without the manager*.
- You can also include momentum (see Lecture 6) as a portfolio, which will give you the Carhart model.
- Jensen's α is also the maximum you should be willing to compensate a portfolio manager.
  - ↪ Remember that α is in units of return
  - ↪ So if, for example, a fund has a pre-expense α of 0.0015 when calculated with a monthly regression, this means that we should be willing to pay up to 0.15%/month (or approximately 1.8%/year) in expenses.
  - ↪ Alternatively, were you to compensate the manager this much, your after-expense α would be zero.

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The Appraisal Ratio

- One issue with the Jensen measure is that it does not adjust for how the risk of the portfolio changes.
  - ↪ If I add a substantial fraction of this fund to my portfolio (as opposed to a small amount **not** δ as in our CAPM derivation), then the fund's 'idiosyncratic risk' ε will increase the variance of my portfolio.

- This motivates the use of the *Appraisal Ratio* (or Information Ratio):

$$AR_j = \frac{\alpha_j}{\sigma(\varepsilon_j)}$$

- The Sharpe Ratio of optimal portfolio C (after you invest in the fund) of M (what you were doing before) and the fund j is:

$$SR_C = \sqrt{SR_M^2 + AR_j^2}$$

The Appraisal Ratio and Asset Allocation

- "Given that I hold portfolio p, should I add fund j to my portfolio?"
- You need to compute the Appraisal Ratio **with respect to your portfolio:**

1. Estimate
$$R_{jt} - r_{f,t} = a_j + \beta_j(R_{p,t} - r_{f,t}) + \varepsilon_{j,t}$$

2. Compute the appraisal ratio of fund j with respect to your portfolio P
$$AR_j = \frac{a_j}{\sigma(\varepsilon_j)}$$

3. Sharpe Ratio of optimal combination C of P and j is: $SR_C = \sqrt{SR_p^2 + AR_j^2}$

- Caution: given that we can't short mutual funds, this is only useful if $AR_j > 0$.

Compensation

- *Jensen's* α: is the maximum amount you should be willing to pay a manager

  a) the payment should be in terms of the fraction of the portfolio value per period.

  b) If you are using a past α, this assumes that the manager's future performance will be the same as their past performance!

  c) If you don't believe that this is so, you should use your best estimate of the manager's future α

- How precisely is the alpha estimated?

Examples

- Here are the calculated alphas and betas for some mutual funds we looked at earlier, over the same period:

-- Betas/Alphas --

Independent Variable: SPC S&P 500 Composite
Holding Period: 1 Months Horizon: 7/84 - 6/94

Asset Code	Name	ROR %	STD %	Beta	Alpha
DWDVX	DEAN WITTER DIV GRTH SEC	1.14	3.79	0.81	0.17
DREVX	DREYFUS FUND	0.87	3.69	0.74	-0.02
FMAGX	FIDELITY MAGELLAN FUND	1.48	5.12	1.09	0.17
JANSX	JANUS FUND	1.22	3.99	0.80	0.26
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How well do mutual fund managers perform?

- Over the past 30 years,
  - ↪ the Wilshire 5000 has returned an average of 14.01% per year.
  - ↪ the average equity fund has returned 12.44% after fees.
- Operating expenses and fees amount to 1.7%.
- The average active manager adds very little/no value
  Jensen (1968), Malkiel (1995) , Daniel et. al. (1997)
- Fairer to compare actively managed funds with index funds, which have operating expenses of 0.3%. This reduces the under-performance margin to 1.27%.

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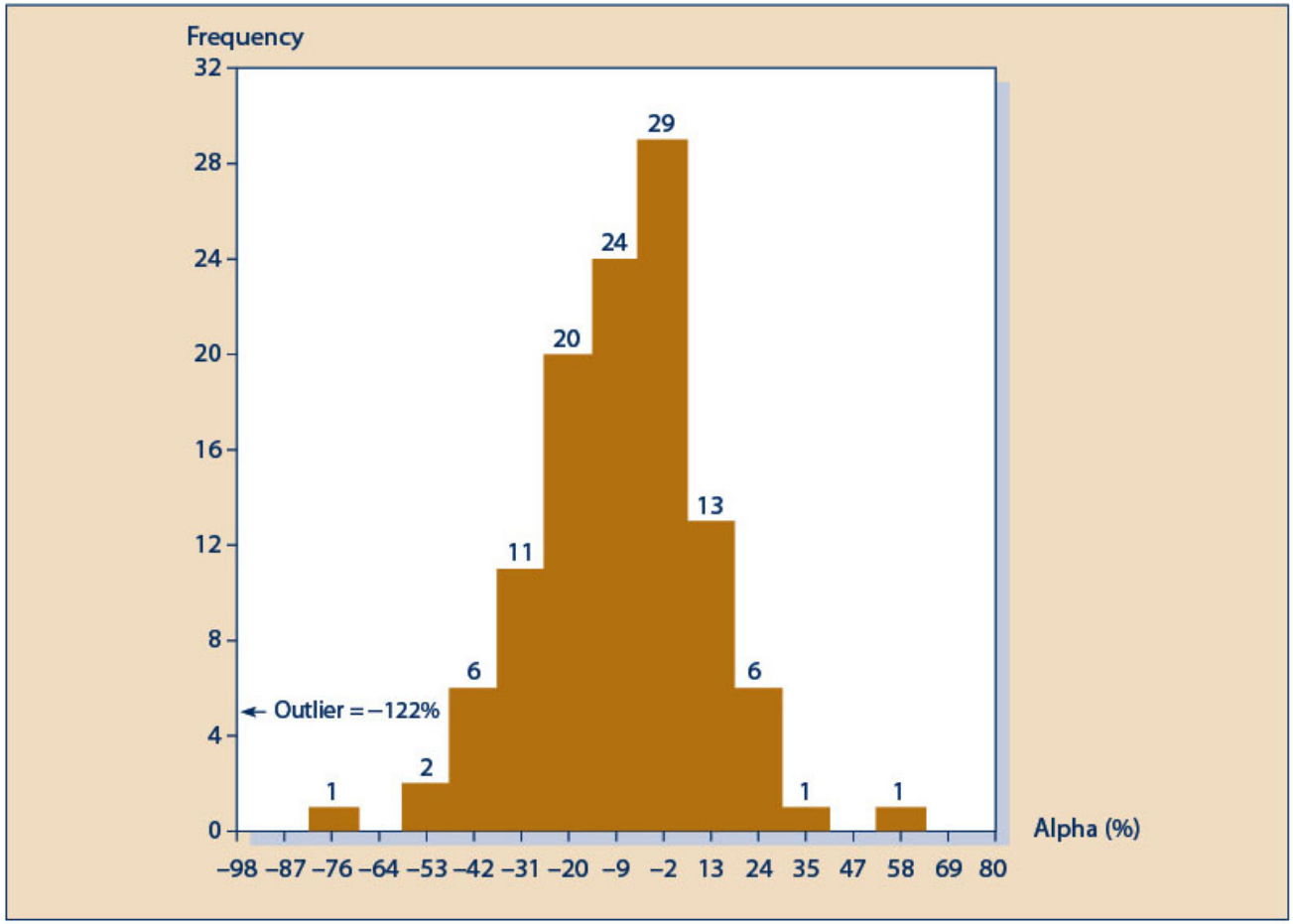
How well do mutual fund managers perform?

Figure 8.4

Frequency distribution of alphas.



Source: Michael C. Jensen, "The Performance of Mutual Funds in the Period 1945–1964," *Journal of Finance* 23 (May 1968). Reprinted by permission of the publisher, Blackwell Publishing Inc.

How well do mutual fund managers perform?

- Yet there might be some managers who add value.
  - ↪ Can we identify them ex-ante?

How well do mutual fund managers perform?

- In 1977, Peter Lynch was named head of the Magellan Fund which had $18m in assets. By the time he resigned in 1990, the fund had grown to more than $14b.

    1. Peter Lynch beat the S&P 500 in 11 of the 13 years in 1977-1989.
    2. This in itself is not evidence of value-enhancement.
       If we look at a set of 500 “coin-flippers,” let each of them flip 13 coins, the winner will, on average, have 11.63 heads.
    3. However, Lynch consistently beat the S&P by large amounts.
       (from 79-89, Magellan returned 29%/year, vs. 17.5% for the S&P).

- Peter Lynch exhibited statistically significant abnormal performance, even after correcting for the fact that he was the best performing manager of this period.
- How much persistence is there among managers?

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How well do mutual fund managers perform?

Portfolio	Monthly Excess Return	Std Dev	CAPM Alpha	CAPM VWRF	CAPM Adj R-sq	4-Factor Model Alpha	RMRF	SMB	HML	PR1YR	Adj R-Sq
1A	0.75%	5.45%	0.27%	1.08	0.777	−0.11%	0.91	0.72	−0.07	0.33	0.891
			(2.06)	(35.94)		(−1.11)	(37.67)	(19.95)	(−1.65)	(11.53)	
1B	0.67%	4.94%	0.22%	1.00	0.809	−0.10%	0.86	0.59	−0.05	0.27	0.898
			(2.00)	(39.68)		(−1.08)	(40.66)	(18.47)	(−1.38)	(10.63)	
1C	0.63%	4.95%	0.17%	1.02	0.843	−0.15%	0.89	0.56	−0.05	0.27	0.927
			(1.70)	(44.65)		(−1.92)	(49.76)	(20.86)	(−1.61)	(12.69)	
1 (high)	0.68%	5.04%	0.22%	1.03	0.834	−0.12%	0.88	0.62	−0.05	0.29	0.933
			(2.10)	(43.11)		(−1.60)	(50.54)	(23.67)	(−1.86)	(13.88)	
2	0.59%	4.72%	0.14%	1.01	0.897	−0.10%	0.89	0.46	−0.05	0.20	0.955
			(1.75)	(57.00)		(−1.78)	(66.47)	(22.95)	(−2.25)	(12.43)	
3	0.43%	4.56%	−0.01%	0.99	0.931	−0.18%	0.90	0.34	−0.07	0.16	0.963
			(−0.08)	(70.96)		(−3.65)	(76.80)	(18.99)	(−3.69)	(11.52)	
4	0.45%	4.41%	0.02%	0.97	0.952	−0.12%	0.90	0.27	−0.05	0.11	0.971
			(0.33)	(85.70)		(−2.81)	(90.03)	(18.18)	(−3.12)	(9.40)	
5	0.38%	4.35%	−0.05%	0.96	0.960	−0.14%	0.90	0.22	−0.05	0.07	0.970
			(−1.10)	(93.93)		(−3.31)	(89.65)	(14.42)	(−3.27)	(6.18)	
6	0.40%	4.36%	−0.02%	0.96	0.958	−0.12%	0.90	0.22	−0.04	0.08	0.968
			(−0.46)	(91.94)		(−2.82)	(86.16)	(14.02)	(−2.37)	(6.01)	
7	0.36%	4.30%	−0.06%	0.95	0.959	−0.14%	0.90	0.21	−0.03	0.04	0.967
			(−1.39)	(92.90)		(−3.09)	(85.73)	(13.17)	(−1.62)	(2.89)	
8	0.34%	4.48%	−0.10%	0.98	0.951	−0.13%	0.93	0.20	−0.06	0.01	0.958
			(−1.86)	(85.14)		(−2.52)	(75.44)	(10.74)	(−3.16)	(0.84)	
9	0.23%	4.60%	−0.21%	1.00	0.926	−0.20%	0.93	0.22	−0.10	−0.02	0.938
			(−3.24)	(67.91)		(−3.11)	(60.44)	(9.69)	(−3.80)	(−1.17)	
10 (low)	0.01%	4.90%	−0.45%	1.02	0.851	−0.40%	0.93	0.32	−0.08	−0.09	0.887
			(−4.58)	(46.09)		(−4.33)	(42.23)	(9.69)	(−2.23)	(−3.50)	
10A	0.25%	4.78%	−0.19%	1.00	0.864	−0.19%	0.91	0.33	−0.11	−0.02	0.891
			(−2.05)	(48.48)		(−2.16)	(42.99)	(10.27)	(−3.20)	(−0.76)	
10B	0.02%	4.92%	−0.42%	1.00	0.817	−0.37%	0.91	0.32	−0.09	−0.09	0.848
			(−3.84)	(40.67)		(−3.45)	(35.52)	(8.24)	(−2.16)	(−2.99)	
10C	−0.25%	5.44%	−0.74%	1.05	0.736	−0.64%	0.98	0.32	−0.04	−0.17	0.782
			(−5.06)	(32.16)		(−4.49)	(28.82)	(6.29)	(−0.73)	(−4.09)	

- Funds are sorted into deciles based on past 12 month performance
- Table depicts performance over the subsequent 12 months relative to risk-free, relative to benchmark (CAPM) and relative to Carhart's Four-Factor model.

How well do mutual fund managers perform?

- Chevalier and Ellison (Journal of Finance, 1999) find that manager characteristics predict future performance:
  1. Younger managers do better.
  2. Managers with an MBA do better.
  3. Undergraduate institution matters.
  4. Higher composite SAT score managers do better.

- We could identify good active managers by analyzing past performance.
  - ↪ The evidence on the persistence of active managers is mixed, but there is some limited evidence consistent with persistence.
  - ↪ Note: *manager* persistence, not necessarily *fund* persistence.

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Fund Characteristics and Manager Characteristics

Characteristics of and actions taken by mutual funds are regressed on characteristics of the funds' managers. The manager characteristics variables include the average SAT of matriculants at the manager's undergraduate institution (divided by 100), a dummy variable that takes the value of one if the manager has an MBA degree and zero otherwise, the manager's age, and the manager's tenure. The observations are fund-years. Newey-West standard errors are in parentheses.

	Dependent Variables			
Independent Variables	Beta	Log of Assets	Expense Ratio (%)	Turnover Ratio (%)
Constant	0.788	4.257	1.911	143.61
	(0.069)	(0.661)	(0.225)	(25.80)
Manager college SAT	0.011	0.063	−0.055	−5.09
	(0.005)	(0.054)	(0.029)	(2.19)
Manager MBA	0.067	0.393	−0.083	−1.88
	(0.016)	(0.149)	(0.054)	(5.18)
Manager age	0.0020	−0.0261	0.0211	−0.027
	(0.0009)	(0.0085)	(0.0076)	(0.351)
Manager tenure	−0.0055	0.054	0.023	−0.26
	(0.0020)	(0.019)	(0.017)	(0.58)
Growth-income dummy	−0.131	0.268	−0.006	−14.47
	(0.015)	(0.162)	(0.083)	(5.35)
Log of assets			−0.206	
			(0.031)	
R^2	0.102	0.036	0.238	0.020
No. of observations	2029	1907	1895	1885

How well do mutual fund managers perform?

Independent Variables	Simple/Full/ OLS	Alpha/Full/ OLS
Constant	−1.730	−0.882
	(1.787)	(1.658)
Manager college SAT	0.462	0.376
	(0.135)	(0.127)
Manager MBA	0.630	0.042
	(0.390)	(0.363)
Manager age	−0.084	−0.082
	(0.022)	(0.021)
Growth-income dummy	−1.835	−0.766
	(0.351)	(0.331)
Expense ratio		
Log of assets		
Turnover ratio		
R^2	0.03	0.02
No. of observations	2029	2029

Managers and alpha

- How could the manager generate alpha?
  a) Market timing, factor timing, or characteristic timing.
  b) Stock selectivity.
  c) Economies of scale, (see DFA)
- I am happy to pay the manager a fee for doing the above.
- However, I wish to avoid a situation where the manager generates excess returns by taking on more risk that is difficult to observe (i.e. buying index futures and then writing out of the money put options).

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Agency costs

- Whenever ownership and control are separate, it is important to understand the wedge in incentives between investors (owners) and managers (decision makers).
- There is one important difference between investing in a firm versus investing in a fund:
  - ↪ Portfolio managers have greater latitude in affecting the risk of the fund than CEOs can affect the risk of the firm.
- This makes the agency problem between managers and investors potentially more severe...

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Equity Flows in US Mutual Funds

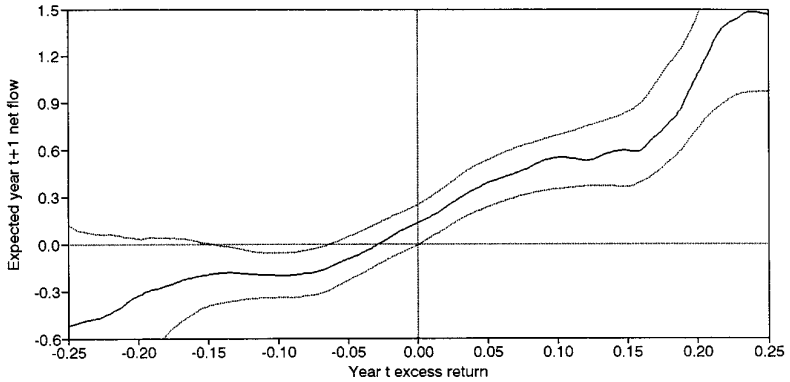

FIG. 1.—Flow-performance relationship $\hat{f}$ for young funds (age 2) with 90 percent confidence bands.

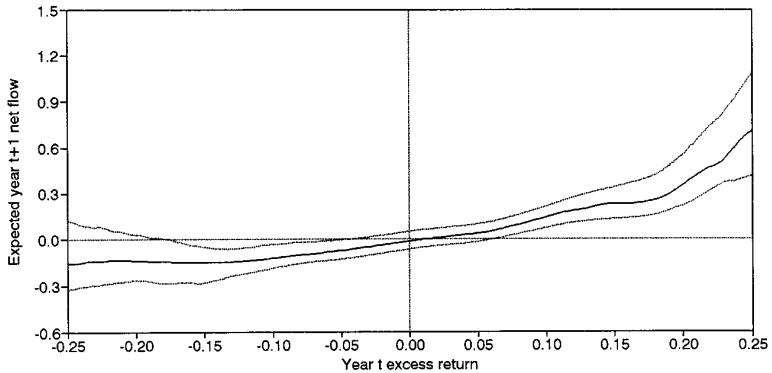

FIG. 2.—Flow-performance relationship $\hat{f}$ for old funds (age > 10) with 90 percent confidence bands.

- For individual funds, the flow-performance relationship is convex.
- If managers get compensation proportional to the size of the fund, what does this convex relationship imply for their attitude towards risk?

Equity Flows in US Mutual Funds

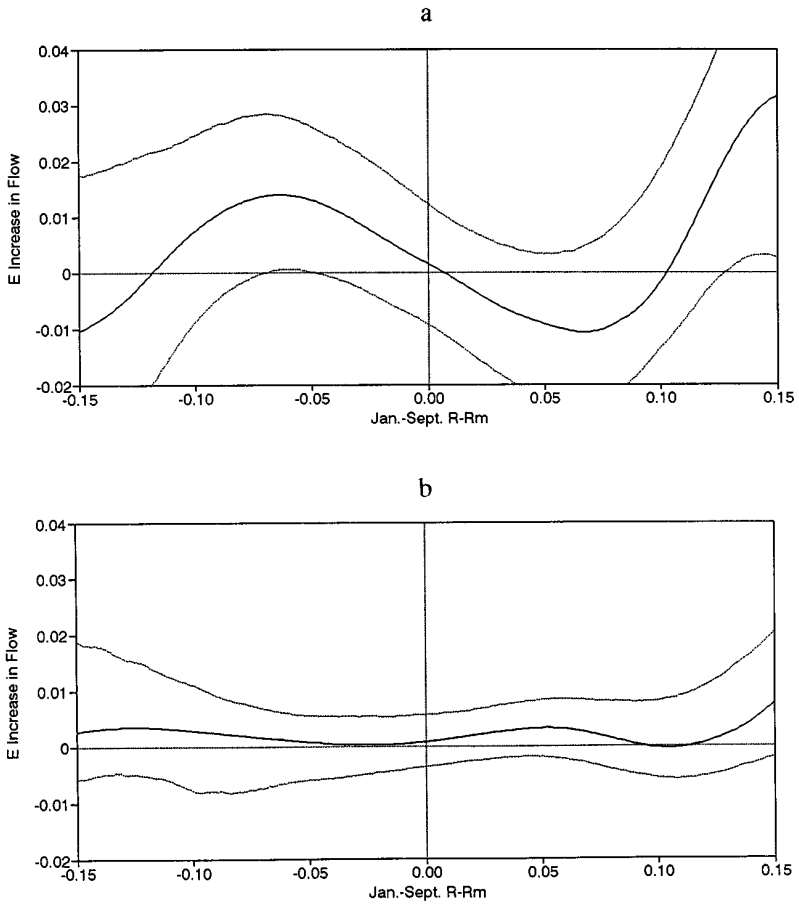

FIG. 3.—Risk incentives with 90 percent confidence bands. *a*, Funds of age 2. *b*, Funds of age 11 or more.

- The managers incentive to take risk increases as he under-performs the benchmark
  - ↪ Gambling for resurrection.
- Incentive to take risk less for older funds

TABLE 4

SEPTEMBER–DECEMBER RISK CHANGES AND INCENTIVES ($N = 464$)

	DEPENDENT VARIABLE		
INDEPENDENT VARIABLE	$\Delta SD(r - rm)$ (1)	$\Delta SD(r - \beta rm)$ (2)	$\Delta\lvert\beta - 1\rvert$ (3)
RiskIncentive	.87	.73	2.22
	(.28)	(.24)	(1.40)
RiskIncentive − log(Assets)	−.15	−.11	−.57
	(.05)	(.04)	(.28)
log(Assets)	.00013	−.00003	.003
	(.0003)	(.0002)	(.002)
Sept. risk level	.05	.03	−.007
	(.02)	(.02)	(.02)
Constant	−.001	−.0002	−.006
	(.002)	(.002)	(.009)
R^2	.03	.03	.01

NOTE.—Estimated standard errors are in parentheses.

Style analysis

- Any performance measure can be gamed.
- Consider a manager who claims to provide index exposure only.
  a) He could buy futures on the index.
  b) Invest the remaining assets on a momentum strategy that has zero correlation with the index.
- Does the previous exercise reveal something about the portfolio the mutual fund is holding?
- Yes! The estimate *betas* with these benchmark portfolios implicitly reveal what the fund is invested in.

  ↪ Sharpe's style analysis.

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Style analysis

- We can decompose the return of the managed portfolio into
  - i) return due to style
  - ii) return due to selection
    - **Definition:** Selection return equals the difference between fund return and that of a passive trading strategy.
- Steps involved:
  - a) Construct a portfolio of style benchmarks $R_1 ... R_K$ that you think encompasses all asset classes the manager might invest in
  - b) Run a Style Regression (Sharpe 1992):

$$r_{i,t} = \underbrace{[b_1 R_{1,t} + ... + b_k R_{k,t}]}_{\text{style}} + \underbrace{a_i + e_{i,t}}_{\text{selection}}$$

- $[a_i + e_{i,t}]$ reflects the manager's contribution
- $[b_1 R_{1,t} + ... + b_k R_{k,t}]$ as the fund-mimicking portfolio.

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A) Mutual Funds

↪ Mutual Funds *cannot* take short positions.

↪ The weights $b_1..b_k$ will have to be determined by minimizing the residual variance subject to the constraints :

$$\begin{aligned} b_1, b_2, .., b_k &\geq 0 \\ b_1 + b_2 + .. + b_k &= 1 \end{aligned}$$

- You must do this using Excel's solver.

B) Hedge Funds

↪ Hedge Funds *can* take short positions.

↪ Slope coefficients (b_i) should be allowed to take negative values.

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Style analysis

- What are the appropriate benchmarks?
- Passive trading strategies that you could do yourself.
- Example: the “Russell Corners”
  a) Russell 1000 Growth
  b) Russell 1000 Value
  c) Russell 2000 Growth
  d) Russell 2000 Value
- Depending on the fund’s mandate, may also include
  ↪ Dynamic strategies with option-like payoffs
  ↪ Other trading strategies that might generate ’abnormal’ returns (see Lecture 6 for ideas)

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Style analysis

- Strengths
  1. Can handle any strategy for which indices exist.
  2. Uses only return information (available at high frequency).
  3. Mutual fund statements are often ambiguous or misleading, for instance Fidelity Magellan's prospectuses never mentioned that they invested in bonds. Style Analysis detects this.

- Weaknesses.
  1. Style is an average over time, NOT a snap shot.
  2. Statistical performance testing difficult, especially if benchmarks are highly correlated.
  3. Problematic if applied to rapid style rotators.
  4. Style Analysis is only as good as the appropriate selection of benchmarks.
  5. Not immune to gaming (example: return smoothing).

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Application - Magellan Fund

- Fund performance is often associated with a manager rather than a fund.
  - ↪ Similarly the style of a fund often changes with managers
- Example: Fidelity Magellan Fund
  - ↪ Fidelity Magellan claims to be a large growth fund.
  - ↪ The Fidelity Magellan managers were
    1. Lynch (1978- 1990)
    2. Smith (1990 - 1992)
    3. Vinik (1992 - 1996)
    4. Stansky (1996 - 2000)
- We will try to take a look at the performance of the Fidelity Magellan fund under these managers, and try and determine each manager's style.

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Example - Magellan Fund

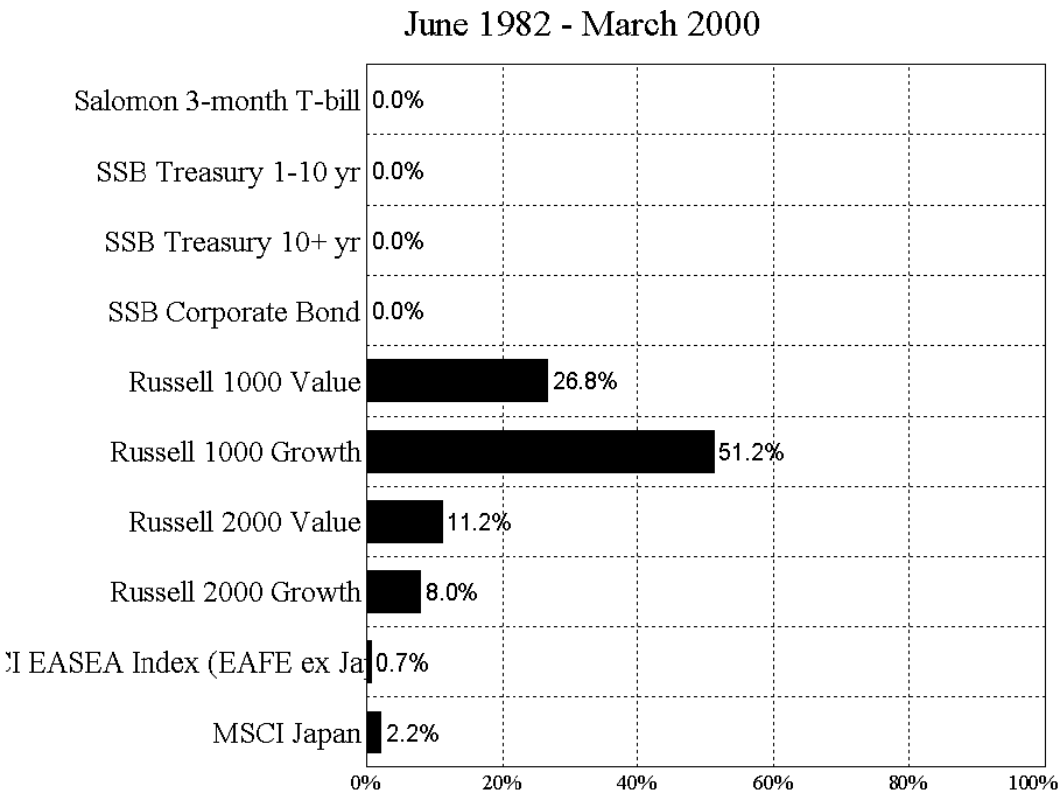
- We choose 10 appropriate benchmarks and perform a style regression

Single Computation
June 1982 - March 2000

	Fidelity Magellan Allocation (%)
Salomon 3-month T-bill	0
SSB Treasury 1-10 yr	0
SSB Treasury 10+ yr	0
SSB Corporate Bond	0
Russell 1000 Value	26.766
Russell 1000 Growth	51.1599
Russell 2000 Value	11.2494
Russell 2000 Growth	7.9827
MSCI EASEA Index (EAFE ex Japan)	0.660238
MSCI Japan	2.18179

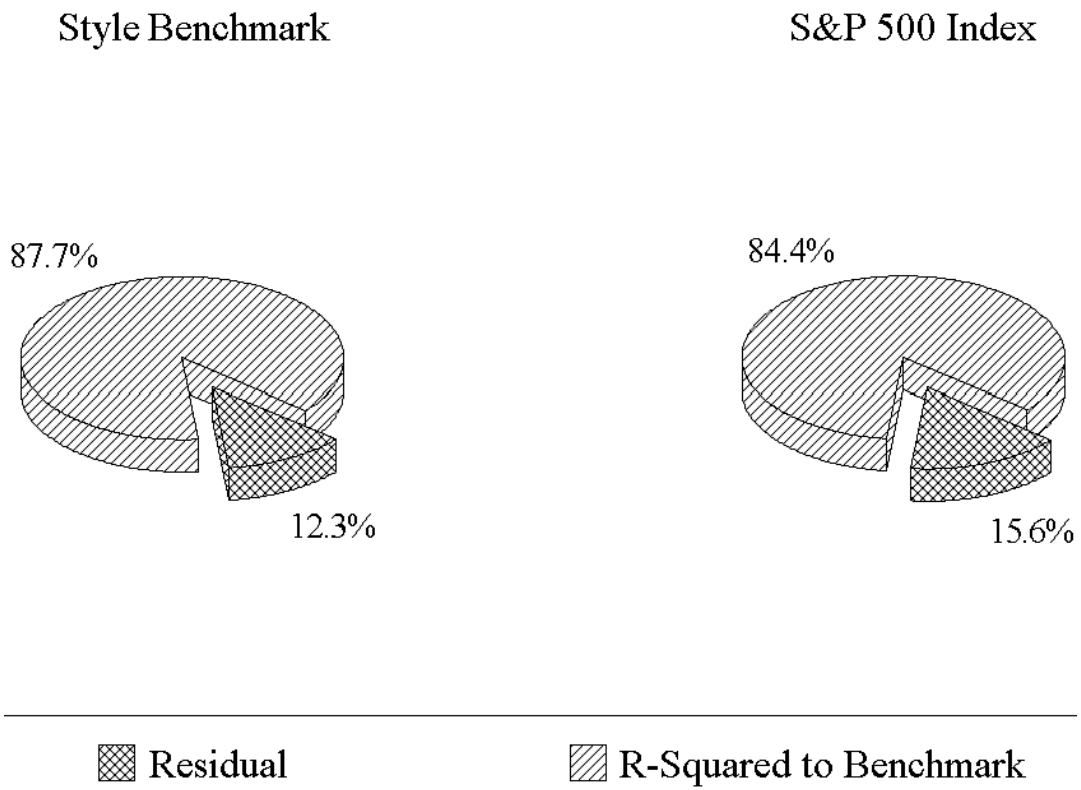
Example - Magellan Fund

- The resulting weights are given below



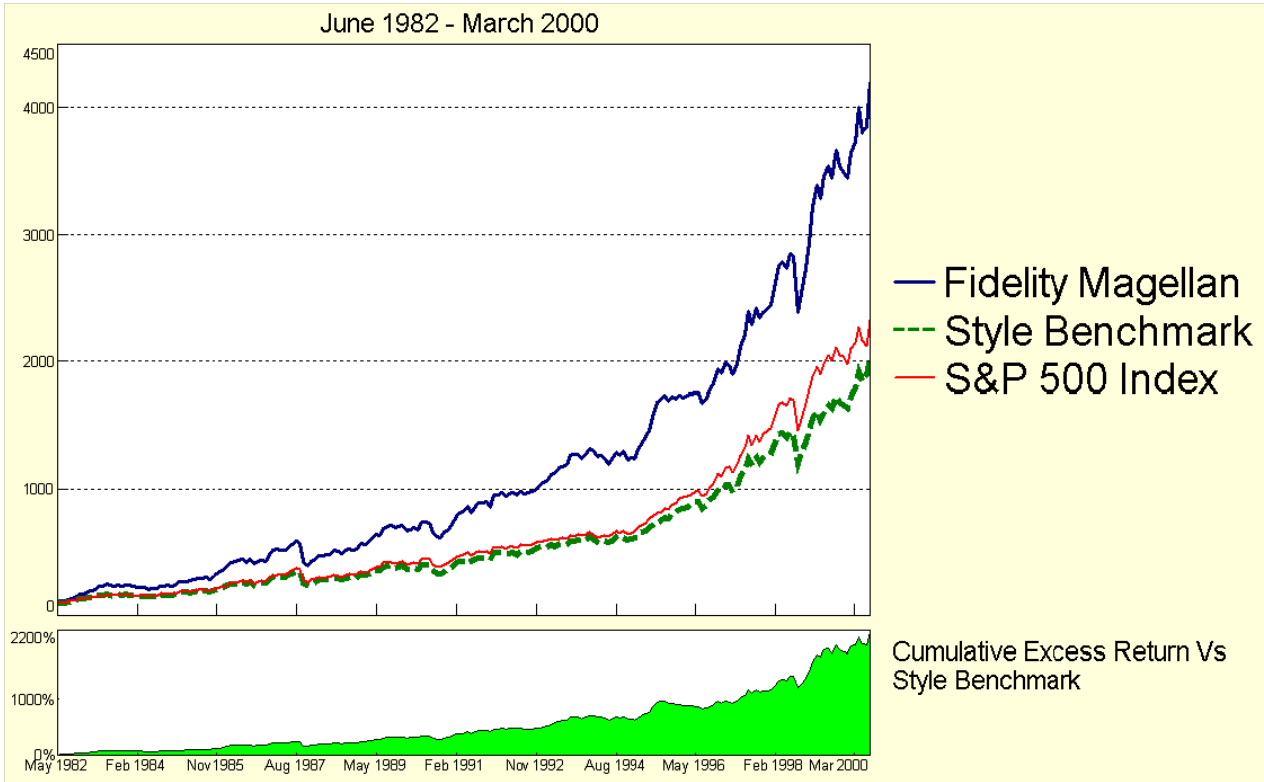
Example - Magellan Fund

- The chosen benchmarks should do a better job explaining the returns of the fund than the market index if correctly chosen.



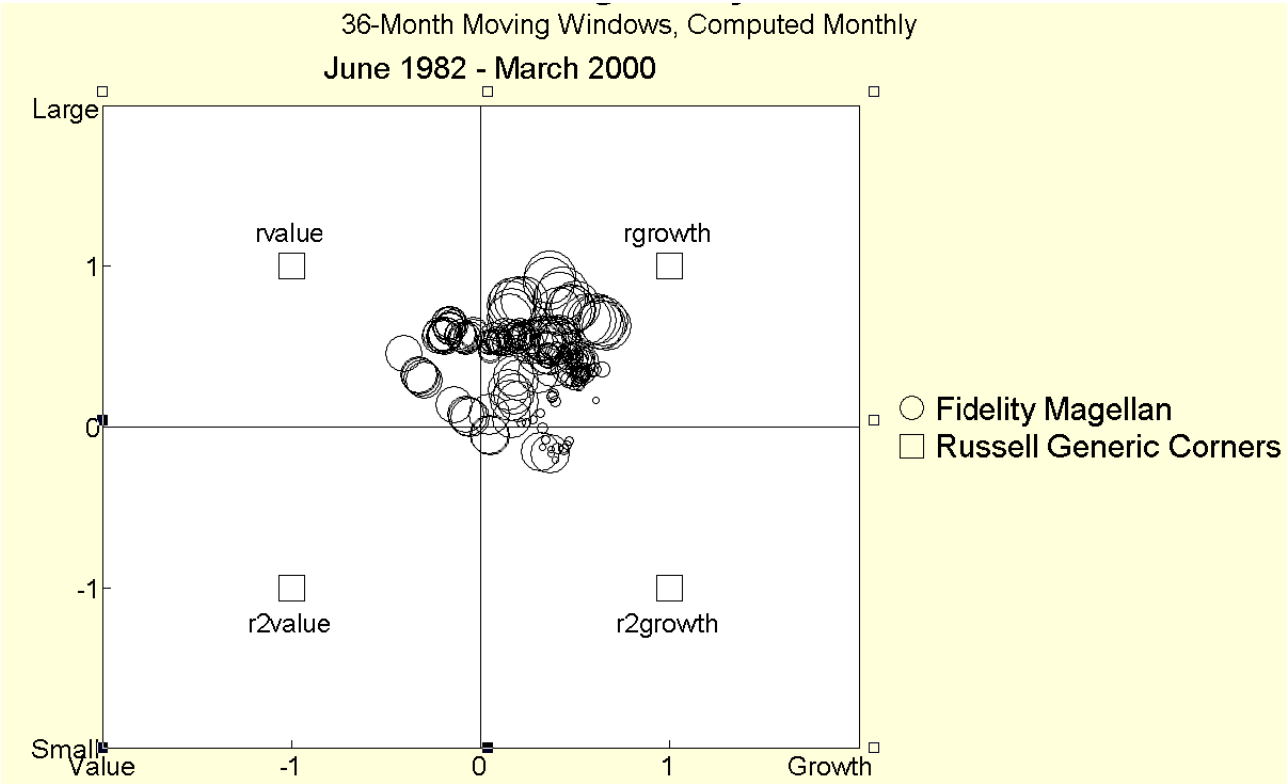
Example - Magellan Fund

- The cumulative performance has very been good, indicating that the residual a_i has been significantly positive



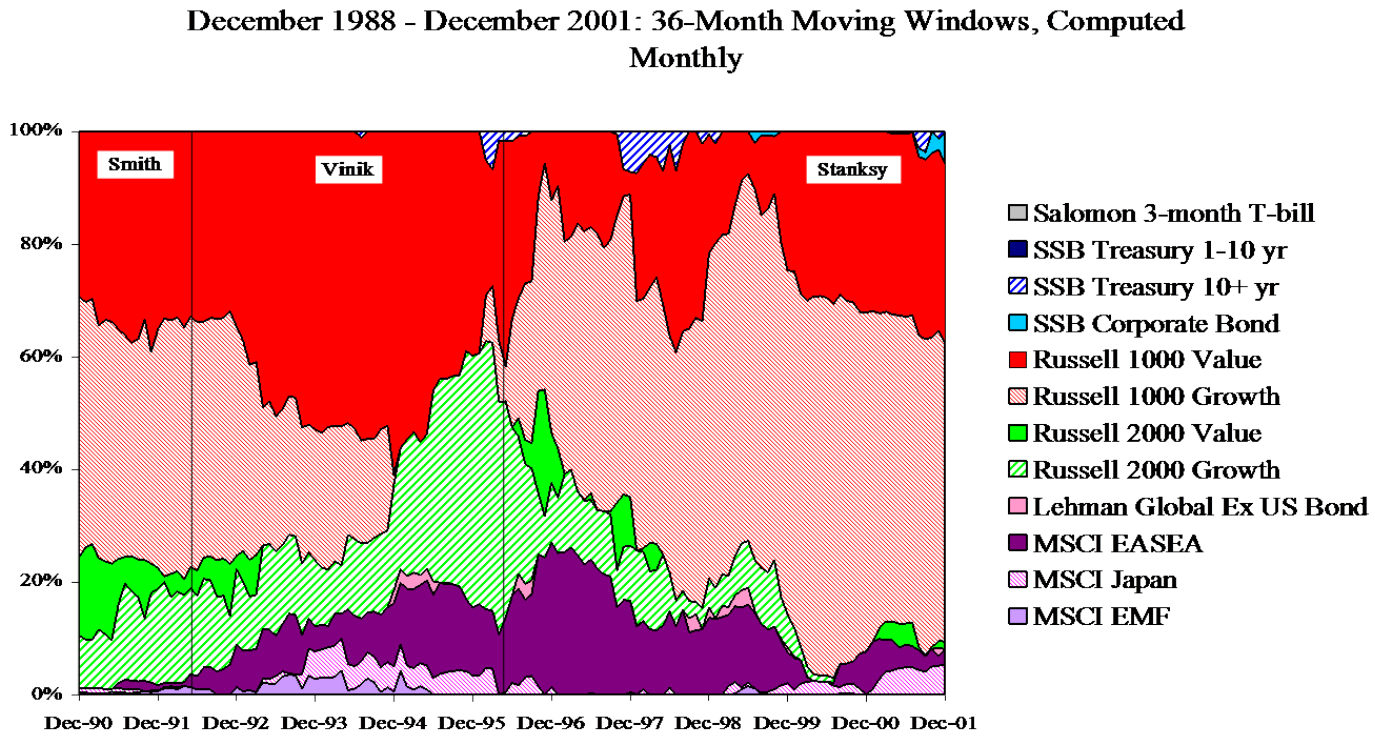
Example - Magellan Fund

- Next, let's track Fidelity Magellan's Style over time.
- As we can see it has mostly behaved as a large growth fund



Example - Magellan Fund

- Style Analysis allows us to track asset “allocations” over time, as described by the style benchmark weights estimated in a rolling regression



Example - Magellan Fund

- Portfolio decisions of different managers

Asset Class	Sample From To	Full 01/88 12/01	Lynch 01/88 05/90	Smith 06/90 06/92	Vinik 07/92 05/96	Stansky 06/96 12/01
Salomon 3-month T-bill		-	-	-	-	-
SSB Treasury 1-10 yr		-	-	-	-	-
SSB Treasury 10+ yr		-	-	-	2.4%	-
SSB Corporate Bond		-	-	-	-	5.5%
Russell 1000 Value		38.4%	29.0%	37.0%	46.0%	37.0%
Russell 1000 Growth		44.3%	47.0%	45.6%	-	53.7%
Russell 2000 Value		2.3%	14.9%	-	-	-
Russell 2000 Growth		7.8%	7.7%	17.4%	29.9%	3.8%
Lehman Global Ex US Bond		-	-	-	2.8%	-
MCSI EASEA Index		4.2%	-	-	14.8%	-
MSCI Japan		3.1%	1.2%	-	3.2%	-
MSCI EMF		-	0.3%	-	0.9%	-
R-squared		93.1%	97.1%	98.3%	74.1%	96.9%

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Example - Magellan Fund

- Performance of Different Managers

Asset Class	Sample From To	Full 01/88 12/01	Lynch 01/88 05/90	Smith 06/90 06/92	Vinik 07/92 05/96	Stansky 06/96 12/01
Monthly Average Excess Returns over 3-month T-bills						
Style Benchmark		0.69	0.97	0.34	0.99	0.50
Selection		0.17	0.36	0.34	0.01	0.13
Fidelity Magellan		0.86	1.32	0.68	1.00	0.63
S&P 500		0.77	1.06	0.38	0.96	0.65
Standard Deviation of Excess Returns over 3-month T-bills						
Style Benchmark		4.13	3.59	4.50	2.21	5.18
Selection		1.15	0.77	0.82	1.67	0.94
Fidelity Magellan		4.39	3.74	5.04	2.92	5.24
S&P 500		4.08	3.76	4.36	2.23	5.05
Sharpe Ratio						
Style Benchmark		0.17	0.27	0.08	0.45	0.10
Selection		0.14	0.46	0.41	0.01	0.13
Fidelity Magellan		0.20	0.35	0.14	0.34	0.12
S&P 500		0.19	0.28	0.09	0.43	0.13

Return Smoothing

- The measures we saw so far rely on returns, which in turn are computed from reported NAVs.
- However, often funds invest in securities for which no immediate price is available:
  a) Restricted or illiquid securities with no up-to-date price quotes.
  b) Complicated derivatives with no active market.
- In these cases, the funds mark these securities to *model*.
  ↪ This is mostly an issue for hedge funds.
- Potential to manipulate returns in order to game the benchmarks.

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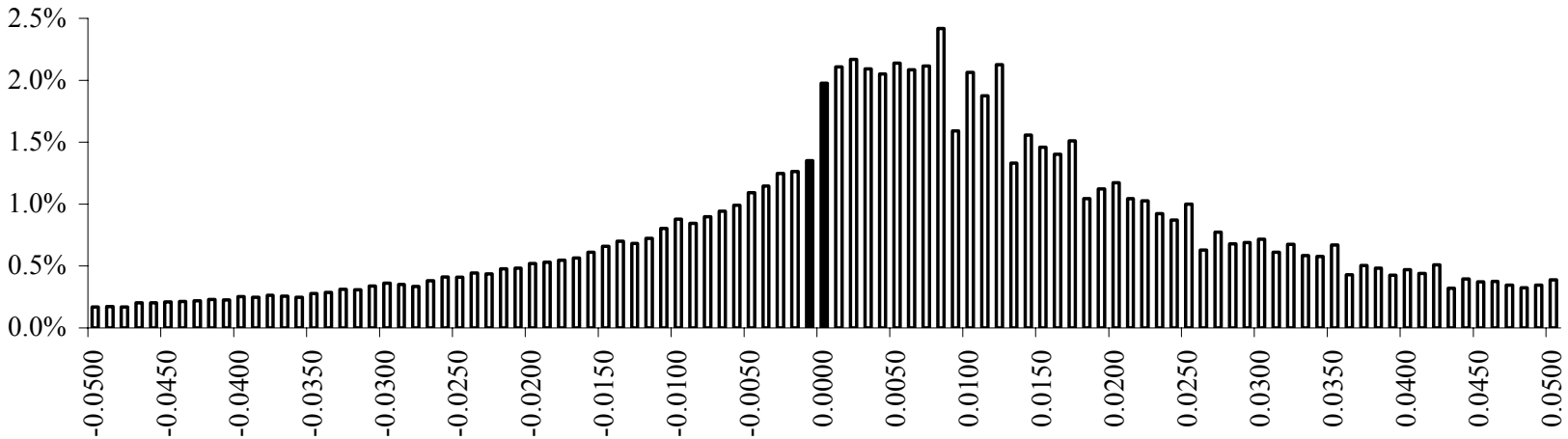
Return Smoothing

- Bollen and Pool (2007) plot the distribution of *all* hedge fund returns in the CISDM database in the 1994-2007 period.



Return Smoothing

- Empirically, hedge funds report higher returns in December than the rest of the year according to Agarwal, Daniel and Naik (2006).

- According to the authors, funds are more likely to report higher reports for December than the rest of the year if

  i) managers have more incentives to do so

  ii) fund values are close to watermark levels.

  iii) fund operates in volatile or illiquid markets.

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Return Smoothing

- Return-smoothing is the practice of delaying the reporting of true returns, either gains or losses, in order to create the impression that the fund is less risky than it actually is.
- This affects directly *all* the performance measures we have seen so far. In the presence of return smoothing:
  - i) Standard deviation of reported returns will be lower than the actual returns.
    - Sharpe Ratio and Appraisal Ratio will be overstated
  - ii) Correlation of reported returns with benchmarks will be lower than the actual.
    - alphas will be overstated
    - Treynor measure and Appraisal Ratio will be overstated

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Return Smoothing - Example

- Suppose that the fund's *true* returns obey the factor model

$$R_{i,t} = \mu + \beta_{i,1} f_{1,t} + \ldots + \beta_{i,K} f_{K,t} + \varepsilon_{i,t}$$

- However, the fund's *reported* returns are

$$R^o_{i,t} = \theta_i R_{i,t} + (1-\theta_i) R_{i,t-1}$$

where $\theta_i \in (0,1)$ is a measure of how much the fund smooths.

- If one evaluates the performance using the smoothed returns

$$SR^o_i = \frac{ER^o_{i,t} - r_f}{\sqrt{var(R^o_{i,t})}} = \frac{ER_{i,t} - r_f}{\sqrt{var(R_{i,t})}} \times \frac{1}{\sqrt{\theta_i^2 + (1-\theta_i)^2}} \geq \frac{ER_{i,t} - r_f}{\sqrt{var(R_{i,t})}}$$

$$\alpha^o_i = \mu - \theta_i \sum_{k=1}^{K} \lambda_k \beta_k > \alpha_i = \mu - \sum_{k=1}^{K} \lambda_k \beta_k$$

How to detect smoothing?

1. In this example, smoothed returns will be serially correlated:

$$corr(R_t^o, R_{t-1}^o) = \theta(1-\theta)$$

   ↪ Use estimate of $corr(R_t^o, R_{t-1}^o)$ to back out θ
   ↪ Use estimate of θ to get the variance of true returns:

$$var(R_{i,t}) = \frac{var(R_{i,t}^o)}{\theta^2 + (1-\theta)^2}$$

2. Use lagged values of the factors:

$$R_{i,t}^o = \mu + \tilde{\beta}_{i,1}(f_{1,t} + f_{1,t-1}) + \ldots + \tilde{\beta}_{i,K}(f_{K,t} + f_{K,t-1}) + \varepsilon_{i,t}$$

   to get "true" exposures $\tilde{\beta}_{i,k}$, and $\tilde{\alpha}_i$

$$\tilde{\alpha}_i = \mu - \sum_{k=1}^{K} \lambda_k \tilde{\beta}_k$$

How to detect smoothing?

- More generally, funds could smooth over multiple periods

$$R^o_{i,t} = \theta_{i,0} R_{i,t} + \theta_{i,1} R_{i,t-1} + \theta_{i,2} R_{i,t-2} + \ldots + \theta_{m,1} R_{m,t-1}$$

- The formulas become more complicated but same intuition.

- Getmansky, Lo and Makarov (2004) perform this exercise for a sample of 908 hedge funds and compute the "correct" Sharpe Ratios under various smoothing assumptions:

How to detect smoothing?

Category	N	Sharpe Ratios For Combined Sample					
		SR		SR^*		SR^{**}	
		Mean	SD	Mean	SD	Mean	SD
Not Categorized	111	1.12	1.09	1.06	0.87	1.00	0.82
US Equity Hedge	162	1.26	0.75	1.31	0.75	1.23	0.69
European Equity Hedge	22	1.43	0.74	1.43	0.80	1.33	0.74
Asian Equity Hedge	5	0.50	0.39	0.52	0.39	0.49	0.37
Global Equity Hedge	27	0.90	0.61	0.95	0.66	0.89	0.61
Dedicated Shortseller	7	0.28	0.59	0.32	0.64	0.30	0.61
Fixed-Income Directional	13	2.02	2.35	1.80	2.23	1.68	2.06
Convertible Fund (Long Only)	15	1.83	1.20	1.66	0.85	1.55	0.80
Event Driven	109	2.36	1.45	2.21	1.57	2.08	1.47
Non-Directional/Relative Value	85	2.20	1.86	2.03	2.39	1.89	2.22
Global Macro	24	1.08	0.67	1.14	0.73	1.07	0.70
Global Opportunity	1	−0.56	—	−0.39	—	−0.37	—
Natural Resources	3	0.60	0.25	0.56	0.23	0.52	0.21
Pure Leveraged Currency	26	0.63	0.49	0.65	0.50	0.61	0.47
Pure Managed Futures	93	0.54	0.55	0.63	0.60	0.60	0.56
Pure Emerging Market	72	0.39	0.45	0.36	0.44	0.34	0.40
Pure Property	1	0.42	—	0.45	—	0.41	—
Fund of Funds	132	1.44	1.01	1.30	0.88	1.22	0.82
All	908	1.32	1.24	1.27	1.27	1.19	1.18

- In illiquid markets smoothing is easier

Summary

- The basic idea behind performance measurement is to determine how well the fund manager did relative to a comparable "benchmark" portfolio.
- What if not sure what the comparable benchmark is? Style analysis can provide an answer.
- By selecting appropriate benchmarks, the manager's contribution or alpha can be evaluated relative to these benchmarks.
- The manager should not be rewarded for following strategies that are common knowledge.
- Little evidence that fund managers outperform the market.
  - ↪ Now, let's reverse roles and consider the problem from the fund manager's perspective.

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