

# SCALE AND SKILL IN ACTIVE MANAGEMENT

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## Motivation

- Fund performance depends on **skill** as well as **scale**
  - To learn about skill, we must understand scale
- Nature of **returns to scale** in active fund management?
  - **Fund level?**
    - \* Fund size  $\uparrow \Rightarrow$  This fund's performance  $\downarrow$
    - \* Perold and Solomon (1991), Berk and Green (2004)
    - \* Evidence: Chen et al. (2004), Bris et al. (2007), Yan (2008), Ferreira et al. (2013), Reuter and Zitzewitz (2013)
  - **Industry level?**
    - \* Industry size  $\uparrow \Rightarrow$  All funds' performance  $\downarrow$
    - \* Pástor and Stambaugh (2012)
    - \* Evidence: ?

## Main Results

### Scale:

- Strong evidence of decreasing returns to scale at **industry** level
  - Stronger for high-turnover, high-volatility, and small-cap funds
- Mixed evidence of decreasing returns to scale at **fund** level
  - Insignificant after removing econometric biases

### Skill:

- Active funds have become **more skilled** over time
  - Yet their performance has not improved
- Negative **age-performance** relation
  - A fund's performance decreases over its lifetime
  - Younger funds outperform older funds

## Narrative

- New funds tend to be more skilled than existing funds
  - Education? Technology?
- Given their better skill, new funds tend to outperform initially
- As these funds grow older, their performance suffers
  - Because industry keeps growing ( $\Rightarrow$  more skilled competition)

## Methodology

- Three methods for estimating **fund-level** returns to scale:

1. **Pooled OLS:**  $R_{it} = a + \beta q_{it-1} + \varepsilon_{it}$

– Biased: omitted variable (skill)

2. **OLS with fund fixed effects:**  $R_{it} = a_i + \beta q_{it-1} + \varepsilon_{it}$

– Biased:  $\text{Corr}(q_{it}, \varepsilon_{it}) > 0$

3. **Recursive demeaning:** new procedure

– Unbiased

## Sample

**Data:** CRSP and Morningstar, 1979–2011

- Check accuracy across databases (return, size, expense ratio)
- Only domestic active equity mutual funds with size  $\geq$  \$15 million

**Final sample:**  $\sim$ 350,000 monthly observations of 3,126 funds

- Main sample: 1993–2011
- Extended sample: 1979–2011
  - Noisier data but very similar results, same conclusions

## Main Variables

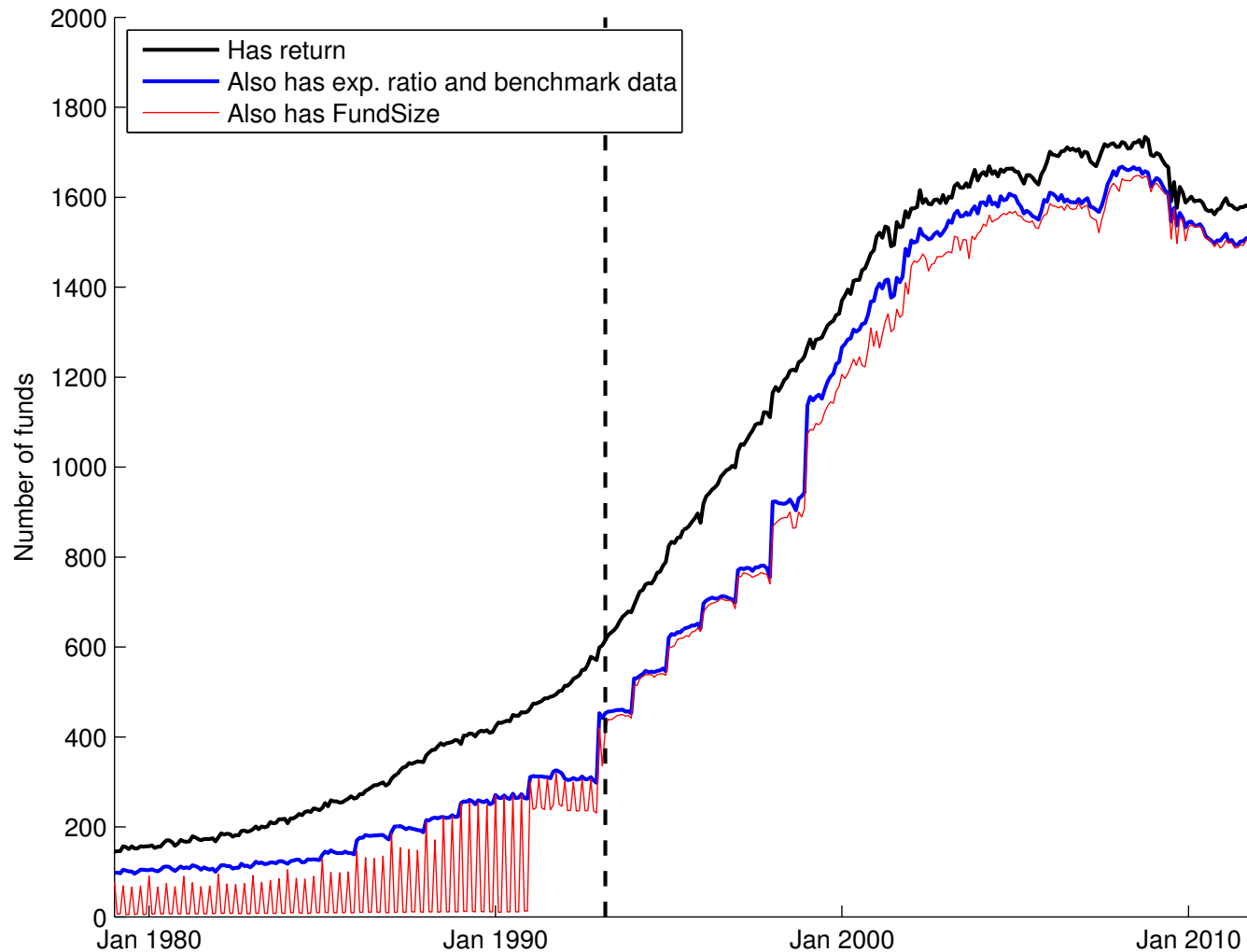
*GrossR*: Fund return gross of fees, minus benchmark return

E.g., for Large Growth, benchmark is Russell 1000 Growth Index

$$FundSize = \frac{\text{Fund's AUM today}}{\text{Total mkt.cap. today}} \times \text{Total mkt.cap. in Dec. 2011}$$

$$IndustrySize = \frac{\text{Funds' total AUM today}}{\text{Total mkt.cap. today}}$$

## Sample Size Over Time

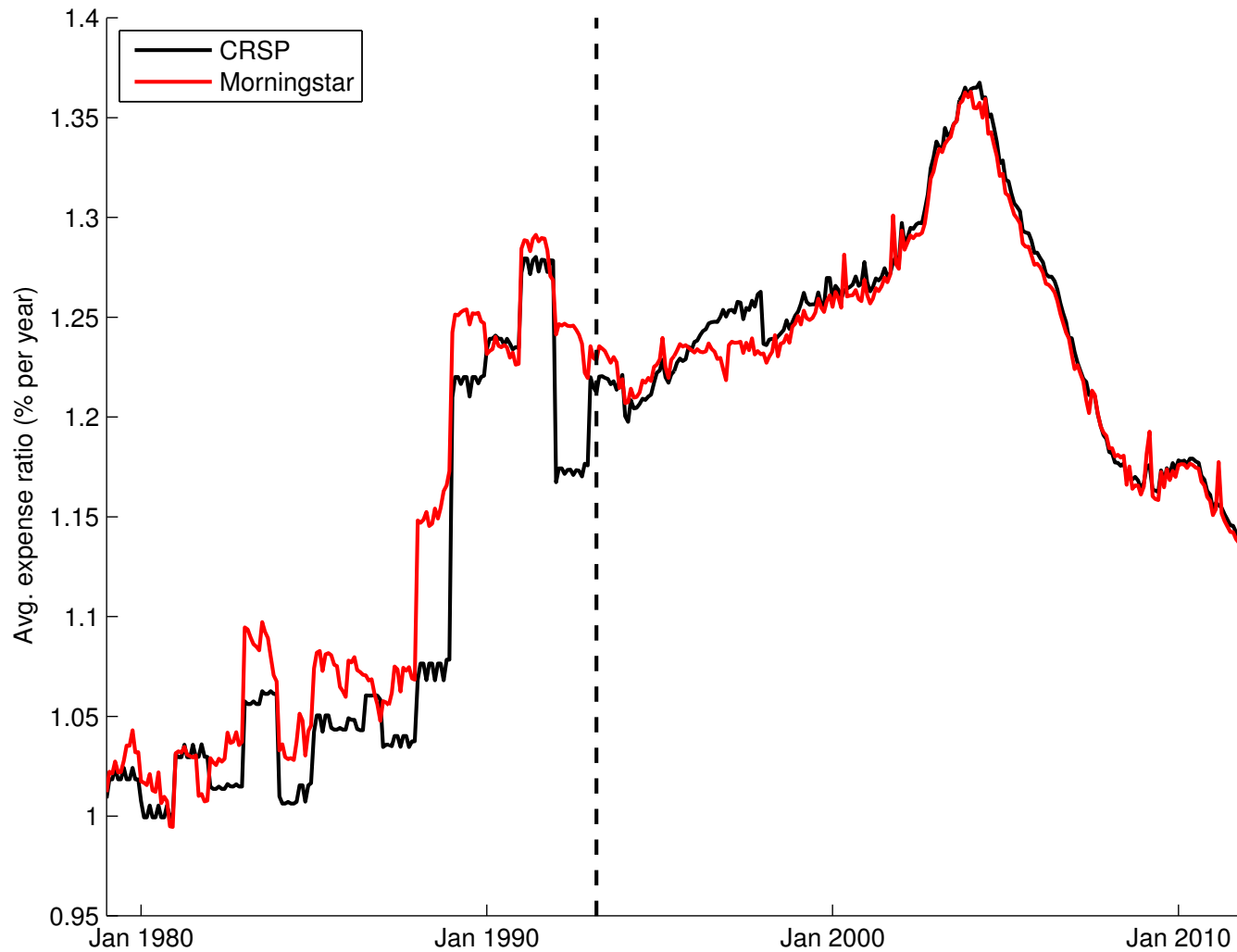


**Main sample:** March 1993 – December 2011

**Extended sample:** January 1979 – December 2011



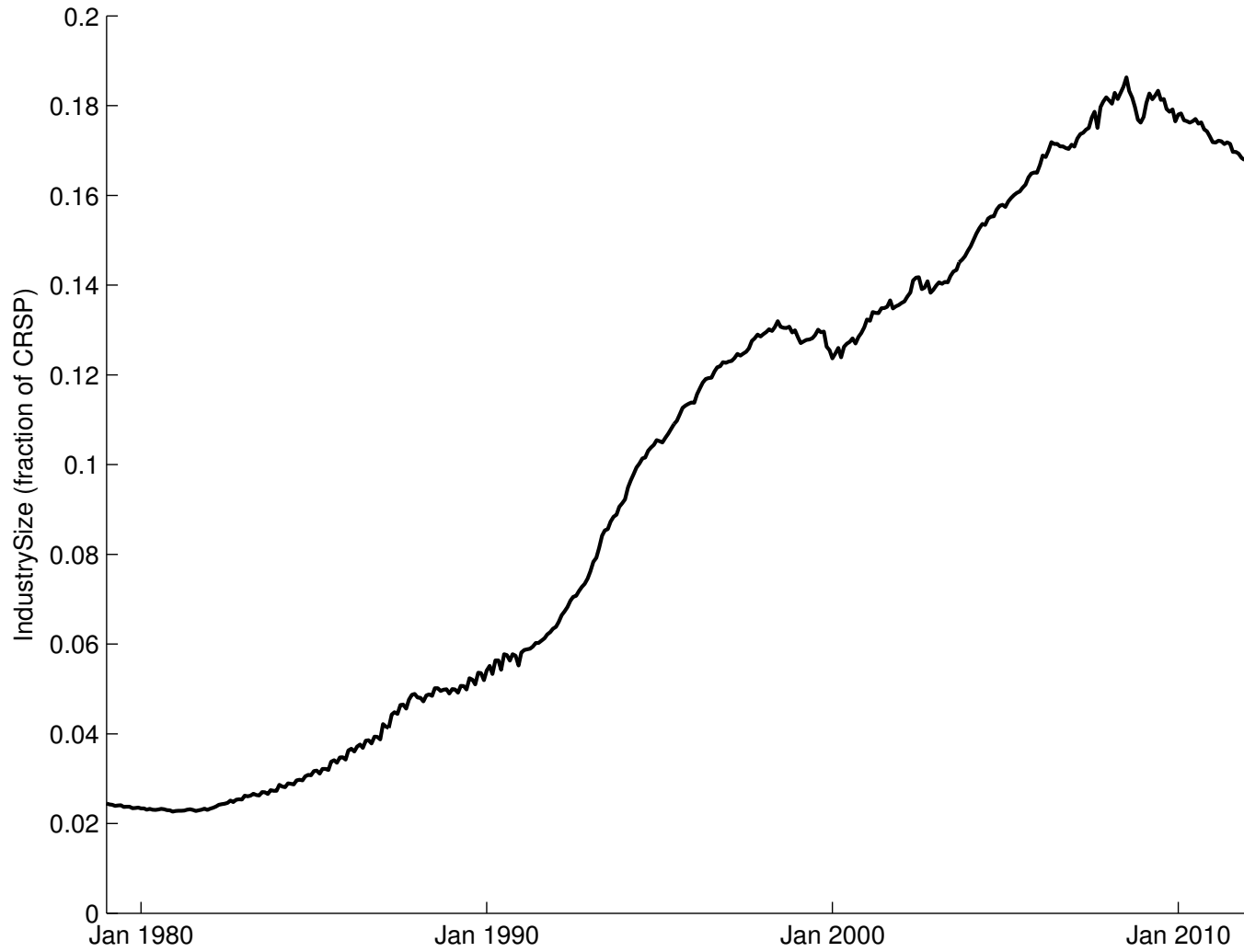
## Average Expense Ratio Over Time



**Main sample:** March 1993 – December 2011

**Extended sample:** January 1979 – December 2011

# Industry Size over Time



## Decreasing Returns to Scale at Fund Level?

Dependent variable: GrossR

|              |                     |                      |                   |
|--------------|---------------------|----------------------|-------------------|
| FundSize     | -0.0137<br>(-1.87)  | -0.168***<br>(-9.38) | -0.220<br>(-0.62) |
| Constant     | 0.000503*<br>(2.18) |                      |                   |
| Observations | 275847              | 275847               | 270556            |
| Estimator    | OLS no FE           | OLS FE               | RD                |

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## Decreasing Returns to Scale at Industry Level?

Dependent variable: GrossR

|              |                    |                       |                     |
|--------------|--------------------|-----------------------|---------------------|
| IndustrySize | -0.0169<br>(-1.93) | -0.0326***<br>(-3.60) | -0.0326*<br>(-2.49) |
| Constant     | 0.00304*<br>(2.18) |                       |                     |
| Observations | 283046             | 283046                | 283046              |
| Estimator    | OLS no FE          | OLS FE                | RD                  |

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## Fund- vs. Industry-level Returns to Scale

Dependent variable: GrossR

|              |                     |                      |                     |
|--------------|---------------------|----------------------|---------------------|
| FundSize     | -0.0147*<br>(-2.02) | -0.148***<br>(-9.09) | -0.425<br>(-1.25)   |
| IndustrySize | -0.0165<br>(-1.90)  | -0.0295**<br>(-3.27) | -0.0277*<br>(-2.14) |
| Constant     | 0.00300*<br>(2.09)  |                      |                     |
| Observations | 275847              | 275847               | 270556              |
| Estimator    | OLS no FE           | OLS FE               | RD                  |

## Industry Size: Just a Time Trend?

Dependent variable: GrossR

|              |         |         |         |
|--------------|---------|---------|---------|
| IndustrySize | -0.0326 |         | -0.0852 |
|              | (-3.60) |         | (-3.04) |
| Time Trend   |         | -10.26  | 23.89   |
|              |         | (-2.99) | (2.21)  |
| Observations | 283046  | 283046  | 283046  |

## A Closer Look at Industry Size

Dependent variable: GrossR

|                   |         |         |         |
|-------------------|---------|---------|---------|
| IndustrySize      |         |         | -0.115  |
|                   |         |         | (-2.60) |
| Average Fund Size | -3.862  | -8.885  | 4.315   |
|                   | (-3.03) | (-3.56) | (0.73)  |
| Number of Funds   | 0.450   | -4.031  | 8.493   |
|                   | (0.83)  | (-3.23) | (1.61)  |
| Observations      | 283046  | 283046  | 283046  |

## Determinants of the Size-Performance Relation

Dependent variable: GrossR

|                          | (1)                | (2)               | (3)               | (4)                | (5)               | (6)                | (7)                | (8)                |
|--------------------------|--------------------|-------------------|-------------------|--------------------|-------------------|--------------------|--------------------|--------------------|
| FundSize                 | -0.0987<br>(-0.66) | 0.0228<br>(0.03)  | -0.316<br>(-0.30) |                    |                   |                    | 0.271<br>(0.42)    | 0.318<br>(0.49)    |
| FundSize*1(SmlCap)       | 0.273<br>(0.13)    |                   |                   |                    |                   |                    | -1.402<br>(-0.70)  | -0.959<br>(-0.49)  |
| FundSize*Std(AbnRet)     |                    | -10.40<br>(-0.28) |                   |                    |                   |                    | -29.83<br>(-0.94)  | -30.19<br>(-0.94)  |
| FundSize*Turnover        |                    |                   | 0.207<br>(0.21)   |                    |                   |                    | 0.0588<br>(0.20)   | 0.0360<br>(0.12)   |
| IndustrySize             |                    |                   |                   | -0.0120<br>(-3.04) | 0.0248<br>(2.92)  | 0.00541<br>(1.11)  | 0.0450<br>(2.35)   | 0.0194<br>(0.68)   |
| IndustrySize*1(SmlCap)   |                    |                   |                   | -0.0348<br>(-2.67) |                   |                    | -0.0340<br>(-1.33) | -0.0360<br>(-1.41) |
| IndustrySize*Std(AbnRet) |                    |                   |                   |                    | -2.137<br>(-4.51) |                    | -2.013<br>(-2.19)  | -2.010<br>(-2.19)  |
| IndustrySize*Turnover    |                    |                   |                   |                    |                   | -0.0287<br>(-4.45) | -0.0250<br>(-2.57) | -0.0249<br>(-2.56) |
| Fund age                 |                    |                   |                   |                    |                   |                    |                    | 0.000151<br>(1.23) |



## Estimating Skill

- Our measure of **skill**:

- Gross alpha when  $FundSize = IndustrySize = 0$

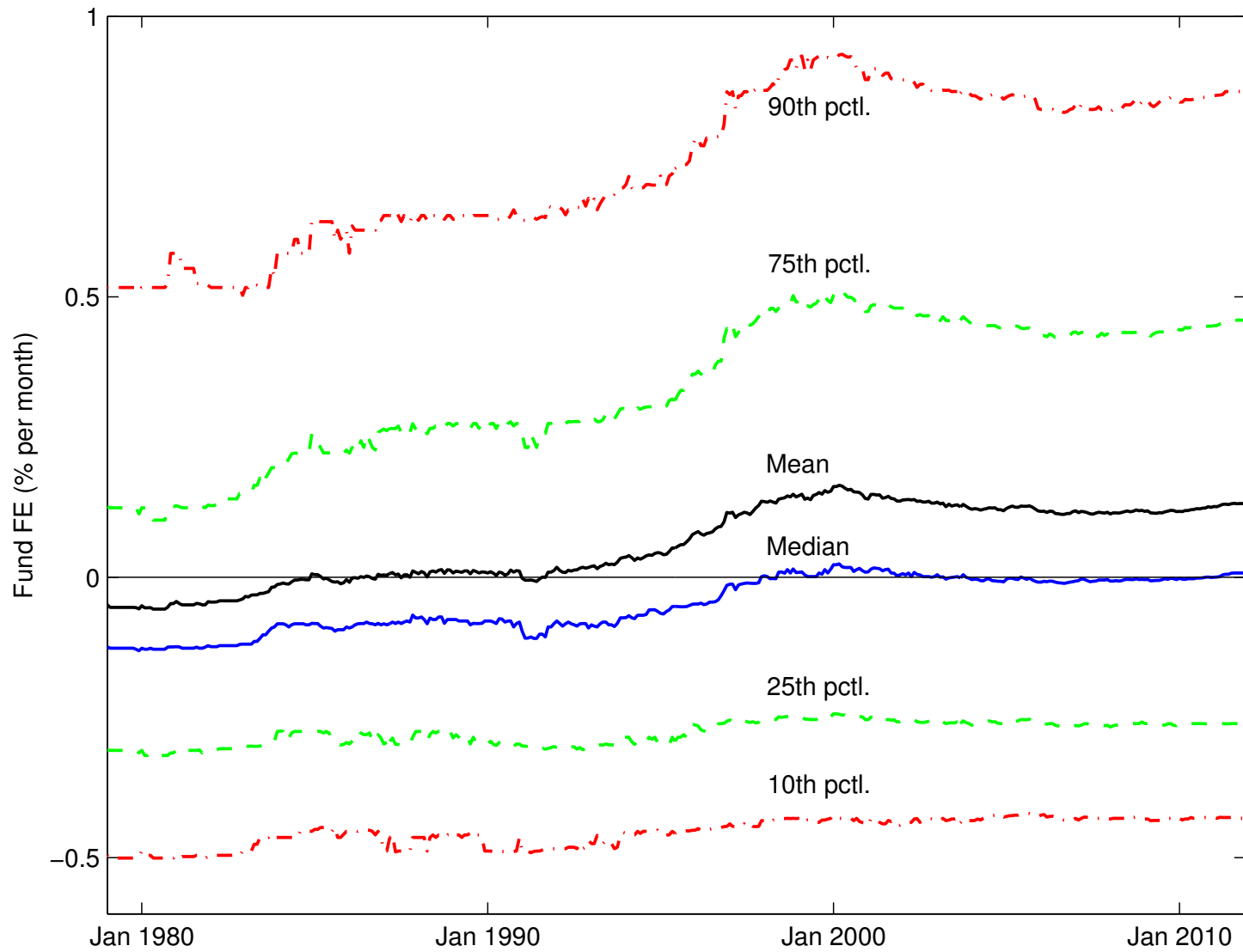
- (Average benchmark-adjusted return on the fund's first dollar invested, with no other funds in the industry)

- We measure fund skill by  $a_i$  in

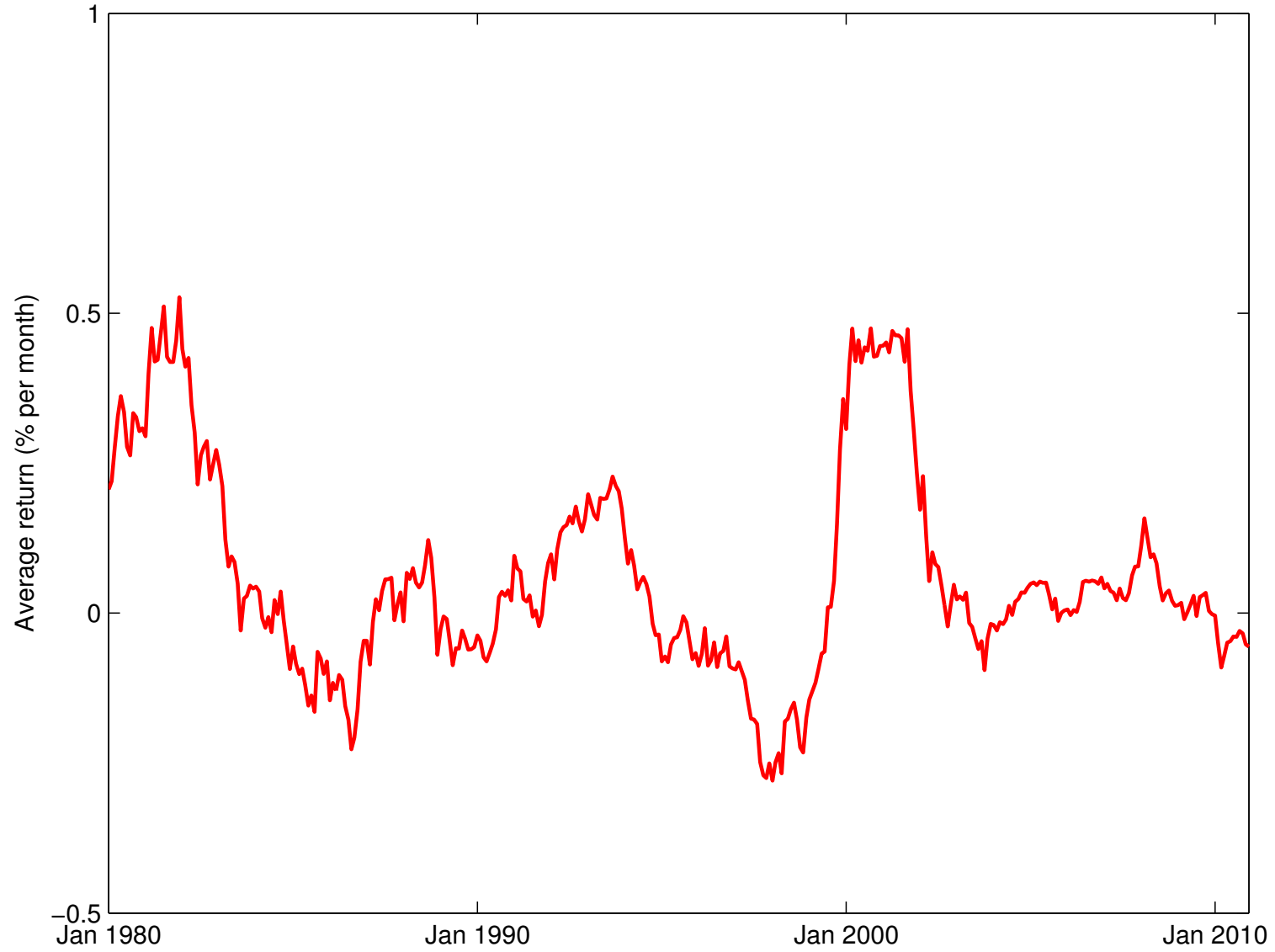
$$GrossR_{it} = a_i + FundSize_{it-1}(\beta_0 + \beta_1 X_i) + IndustrySize_{it-1}(\gamma_0 + \gamma_1 X_i) + \varepsilon_{it}$$

- where  $X_i$  includes all fund characteristics from previous table

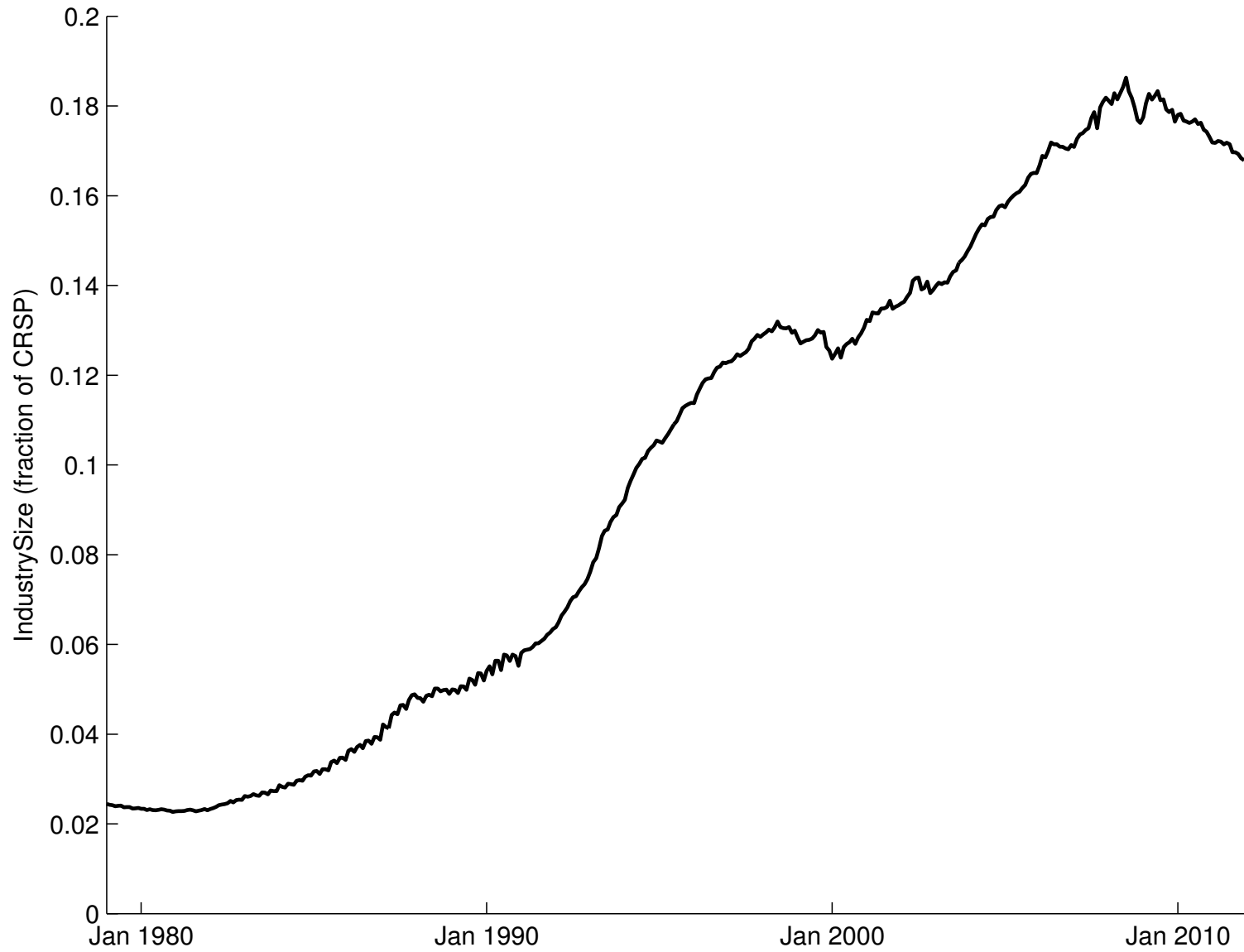
# Distribution of Fund Skill over Time



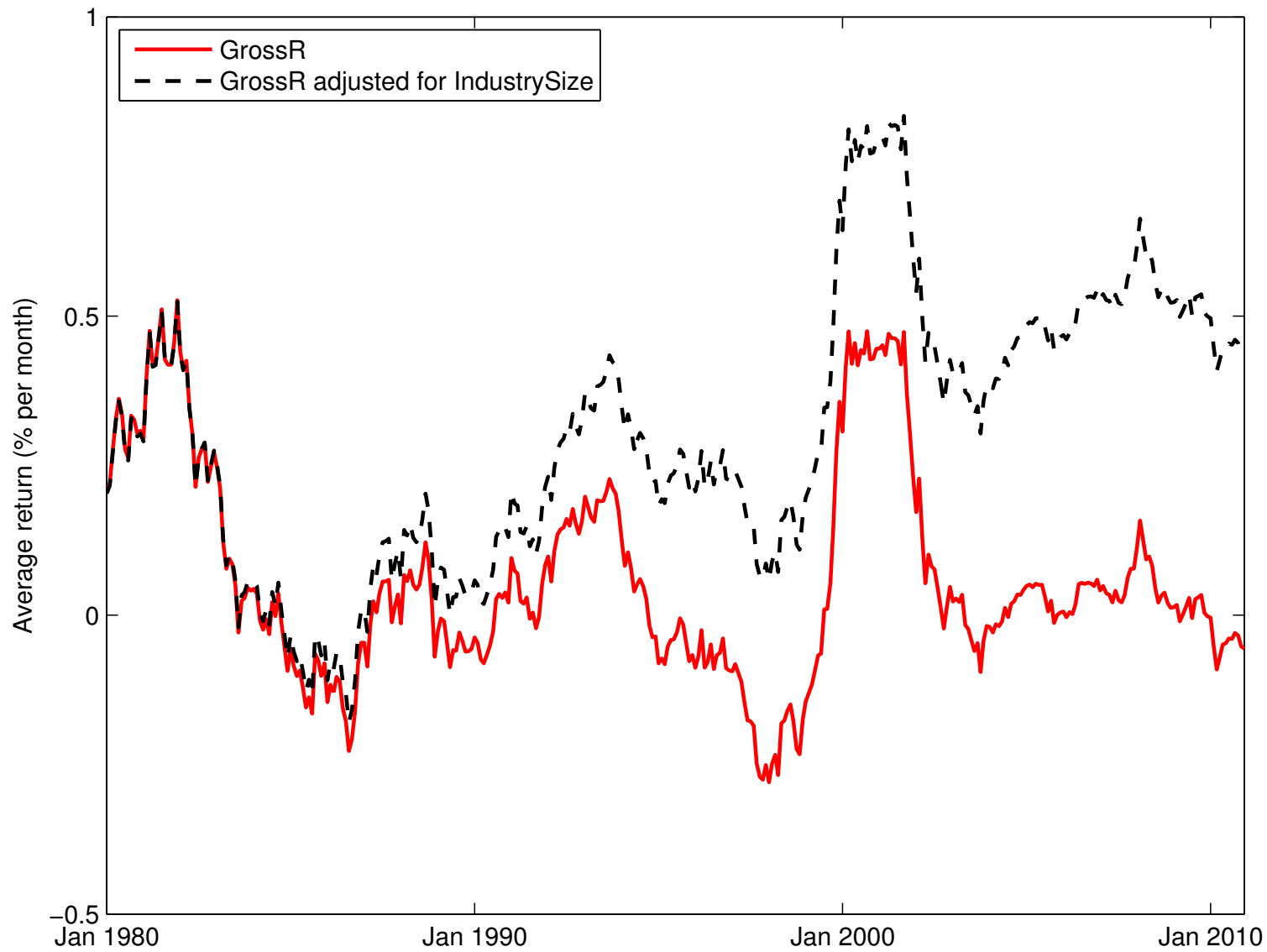
# Average Fund Performance over Time



# Industry Size over Time



# Average Fund Performance over Time



## Fund Age vs. Performance

### Prediction:

Fund's skill constant

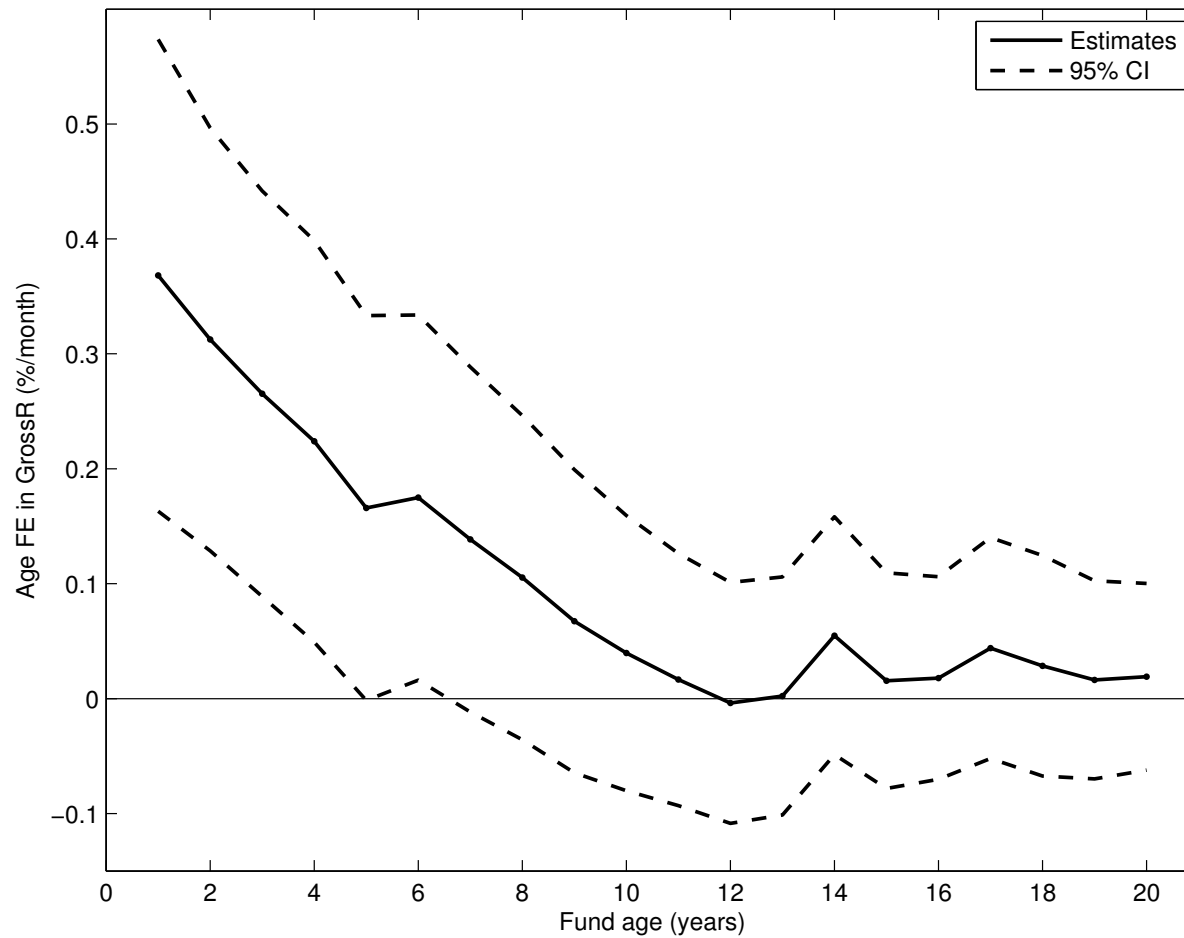
Industry-level DRTS

Industry size ↑

} Performance ↓ over fund's life

# Fund Age vs. Performance: Age Fixed Effects

$$GrossR_{it} = a_i + \beta_1 1_{\{age=1\}} + \dots + \beta_{20} 1_{\{age=20\}} + \varepsilon_{it}$$



## Fund Age vs. Performance: Continuous Age

Dependent variable: GrossR

|              |                        |                      |                       |                      |
|--------------|------------------------|----------------------|-----------------------|----------------------|
| Fund age     | -0.000123**<br>(-3.00) | 0.000283*<br>(2.19)  | -0.000102*<br>(-2.37) | 0.000281*<br>(2.19)  |
| IndustrySize |                        | -0.0845**<br>(-3.02) |                       | -0.0799**<br>(-2.86) |
| Observations | 283046                 | 283046               | 248050                | 248050               |
| Fund ages    | All                    | All                  | $\geq 3$ years        | $\geq 3$ years       |

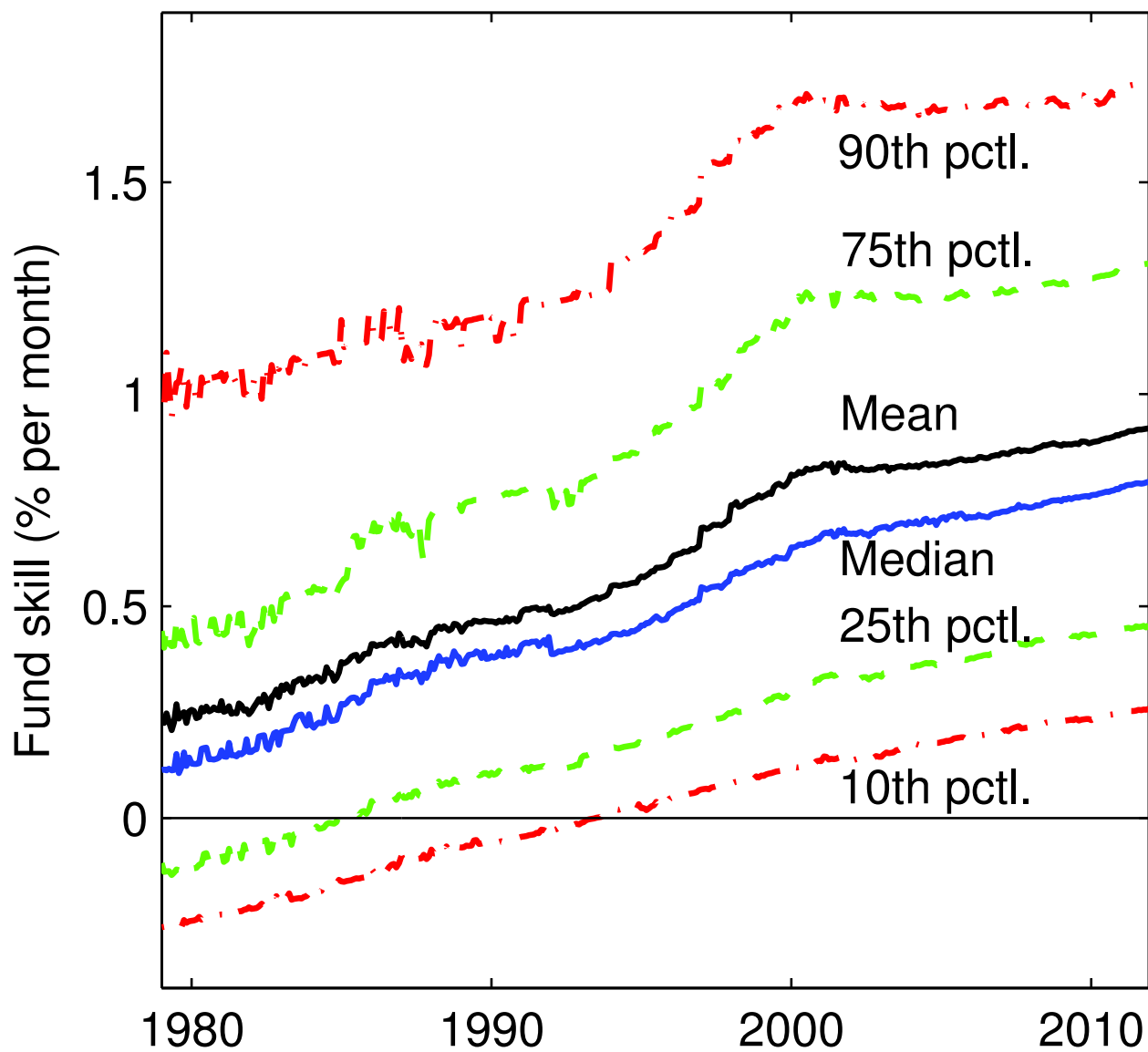


## Learning on the Job?

- We modify our skill measure to allow learning on the job
- As before, skill is alpha when  $FundSize = IndustrySize = 0$
- But now,  $Skill_{it} = a_i + b FundAge_{it}$

$$GrossR_{it} = a_i + b FundAge_{it} + FundSize_{it-1}(\beta_0 + \beta_1 X_i) + IndustrySize_{it-1}(\gamma_0 + \gamma_1 X_i) + \varepsilon_{it}$$

# Distribution of Fund Skill, With Learning on the Job



## Age-based Investment Strategies

| Fund age    | Average portfolio return |                   |                   |                   | Average differences |                 |                   | <i>F</i> - test |
|-------------|--------------------------|-------------------|-------------------|-------------------|---------------------|-----------------|-------------------|-----------------|
|             | [0, 3]                   | (3, 6]            | (6, 10]           | >10               | [0,3] - (>10)       | (3,6] - (>10)   | (6,10] - (>10)    | <i>p</i> -value |
| Avg. GrossR | 0.084<br>(2.33)          | 0.056<br>(1.45)   | 0.020<br>(0.55)   | 0.012<br>(0.30)   | 0.072<br>(2.85)     | 0.043<br>(2.48) | 0.008<br>(0.52)   | 0.014           |
| Avg. NetR   | -0.005<br>(-0.15)        | -0.052<br>(-1.38) | -0.084<br>(-2.29) | -0.083<br>(-2.07) | 0.077<br>(3.10)     | 0.031<br>(1.79) | -0.001<br>(-0.08) | 0.008           |

## Robustness

Our conclusions are robust to

- Controlling for business cycle variables
- Controlling for *FamilySize*
- Trimming extreme outliers in *FundSize*
- Different functional forms for *FundSize*
- Alternate benchmark-adjustments
  - Fama-French
  - Morningstar benchmark with estimated betas

## Main Takeaways for Practitioners

- You are **more skilled** than your predecessors!
  - But so is your competition, and there is more of it
  - ⇒ Don't expect better industry performance
- It is harder for active managers to outperform in a **larger industry**
  - Especially for high-turnover, high-volatility, and small-cap funds
  - Likely to hold at strategy level, too
  - ⇒ Stay away from crowded trades/strategies/industries!
- A fund's **performance deteriorates** over its lifetime
  - Due to growing competition
  - Despite learning on the job
  - ⇒ Invest in younger funds!