The Industrial Organization of Money Management

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7 June 2012

BACKGROUND

- Key observations about money management (MM) industry.
    - Different forms of money management: mutual funds, hedge funds, VC/PE firms, etc.
    - Common tools: financial securities (and potentially voice).
    - Common objective: generate returns for investors.

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  - What is the optimal form of money management to adopt?
  - How do I benefit the most from my set (or lack) of investment skills?

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- This paper.
  - Choice of MM form $\approx$ Signal about skills.
  - Question: who chooses what organizational form?

Overview of the Paper

- Main assumption.
  - **Forms of MM indexed by (costly) transparency.**
  - Examples.
    - Mutual funds more transparent than hedge funds.
    - Some hedge funds divulge their strategies to potential investors more than others.
  - Costs: monitoring, reporting, fund family, strategy leaks, etc.

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- Main result.
  - **High-skill and low-skill** managers in **opaque** funds.
  - **Medium-skill** managers in **transparent** funds.

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  - **High-skill and low-skill** managers in **opaque** funds.
  - **Medium-skill** managers in **transparent** funds.
- Intuition.
  - High skill: “My performance will speak for itself.”
  - Medium skill: “My performance may make me look unskilled, so I will incur the cost to separate from the low-skilled with a transparent fund.”

LITERATURE

- Signaling in principal-agent models of MM.
  - Risky strategies: Huberman & Kandel (1993), Huddart (1999).
  - Risky compensation: Das & Sundaram (2002).
  - Open-end mutual fund: Stein (2005).
- Job-market signaling.
  - Canonical model: Spence (1973).
    - Separating equilibrium.
    - Key assumption: cheaper for skilled to signal.
  - Grades: Daley & Green (2011), Feltovich et al. (2002).
    - Pooling when grade is informative.
    - Partial-pooling when medium type can't fully rely on grade.
- Modeling technology.
  - Berk & Green (2004).
  - High $r_t \to \Pr\{\text{MM skilled}\} \uparrow \to$ Capital flows $\to E[r_{t+1}] = 0$.

Model – Money Managers

- Risk-neutral, 3 types: $\tilde{\tau} = \begin{cases} h, & \text{prob. } \lambda_h \\ m, & \text{prob. } \lambda_m \\ \ell, & \text{prob. } \lambda_\ell \end{cases}$ $\quad \lambda_h + \lambda_m + \lambda_\ell = 1$

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- Performance (excess return) in period $n \in \{1, \ldots, N\}$: $\tilde{r}_n(\tilde{\tau})$.
  - **Low types:**

$$\tilde{r}_n(\ell) = \begin{cases} r_G, & \text{prob. } p_G \\ r_A, & \text{prob. } p_A \\ r_B, & \text{prob. } p_B \end{cases} \qquad \begin{aligned} p_G + p_A + p_B &= 1 \\ r_G > r_A &> r_B \\ \mu_\ell \equiv p_G r_G + p_A r_A + p_B r_B &= \mathbf{0} \end{aligned}$$

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$$\tilde{r}_n(h) = r_{\mathrm{G}} \equiv \boldsymbol{\mu_h > \mu_m}.$$

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    $\tilde{r}_n(h) = r_G \equiv \boldsymbol{\mu_h > \mu_m}$.
- MLRP important; above dist. useful (updating, 1st-passage time).

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$$\Pr\{\tilde{\imath}_t = 0 \mid \tilde{\tau} = \ell\} = t = 1 - \Pr\{\tilde{\imath}_t = 1 \mid \tilde{\tau} = \ell\}$$
$$\Pr\{\tilde{\imath}_t = 1 \mid \tilde{\tau} = m\} = \Pr\{\tilde{\imath}_t = 1 \mid \tilde{\tau} = h\} = 1$$

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- Costly.
  - Adds to costs to manage/run the fund (Berk & Green, 2004).
  - Per-dollar-managed costs in period n: $k_t A_n$.
    - A_n: assets under management in n. [endogenous]
    - $k_0 > 0$, k_t strictly increasing in t. [exogenous]
    - k_t independent of MM's skill, but skill will affect total costs through A_n.

MODEL – COMPENSATION

- Per-\$-invested payment $w_n > 0$ to manage the fund in period n.
  - Announced by MM at the beginning of each period n.
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- Remarks.
  - Could be made contingent on period-n performance.
    - Implications about risk of compensation as a function of t.
    - Useful for moral hazard issues.
  - Cannot lock investors into a multiperiod state-contingent contract.

MODEL – INVESTORS

- Information.
  - Outset: observe t and $\tilde{\imath}_t$.
  - Start of period n: observe $\{\tilde{r}_1(\tilde{\tau}), \ldots, \tilde{r}_{n-1}(\tilde{\tau})\}$ and w_n.
  - Update rationally about type $\tilde{\tau}$.

Model – Investors

- Information.
  - Outset: observe t and $\tilde{\imath}_t$.
  - Start of period n: observe $\{\tilde{r}_1(\tilde{\tau}), \ldots, \tilde{r}_{n-1}(\tilde{\tau})\}$ and w_n.
  - Update rationally about type $\tilde{\tau}$.
- Decide on how much money A_n to invest.
  - Profits in period n: $\tilde{\pi}_n \equiv A_n\left[\tilde{r}_n(\tilde{\tau}) - w_n - k_t A_n\right]$.
  - Competition (and scarcity of MM talent):

$$\mathrm{E}\left[\tilde{\pi}_n \mid \mathcal{I}_n\right] = 0 \quad \Rightarrow \quad A_n = \frac{\mathrm{E}\left[\tilde{r}_n(\tilde{\tau}) \mid \mathcal{I}_n\right] - w_n}{k_t}.$$

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- Remarks.
  - $\uparrow w_n$ by MM $\rightarrow \downarrow A_n$ by investors.
  - $\Pr\{\tilde{\tau} = \ell \mid \mathcal{I}_n\} = 1 \rightarrow \mathrm{E}[\tilde{r}_n(\tilde{\tau}) \mid \mathcal{I}_n] = 0 \rightarrow A_n = 0$ (fund closes).

MODEL – MM'S DECISIONS

- Transparency t at outset (equil. analysis later).
- Compensation w_n at the beginning of period n.

$$\max_{w_n} \; w_n A_n = w_n \left(\frac{\mathrm{E}\left[\tilde{r}_n(\tilde{\tau}) \mid \mathcal{I}_n\right] - w_n}{k_t} \right) \;\; \Rightarrow \;\; w_n = \frac{1}{2}\mathrm{E}\left[\tilde{r}_n(\tilde{\tau}) \mid \mathcal{I}_n\right]$$

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- With this w_n in period n:

$$\text{fund size: } A_n = \frac{1}{2k_t}\mathrm{E}\left[\tilde{r}_n(\tilde{\tau}) \mid \mathcal{I}_n\right]$$

$$\text{MM comp: } u_n \equiv w_n A_n = \frac{1}{4k_t}\left(\mathrm{E}\left[\tilde{r}_n(\tilde{\tau}) \mid \mathcal{I}_n\right]\right)^2$$

EQUILIBRIUM – PRELIMINARIES

- Pure strategy equilibrium $\{t_h, t_m, t_\ell\}$.
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Equilibrium – Preliminaries

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- Equilibrium elimination.
    - Low type always pools.
        - Otherwise, $A_1 = A_2 = \cdots = A_N = 0$, since $\mu_\ell = 0$.
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  - N large (and Mailath et al., 1993, "undefeated equilibria"): partial-pooling $\{0, t, 0\}$ vs. pooling $\{0, 0, 0\}$.

Partial-Pooling Equilibrium (HF)

- Conjectured equilibrium.
  - h and ℓ in opaque fund with $t = 0$ (HF).
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  - $\text{E}[\tilde{r}_n^{\text{HF}} \mid \tilde{r}_1^{\text{HF}} = \cdots = \tilde{r}_{n-1}^{\text{HF}} = r_{\text{G}}] = \frac{\lambda_h \mu_h}{\lambda_h + \lambda_\ell \, p_{\text{G}}^{n-1}} \equiv \bar{r}_n \nearrow \mu_h$

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- Hedge Fund – MM expected utility (i.e., total compensation).
  - Type h: $u_h = \frac{1}{4k_0}\left[\bar{r}_1^2 + \bar{r}_2^2 + \cdots + \bar{r}_N^2\right]$
  - Type ℓ: $u_\ell = \frac{1}{4k_0}\left[\bar{r}_1^2 + p_{\text{G}}\bar{r}_2^2 + \cdots + p_{\text{G}}^{N-1}\,\bar{r}_N^2\right]$

PARTIAL-POOLING EQUILIBRIUM (MF)

- Recall conjectured equilibrium.
  - h and ℓ in opaque fund with $t = 0$ (HF).
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Partial-Pooling Equilibrium (MF)

- Recall conjectured equilibrium.
  - h and ℓ in opaque fund with $t = 0$ (HF).
  - m in transparent fund with $t > 0$ (MF).
- Mutual fund.
  - Only type m in MF. No (need for) updating.
  - $\mathrm{E}\left[\tilde{r}_n^{\mathrm{MF}} \mid \mathcal{I}_n\right] = \mu_m$
  - Utility (i.e, total compensation):

$$u_m = \frac{1}{4k_t}\left[\mu_m^2 + \mu_m^2 + \cdots + \mu_m^2\right]$$

Partial-Pooling Equilibrium (Deviations?)

- Type ℓ: HF vs. MF

$$\frac{1}{4k_0}\left[\bar{r}_1^2 + p_G \bar{r}_2^2 + \cdots + p_G^{N-1}\,\bar{r}_N^2\right] \geq (1-t)\frac{1}{4k_t}\left[\mu_m^2 + \mu_m^2 + \cdots + \mu_m^2\right]$$

$\hookrightarrow$ To separate, type m will choose t to make this an equality.

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- Type h: HF vs. MF

$$\frac{1}{4k_0}\left[\bar{r}_1^2 \quad + \quad \bar{r}_2^2 \quad + \quad \cdots \quad + \quad \underbrace{\bar{r}_N^2}_{\to \mu_h^2 > \mu_m^2}\right] \geq \frac{1}{4k_t}\left[\mu_m^2 + \mu_m^2 + \cdots + \mu_m^2\right]$$

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- Bottom line: **P-P equilibrium $\{0, t, 0\}$ $\exists$ if N is sufficiently large.**

POOLING EQUILIBRIUM

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Pooling Equilibrium

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- Tradeoffs.
  - High type must stand out from medium type as well.
    - Prob. of being mimicked: $\frac{p_G}{p_G + p_A}$ for med type, p_G for low type.
    - Convergence to μ_h slower.
  - Medium type may look like low type.
    - Prob. of being mimicked by low type: $p_G + p_A$.
    - Slow convergence (especially if p_A is large) vs. instantaneous in partial-pooling equilibrium.
  - Medium type saves on monitoring costs (k_0 vs. k_t in P-P).

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    - Slow convergence (especially if p_A is large) vs. instantaneous in partial-pooling equilibrium.
  - Medium type saves on monitoring costs (k_0 vs. k_t in P-P).
- Result: **Partial-Pooling $\succ$ Pooling iff med-type prefers P-P**.
  - When p_G is small, and p_A is large.

PREDICTIONS – PERFORMANCE

- **Performance evaluations (cross-sectional):** (gross-return) α's more dispersed in HF than MF, especially for young funds.

$$\alpha_n^{\text{HF}} = \begin{cases} \mu_h > 0, & \text{prob. } \phi_n \\ \mu_\ell = 0, & \text{prob. } 1 - \phi_n \end{cases} \qquad \alpha_n^{\text{MF}} = \mu_m$$

$$\Rightarrow \text{Var}\left(\alpha_n^{\text{HF}}\right) - \text{Var}\left(\alpha_n^{\text{MF}}\right) = \phi_n \left[1 - \phi_n\right] \mu_h > 0 \;\; (\text{also} \downarrow n)$$

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- **Attrition rate (cross-sectional):** HF more likely to close than MF, especially in early years.

$$\Pr\big\{\tilde{r}_n^{\text{HF}} < r_{\text{G}} \,|\, \mathcal{I}_n\big\} = 1-\phi_n > 0 = \Pr\big\{\tilde{r}_n^{\text{MF}} < r_{\text{A}} \,|\, \mathcal{I}_n\big\}$$

PREDICTIONS – FUND FLOWS AND SIZE

- **Fund flows.** Steeper relationship between performance and fund flows in HF than in MF.
  - A_n^{MF} constant $\rightarrow$ flat relation between performance and flows.
  - $A_{n+1}^{\mathrm{HF}} - A_n^{\mathrm{HF}} = \begin{cases} \frac{\bar{r}_{n+1} - \bar{r}_n}{2k_0} > 0, & \text{if } \tilde{r}_n^{\mathrm{HF}} = r_{\mathrm{G}} \\ 0 - \frac{\bar{r}_n}{2k_0} < 0, & \text{otherwise} \end{cases}$

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- **Fund size.** The disparity in size between HF and MF increases with fund age and manager tenure.

$$\bar{A}_1^{\text{MF}} = \cdots = \bar{A}_n^{\text{MF}} = \frac{\mu_m}{2k_t} \quad \text{and} \quad \bar{A}_1^{\text{HF}} < \bar{A}_2^{\text{HF}} < \cdots < \bar{A}_n^{\text{HF}} = \frac{\bar{r}_n}{2k_0}$$

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PREDICTIONS – CONTRACTS

- **MM compensation.** The disparity in MM compensation between HF and MF increases with manager tenure.

$$w_1^{\text{MF}} = w_2^{\text{MF}} = \cdots = w_n^{\text{MF}} = \frac{\mu_m}{2} \quad \text{and} \quad w_1^{\text{HF}} < w_2^{\text{HF}} < \cdots < w_n^{\text{HF}} = \frac{\bar{r}_n}{2}$$

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- **Lock-up periods.** Lock-up periods will tend to be longer when annual performance is a noisy signal of skill.
  - Intuitively, this reduces the probability (p_{G}) that skilled MMs are mimicked successfully.

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CONCLUSION

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- Extensions.
  - When should MM switch from MF to HF?
  - Regulation of HF.
    - Can slow down talent discovery.
    - Can incentivize talent to do something else.