Gaming Performance Fees by Portfolio Managers

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The current financial crisis has been blamed in part on excessive risk-taking induced by lavish bonuses paid for short-run performance.

This has led to various proposed reforms, including

- Postponement
- Bonuses offset by maluses
- Payment in kind....etc.

These reforms may help to reduce risk-taking and the manipulation of results through accounting gimmicks

BUT they cannot eliminate risk-taking – including extreme risk-taking – unless combined with significant restrictions on the positions that fund managers can take in the derivatives market and/or much greater transparency about their positions and trading strategies

Summary of Results

*Essentially any compensation mechanism can be gamed by managers with no particular investment skill, and they can capture a sizable amount of the fees intended to reward the skilled managers (**the coat-tail effect**).*

Mimics can be deterred by levying heavy penalties on managers' personal wealth if they underperform.

However, if the penalties are sufficient to deter risk-neutral mimics they will deter all the skilled managers too.

These results are proved using a combination of elementary options pricing, probability theory, and a game-theoretic concept called *mimicry*.

Case 1 : the benchmark is risk - free rate

$$r_{ft} = \textit{risk - free rate of return in year } t$$

$$X_t = 1 + r_{ft} = \text{ total return on risk - free asset (T - bills)}$$

$$Y_t = M_t X_t = \text{total return of a managed fund}$$

$$M_t = \text{multiplicative excess return (a random variable)}$$

$$\prod_{1 \le t \le T} M_t X_t = \text{fund's compound return over } T \text{ years}$$

Case 2 : Benchmark = Stock market

X_t = total market return in year t

$M_t X_t$ = fund's total return in year t

$$\prod_{1 \le t \le T} M_t X_t = \text{fund's compound return over } T \text{ years}$$

A *compensation contract for* T *years* is a function

$$\phi : R^{2T} \to R^{T}$$

$\phi_t(m_1, \ldots, m_T; x_1, \ldots, x_T)$ is the total fee to the manager in period t per dollar in the fund at the start of the period

ϕ_t depends only on $m_1, \ldots, m_{t-1}; x_1, \ldots, x_{t-1}$

"Two and Twenty"

2% management fee upfront, 20% on returns in excess of the risk - free rate

In the t^{th} period the fee per dollar in the fund at the start of the period is

$$\phi_t(\vec{m}, \vec{x}) = .02 + .2[m_t x_t - 1 - r_{ft}]_+$$

Two and Deferred Twenty

2% management fee at the start of each year

20% in year T on the excess return over the T periods.

Fee in the T^{th} period per dollar invested in period 1:

$$.02[(.98)^{T-1}\prod_{1\le t\le T-1} m_t x_t] + .2[\prod_{1\le t\le T} m_t x_t - \prod_{1\le t\le T}(1+r_{ft})]_+$$

Hence

$$\phi_T(\vec{m},\vec{x}) = .02 + \frac{.2[\prod_{1\le t\le T} m_t x_t - \prod_{1\le t\le T}(1+r_{ft})]_+}{(.98)^{T-1}\prod_{1\le t\le T-1} m_t x_t}$$

A **strategy** is a method for generating stochastic return sequences $\vec{M} = (M_1, \ldots, M_T)$ through arbitrage, superior predictive skills, etc.

A manager is *unskilled* if for all of his strategies $\vec{M}$

$$\forall \vec{m}, \forall \vec{x}, \forall t \qquad E[M_t \mid m_1, \ldots, m_{t-1}; x_1, \ldots, x_{t-1}] = 1$$

A manager can **generate excess returns in expectation** if

$$\forall \vec{m}, \forall \vec{x}, \forall t \qquad E[M_t \mid m_1, \ldots, m_{t-1}; x_1, \ldots, x_{t-1}] \geq 1$$

She can **consistently generate excess returns** if for some $\vec{M}$

$$\forall \vec{x}, \forall t, \qquad M_t \geq 1$$

The "cut"

Conditional on a realization of the benchmark returns series $\vec{x}$, the manager's **cut** in period t is his expected earnings per dollar in the fund at the end of the period

$$c_t(\vec{M} \mid \vec{x}) = E_{\vec{M}}\left[\frac{\phi_t(\vec{M}, \vec{x})}{M_t x_t}\right]$$

Example

A skilled manager generates excess returns of 10% every year over and above the risk - free rate, say 4%

$$\text{Yearly return} = (1.04)(1.10) = 1.144$$

$$\text{Fees per dollar invested} = .02 + .20(.144 - .04) = .0408$$

$$Cut = .0408/1.144 = .0357$$

Theorem 1

Let $\phi(\vec{m}, \vec{x}) \geq 0$ be a nonnegative compensation contract. Suppose some manager i consistently generates excess returns $M_t^i \geq 1$ relative to a benchmark portfolio generating returns X_t, $1 \leq t \leq T$.

An unskilled mimic has a strategy $\vec{M}^0$ such that, in every period t and for every realization $\vec{x}$, the expected fees are at least $c_t(\vec{M}^i \mid \vec{x})(x_1 x_2 \cdots x_t)$.

Given any skilled manager he chooses to target, a mimic has a strategy that, in expectation, earns as a high a percentage of the benchmark portfolio as the skilled manager earns as a percentage of his portfolio.

Implementing this strategy requires no knowledge of the method by which the skilled manager is achieving his results

Previous example

In expectation a mimic can earn over 3.57% of a fund compounding at 4% per year by mimicking a fund that is growing steadily at 14.4% per year

e.g., starting with $100 million, the mimic's expected earnings in year *t* are in excess of

$$(1.04)^t (\$3.57 \ million)$$

Mimicry Lemma

Given any target sequence of excess returns

$$\vec{m} = (m_1, m_2, ..., m_T) \geq (1, 1, ..., 1)$$

a mimic has a strategy $\vec{M}^0(\vec{m})$ that generates $\vec{m}$ with probability at least

$$1/(m_1 m_2 \cdots m_T)$$

irrespective of the returns generated by the benchmark asset

Proof sketch

Let $(m_1, \ldots, m_T)$ be a target series of excess returns

Invest everything in Treasury bills earning the continuous risk-free rate $\tilde{r}_{ft} > 0$ $(e^{\tilde{r}_{ft}} = 1 + r_{ft})$

At some randomly chosen time $\tilde{t}$ during the period write a binary cash-or-nothing put on the market with strike price s and time to expiration Δ

Choose s and Δ such that the present value of the option, $ve^{-\tilde{r}_{ft}\Delta}$, and the probability it is exercised, p, satisfy

$$p \leq v = 1 - 1/m_t$$

If $w_{\tilde{t}}$ is the value of the fund when the options are written, one can cover q options where

$$(e^{\tilde{r}_{ft}\Delta})w_{\tilde{t}} + vq = q$$

$$\Rightarrow q = (e^{\tilde{r}_{ft}\Delta})w_{\tilde{t}} / (1-v) = (e^{\tilde{r}_{ft}\Delta})w_{\tilde{t}} m_t$$

The options won't be exercised with probability $\geq 1/m_t$,
in which case the fund is worth $(e^{\tilde{r}_{ft}})w_{t-1}m_t$ by the end of period t

Thus the probability is $\geq 1/m_t$ the fund grows by the factor

$$m_t(1+r_{ft})$$

Let's restructure the incentives

a) postpone bonus payments for a number of years

b) clawback bonuses with maluses

c) pay the bonuses in shares of the fund

Example: No mgt fee and a 20% bonus paid in year 10 on excess returns generated over ten years

Start with \$100 million. A skilled manager generating 10% excess returns on top of a risk-free 4% makes

$$.20(1.144^{10} - 1.04^{10})100 = \$47.18 \text{ million}$$

In expectation a mimic makes the cut $\times (1.04)^{10} 100$

$$\text{cut} = \frac{47.18}{100(1.144)^{10}} = .1229$$

Mimic makes about \$18.2 million in expectation

Solution?
Levy penalties for underperformance

e.g., if a manager loses most of the investors' money, he has to make up some (or all) of the loss *out of his own pocket*

Of course, this may severely restrict the ability of skilled managers to maximize returns for their investors

Impossibility Theorem

There is no compensation mechanism $\phi(\vec{m}, \vec{x})$*, either with or without penalties, that can separate skilled from unskilled portfolio managers on the basis of their track records*

Any compensation mechanism that deters risk - neutral mimics deters managers of arbitrarily high skill levels and any degree of risk aversion

Proof Sketch

Assume the benchmark is the risk - free rate r, which for simplicity we set equal to zero.

Consider a one - period model with fee $\phi(\mathrm{M})$ provided the fund delivers return $M \geq 0$

If $\phi(\mathrm{M})$ can be negative, the manager must post a bond to pay it.

Unless he can guarantee that M is bounded away from zero the bond must satisfy $b \geq -\phi(0)$

Keeping out the risk-neutral mimics requires that all lotteries M with expectation 1 must have nonpositive expected fees. It follows that for all $m' > 1,\ m'' < 1,$

$$\phi(m')/(m'-1) \le \phi(m'')/(m''-1)$$

Let $$s = \min_{0 \le m'' < 1} \phi(m'')/(m''-1) \le b$$

$$\Rightarrow \forall m, \qquad \phi(m) \le s(m-1)$$

$$\Rightarrow \forall m, \qquad \phi(m) + b \le sm - s + b$$

$$\Rightarrow E_M[u(\phi(M)+b)] \le E_M[u(sM+b-s)]$$

Ecological game theory

Financial markets are like ecological systems : they are too complex to be able to specify the complete set of players, payoff functions, skill levels, degrees of risk aversion, and so forth

The mimicry argument says something about equilibrium (and disequilibrium) outcomes even when we cannot model the game in full

If a skilled player can make lots of money, an unskilled player can also make lots of money in expectation by mimicking the first type of player

Mimicry does not require knowing how the skilled player actually generates his payoffs; it suffices to mimic his track record

Since mimicking is virtually costless, the market is vulnerable to an invasion by mimics

Conclusion

Fees and/or investor confidence could eventually collapse unless there is enough transparency for investors to tell the difference between the mimics and the real McCoys

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