Active and Passive Investment

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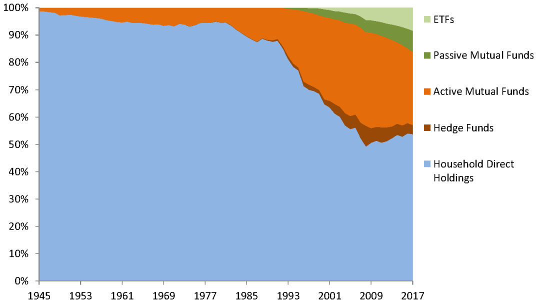
Motivation: Active vs. Passive Investment

- Significant trends in financial markets over the past half century
  - increase in delegated asset management
  - increase in passive management, recent decade(s)



- Research questions
  - What drives these trends?
  - What are the implications for (macro/micro) market efficiency?
  - What do optimal active and passive portfolios look like?
  - Implications for fees, returns, and market structure?

Main Results:

1. Optimal portfolios
    - Passive related to the "expected market portfolio"
        - overweight assets with low supply uncertainty (like an index)
    - Active buys when
        - supply increases and price drops (value investing)
        - positive signal on fundamentals (quality investing)
2. Make precise Samuelson's Dictum: macro inefficiency>micro inefficiency
    - with many assets, *all* inefficiency is factor-based (APT of efficiency)
3. Examining trends:
    - Lower costs of passive investing leads to
        - higher overall inefficiency, especially macro inefficiency
        - #passive investors increases
        - #active investors, #informed active managers decrease
        - active management fee decreases by less than passive fees
    - Calibration of economic magnitude

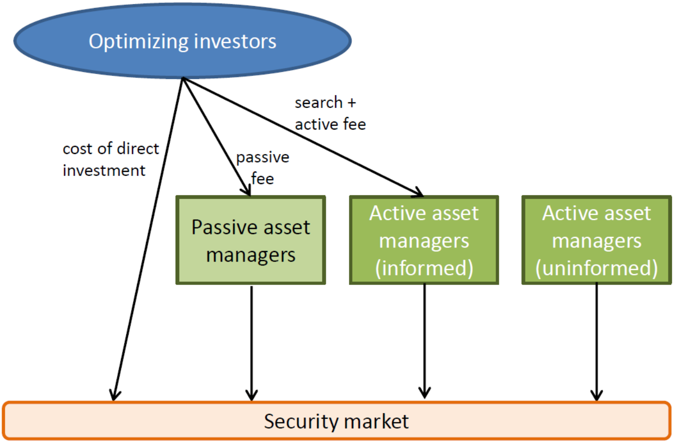
Related Literature

- **Theoretical literature**:
  - **REE with managers**: Garcia and Vanden (09), Stambaugh (14), Garleanu and Pedersen (18)
  - **Arithmetic of active management**: Sharpe (1991), Pedersen (2018)
  - **REE models**: Grossman and Stiglitz (80), Hellwig (80), Admati (85),...
  - **Models of informed trading**: Glosten and Milgrom (85), Kyle (85),...
  - **Search models in finance**: Duffie, Garleanu, and Pedersen (05), ...
  - **Asset management contract can distort prices**: Stein (05), Cuoco and Kaniel (11), Buffa, Vayanos, and Woolley (14)
  - **Trust in asset managers**: Gennaioli, Shleifer, and Vishny (15)
  - **Information choice**: Kacperczyk, van Nieuwerburgh, and Veldkamp (16), Glasserman and Mamaysky (18)
- **Empirical literature**:
  - **Search and asset man.**: Sirri and Tufano (98), Hortacsu and Syverson (04)
  - **Active/passive inv.**: French (08), Cremers, Ferreira, Matos, Starks (16)
- **What we add: studying, in light of multiple assets,**
  - optimal passive and active portfolios
  - general conditions for Samuelson's Dictum + APT of efficiency
  - investors' costs of self-directed, passive, and active management
  - what happens when information costs and asset management costs change
  - potential explanation of recent trends in markets and in asset management

Overview of the Rest of the Talk

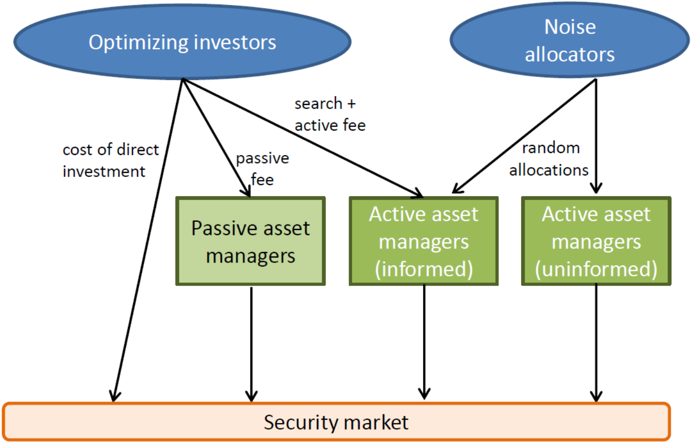
- Model setup and solution
- Results
  - Optimal passive and active portfolios
  - Samuelson's Dictum: macro vs. micro efficiency
  - Falling Costs of Informed and Uninformed Investing
- Economic magnitude: calibration

Model



Optimizing investors
search +
active fee
cost of direct
investment
passive
fee
Passive asset
managers
Active asset
managers
(informed)
Active asset
managers
(uninformed)
Security market

Model



Optimizing investors
Noise allocators
search + active fee
cost of direct investment
passive fee
random allocations
Passive asset managers
Active asset managers (informed)
Active asset managers (uninformed)
Security market

Model

- Assets: $r^f = 0$ and n risky assets
  - Endogenous price $p \in \mathbb{R}^n$
  - Final payoffs $v \sim \mathcal{N}(\bar{v}, \Sigma_v)$
  - Signal $s = v + \varepsilon$, where $\varepsilon \sim \mathcal{N}(0, \Sigma_\varepsilon)$, at a cost k
  - Supply $q \sim \mathcal{N}(\bar{q}, \Sigma_q)$

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- Asset managers:
  - Representative passive manager with fee $f_p = k_p$
  - M informed active managers, marginal cost k_a and fee f_a
  - $\bar{M} - M$ uninformed active managers

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- Investors with CARA utility:
  - S_p allocate to passive manager, cost f_p
  - S_a search for informed manager, cost $c(M, S_a) + f_a$
  - $\bar{S} - S_a - S_p$ self-directed, cost d_l for investor l
  - N noise allocators

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market clearing

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manager optimality

Nash bargaining

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investor optimality

Equilibrium: Market Prices

- Prices linear in information s and supply q:

$$p = \theta_0 + \theta_s^\top \left((s - \bar{v}) + \theta_q^\top (q - \bar{q}) \right)$$

- Demand x_i and certain-equivalent utility u_i of informed:

$$-\frac{1}{\gamma} \log \left(\mathrm{E} \left[\max_{x_i} \mathrm{E} \left(e^{-\gamma(W + x_i(v-p))} | p, s \right) \right] \right) =: W + u_i$$

and uninformed

$$-\frac{1}{\gamma} \log \left(\mathrm{E} \left[\max_{x_u} \mathrm{E} \left(e^{-\gamma(W + x_u(v-p))} | p \right) \right] \right) =: W + u_u$$

- Value of information=market inefficiency, $\gamma(u_i - u_u) = \eta$, where

$$\eta = \frac{1}{2} \log \left(\frac{\det(\mathrm{var}(v|p))}{\det(\mathrm{var}(v|s))} \right).$$

Asset Management Fees

- Passive fee: $f_p = k_p$
- Active fee determined through Nash bargaining

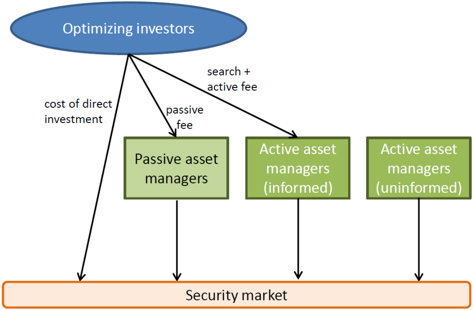
$$
\begin{aligned}
f_a &= \arg\max_f \left(W - c - f + u_i - (W - c - f_p + u_u)\right)(f - k_a) \\
&= \arg\max_f \left(u_i - u_u + f_p - f\right)(f - k_a) \\
&= \frac{u_i - u_u + f_p + k_a}{2} \\
&= \frac{k_a + k_p}{2} + \frac{\eta}{2\gamma}
\end{aligned}
$$

Active Asset Managers Information Choice

- Cost of information: k
- Benefit of information: $(f_a - k_a)\frac{S_a}{M}$
- Indifference condition (using $f_a = \frac{k_a + k_p}{2} + \frac{\eta}{2\gamma}$)

$$\frac{k_p - k_a}{2} + \frac{\eta}{2\gamma} = \frac{M}{S_a}k$$

Investors Optimality



- Investor utilities
  - Self-directed: $W + u_u - d_I$
  - Passive management: $W + u_u - f_p$
  - Active management: $W + u_i - c - f_a$
- Optimal choice for investor I
  - $d_I < f_p$: invest directly in the financial market
  - $d_I \geq f_p$: indifferent between active and passive:

$$u_i - c - f_a = u_u - f_p \qquad \text{i.e.,} \qquad \frac{\eta}{2\gamma} + \frac{k_p - k_a}{2} = c$$

Statistical Assumptions

Assumption 1. Fundamentals follow a factor structure:

$$\begin{aligned} v &= \bar{v} + \beta F_v + w_v \\ \varepsilon &= \beta F_\varepsilon + w_\varepsilon \\ q &= \bar{q} + \beta F_q + w_q, \end{aligned}$$

$\beta \in \mathbb{R}^n$ is normalized such that $\beta^\top \beta = n$. All rv's are independent.

Assumption 1.' Assumption 1 holds and the common factor of v is non-zero, $\sigma^2_{F_v} > 0$, and at least as important as that of ε, i.e., $\sigma^2_{F_v}/\sigma^2_{w_v} \geq \sigma^2_{F_\varepsilon}/\sigma^2_{w_\varepsilon}$.

Assumption 2. Assumption 1 holds with $\beta = 0$ (or, more generally, there exist scalars z_ε and z_q such that $\Sigma_\varepsilon = z_\varepsilon \Sigma_v$ and $\Sigma_q^{-1} = z_q \Sigma_v$).

Optimal Uninformed Portfolio: The Economics of an Index

Proposition.

- Portfolio x_u is linear in $E[q|p]$: $x_u = AE[q|p]$.
  - Under Assumption 2, A is scalar and positive.
  - Under Assumption 1,

$$x_u = A_0\, E[q|p] - A_1\, (\beta^\top E[q|p])\, \beta$$

    with $A_0 > 0$; $A_1 > 0$ under Assumption 1'
- Expected portfolio $E[x_u]$
  - Under Assumption 2, $E(x_u) \sim E(q)$
  - Under more realistic assumptions, $E[x_u]$ is tilted away from risky (high beta) securities and securities with more supply risk (high $\Sigma_{q,jj}$)

Optimal Active Portfolio: Value and Quality

Proposition. Under Assumption 1 or 2, an informed investor's position in any asset j is more sensitive than that of an uninformed agent to its

a. supply shocks, $\frac{\partial E[x_{i,j}|q]}{\partial q_j} > \frac{\partial E[x_{u,j}|q]}{\partial q_j}$ *(value investing)*

b. signal s_j, $\frac{\partial E[x_{i,j}|s]}{\partial s_j} > 0 > \frac{\partial E[x_{u,j}|s]}{\partial s_j}$ *(quality investing)*

Samuelson's Dictum: Macro vs. Micro Efficiency

"Modern markets show considerable micro efficiency (for the reason that the minority who spot aberrations from micro efficiency can make money from those occurrences and, in doing so, they tend to wipe out any persistent inefficiencies)... In no contradiction to the previous sentence, I had hypothesized considerable macro inefficiency"
—Samuelson (as cited by Shiller)

- We have setting to analyze Samuelson's dictum
- Market inefficiency of any portfolio $\zeta \in \mathbb{R}^n$ defined as:

$$\eta^{\zeta} = \frac{1}{2} \log \left(\frac{\mathrm{var}\left(\zeta^{\top} v | p\right)}{\mathrm{var}\left(\zeta^{\top} v | s\right)} \right)$$

- But how to define "macro" and "micro"?
- When does Samuelson's Dictum hold?

Samuelson's Dictum: Macro vs. Micro Efficiency

Proposition.

a. Under Assumption 2, η^{ζ} is the same for all portfolios ζ.

b. Under Assumption 1', **Samuelson's Dictum** applies:

$$\max_{\zeta \in \mathbb{R}^n} \eta^{\zeta} = \eta^{\beta} \qquad \min_{\zeta \in \mathbb{R}^n} \eta^{\zeta} = \eta^{z} \text{ for any with } z^{\top}\beta = 0$$

c. $\exists$ parameters for which the opposite conclusion of part b holds.

d. $\forall$ parameters satisfying As. 1, one of outcomes a-c obtains.

Samuelson's Dictum on Steroids: APT of Efficiency

- Overall inefficiency decomposed: $\eta = \eta^{\beta} + \eta^{\text{micro }1} + ... + +\eta^{\text{micro }n-1}$

Proposition. For n large enough, Samuelson's Dictum holds. Further, all inefficiency is due to the factor in the limit: as $n \to \infty$, $\eta^{\beta}/\eta \to 1$.

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- Generalize to $k > 1$ factors: $\beta = (\beta_1, ..., \beta_k)$
- Overall inefficiency decomposed: $\eta = \underbrace{\eta^{\beta_1} + ... + \eta^{\beta_k}}_{\eta^{\beta}} + \eta^{\text{micro } 1} + ... + +\eta^{\text{micro } n-k}$

Proposition. As $n \to \infty$:

$$E(v_i - p_i) = \sum_j \beta_{ij}\lambda_j \qquad \text{(APT of Returns)}$$

$$\eta^{\beta}/\eta \to 1 \qquad \text{(APT of Efficiency)}$$

Consequently, a portfolio with zero factors loadings has zero expected excess return and zero inefficiency.

Samuelson's Dictum: Evolution over Time

"We've come a long way, baby, in two hundred years toward micro efficiency of markets: Black-Scholes option pricing, indexing of portfolio diversification, and so forth. But there is no persuasive evidence, either from economic history or avant garde theorizing, that MACRO MARKET INEFFICIENCY is trending toward extinction: The future can well witness the oldest business cycle mechanism, the South Sea Bubble, and that kind of thing."—Samuelson (1998)

- What has changed over time?
- Cost of
  - passive asset management
  - information

Falling Costs of Passive Asset Management

Proposition. When the cost of passive investing $k_p = f_p$ decreases:

- overall asset price inefficiency η increases, especially macro
- #passive investors S_p increases
- #self-directed investors decreases
- #searching S_a and #informed investors I decrease
- #informed active managers M decreases
- passive fee f_p decreases, active management fee f_a decreases by less

Empirically, lower-cost index funds leads to (Cremers et al (2016))

- higher average alpha for active managers
- larger share of passive investment
- lower active fees, but larger spread to passive fees.

Falling Costs of Information

Proposition. When the cost of information k decreases:

- overall asset price inefficiency η decreases, especially macro
- #informed investors I increases
- #informed active managers M increases
- #self-directed investors remains unchanged
- active management fee f_a decreases

Falling Amount of Noise

Stambaugh (2014) argues that noise trading has gone down

Proposition. A lower supply uncertainty leads to

- #informed investors I decreases
- #passive investors increases
- #informed active managers M decreases
- overall asset price inefficiency η can increase or decrease

Economic Magnitude: Calibration of Inefficiency

- Equilibrium connection between overall efficiency and fees

$$\begin{aligned}\eta &= 2\gamma(f_a - f_p) + \gamma(k_p - k_a)\\ &= 2\gamma^R({f_a}^{\%} - {f_p}^{\%}) + \gamma^R({k_p}^{\%} - {k_a}^{\%})\\ &= 2 \times 3 \times 1\% + 0 = 6\%\end{aligned}$$

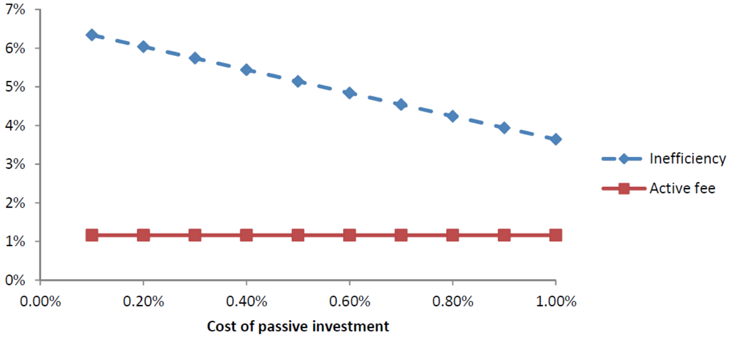
- Overall inefficiency decomposed: calibration with 1000 assets, 2 factors:
  - 81% due to the expected market portfolio $\beta_1 = (1, 1, ..., 1)^\top$
  - 18% is due to the relative-value portfolio $\beta_2 = (.61, -.61, ..., -.61)^\top$
  - 1% is due to all the 998 micro portfolios

  - Parameters chosen to match the finding of Roll (1988) that "the mean R^2s were, respectively, .179 for the CAPM and .244 for the APT"

Numerical Example

A decrease in the cost of passive investment

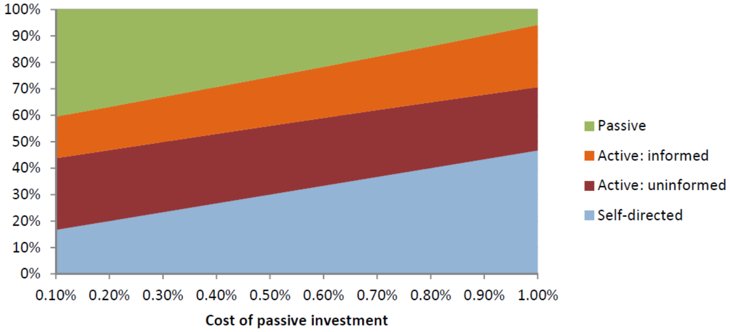
- increase in market inefficiency
- without necessarily affecting the active-investment fee



Numerical Example, Continued

A decrease in the cost of passive investment, further implies

- increase in passive management
- decrease in self-directed investment
- decrease in active management, especially by discerning investors



Efficiency, Entropy, and the Value of Information

Proposition. In equilibrium, the following are equal:

a. overall market inefficiency, η
b. utility difference of informed vs. uninformed, $(u_i - u_u)\gamma$
c. the difference in entropy, $entropy(v|p) - entropy(v|s)$
d. the expected Kullback-Leibler divergence, KL, of the distribution of v conditional on p from that conditional on s, $E(KL)$.

Conclusion: The Future of Markets and Management

- Optimal portfolios of active and passive
- Samuelson's Dictum and the "APT of efficiency"
- Examining trends in financial markets, incl. economic magnitudes
  - Passive management is increasing due to reduction in cost and fees
  - Rising passive increases inefficiency, especially macro
  - But, reduced information cost decreases inefficiency, especially macro