Delegated Portfolio Management with Socially Responsible Investment Constraints

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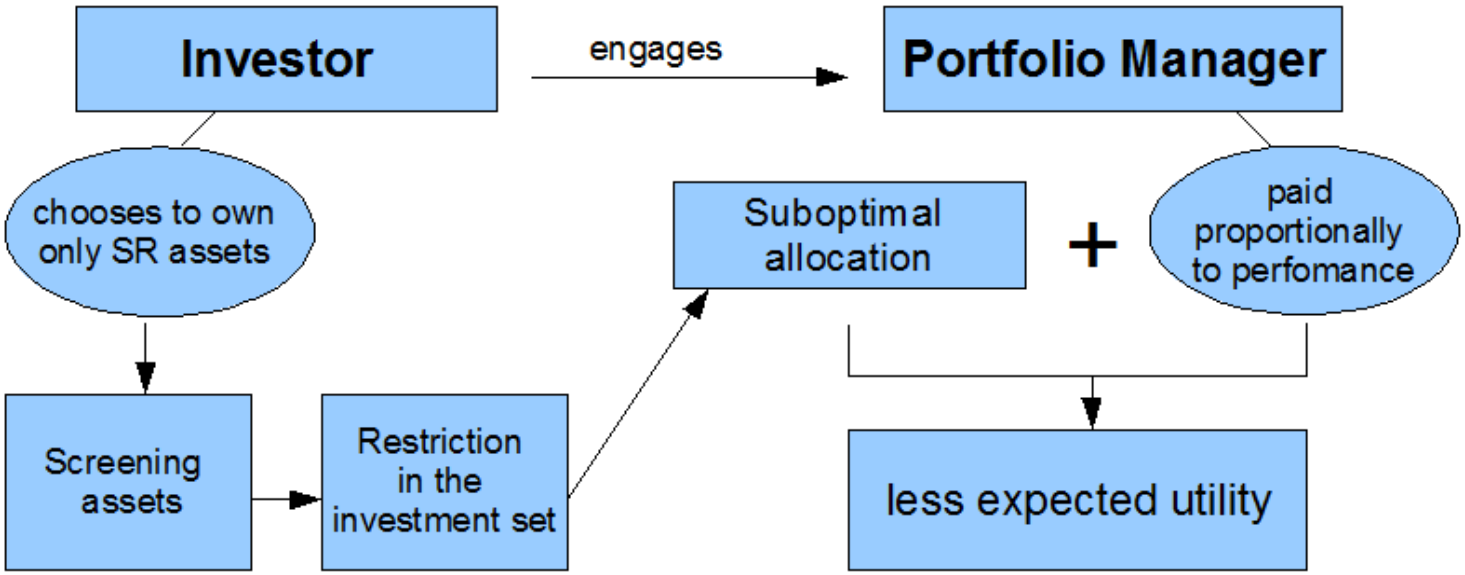
What is Socially Responsible Investment?

- Any investment process that combines investors' financial objectives with their concerns about environmental, social and governance issues (ESG).
- Example: Principles for Responsible Investment (PRI) provide a menu of possible actions for incorporating ESG issues into mainstream investment decision-making and ownership practices.
- Growing Interest ▸ plot

Incentives for portfolio managers



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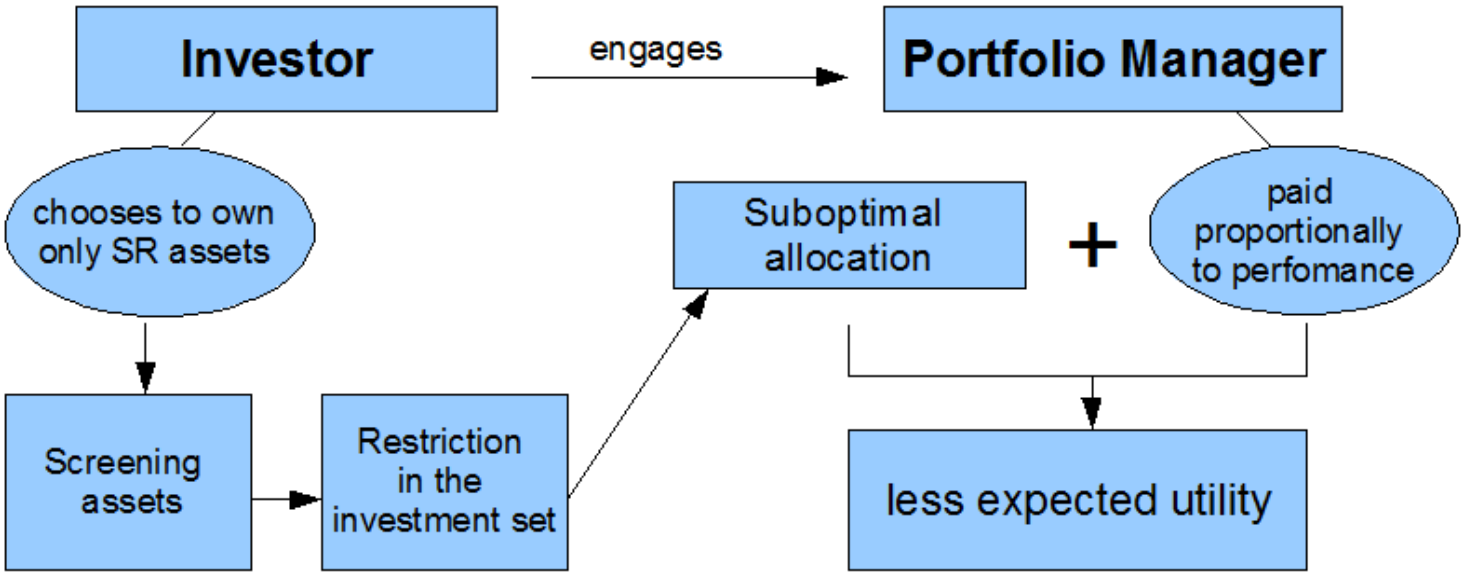

How to set incentives to compensate Portfolio Manager for the investment restriction?

The Market

Single period market with

- n risky assets with return $\mathbf{X}$ distributed as a multivariate normal:
$$\mathbf{X} \sim N(\bar{\mathbf{X}}, \Sigma);$$
- a risk free asset, with return R.

The first p components of $\mathbf{X}$ represent green assets $\mathbf{P}$, the remaining q components represent non-green assets $\mathbf{Q}$:

$$\mathbf{X} = \begin{pmatrix} \mathbf{P} \\ \mathbf{Q} \end{pmatrix}, \quad \bar{\mathbf{X}} = \begin{pmatrix} \bar{\mathbf{P}} \\ \bar{\mathbf{Q}} \end{pmatrix}, \quad \Sigma = \begin{pmatrix} \Sigma_P & \Sigma_{PQ} \\ \Sigma_{PQ}^T & \Sigma_Q \end{pmatrix}.$$

Agents

- The Investor
  - risk neutral
  - providing an *initial wealth* W_0 to the Portfolio Manager to be invested
  - aware of SR: she maximizes her expected wealth but she wants only "Green" assets.

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- The Portfolio Manager
  - risk averse with utility function $u(x) = e^{-\alpha x}$
  - paid proportionally to the portfolio performances
  - receiving a private signal
  - accepting the contract iff the expected utility is greater than his reservation utility

The contract

The contract offered by the investor:

$$f(W) := AR + b_g W,$$

W is the portfolio composed only by green assets **P**
The reservation contract :

$$r(W') := AR + bW',$$

W' is the portfolio composed by all assets **X**
The quantity $\Delta = b_g - b$ is the "Green bonus ".

The information

The manager receives a signal

$$\mathbf{S} = \mathbf{X} + \epsilon$$

where $\mathbf{X}$ and ϵ are uncorrelated and $\epsilon \sim N(\mathbf{0}, \Sigma_\epsilon)$, Σ_ϵ represents the skill of the manager.
The conditional distribution of $\mathbf{X}$ given $\mathbf{S} = S$ is normal with mean

$$\mathbf{M}(S) = E(\mathbf{X}|\mathbf{S} = S) = \bar{\mathbf{X}} + \Sigma\Sigma_S^{-1}(S - \bar{\mathbf{X}}),$$

and variance

$$V = Var(\mathbf{X}|\mathbf{S} = S) = \Sigma - \Sigma\Sigma_S^{-1}\Sigma.$$

The principal optimization problem

- Principal optimization problem

$$\max_{\Delta} \mathbb{E}\ [\ W(\omega_P^*(\Delta, \mathbf{S})) - f(W(\omega_P^*(\Delta, \mathbf{S})))\ ]$$

- subject to

$$\omega_P^*(\Delta, S) = \arg\max_{\omega_P} \mathbb{E}\ [\ u\left(AR + (b + \Delta)W(\omega_P)\right) | \mathbf{S} = S\ ]$$

- and the manager's participation constraint

$$\mathbb{E}\ [\ u(f(W))\ ]\ \geq\ \mathbb{E}\ [\ u(r(W'))\ ]$$

Compensation bonus

The solution of principal optimisation problem is

$$\bar{\Delta} = c(\Psi + \Phi)$$

where

- c depends on manager's risk aversion, risk free rate and AUM.
- Ψ is the minimum required by any manager of whatever ability level. It is related to the differences, in terms of market properties, between green and non-green assets.
- Φ is the compensation for the unexploited ability due to the restriction. It is related to manager's expertise.

The minimum required when $\Phi = 0$ is $\bar{\Delta}_0 = c\Psi$

$$\Psi = \mathcal{H} - \mathcal{H}_P, \qquad c = \frac{1}{2\alpha W_0 R}$$

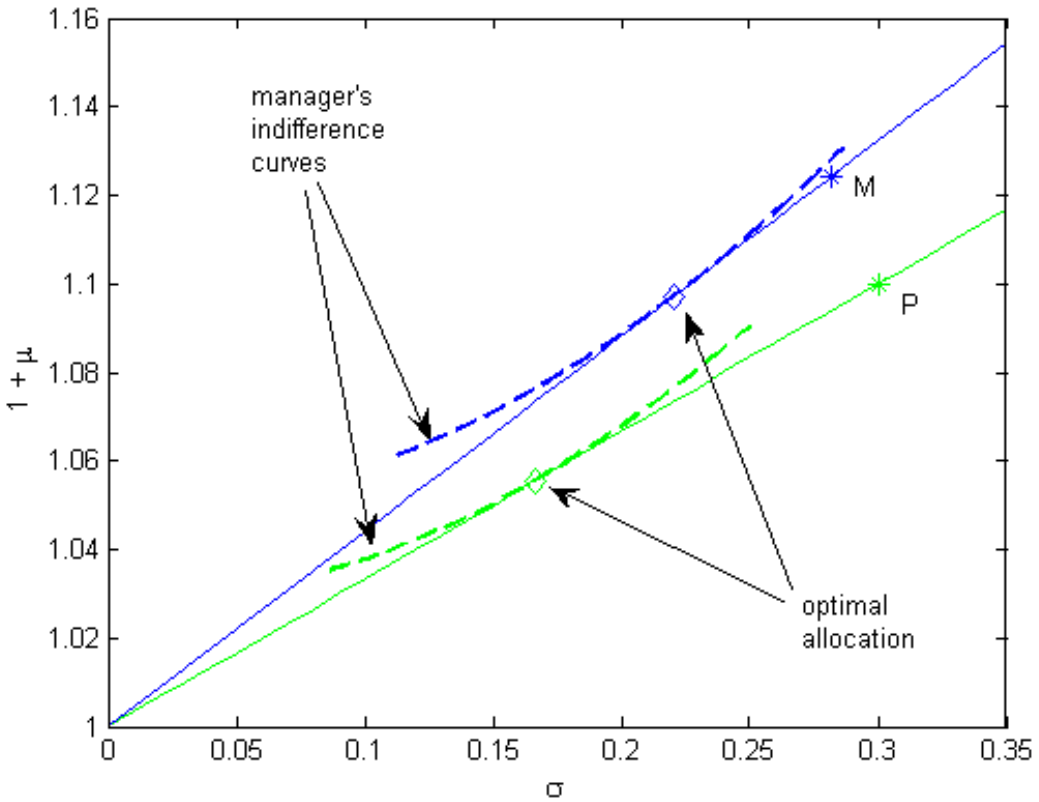
where

$$\mathcal{H}_P = (\bar{\mathbf{P}} - R\mathbf{1}_p)^T \Sigma_P^{-1} (\bar{\mathbf{P}} - R\mathbf{1}_p)$$

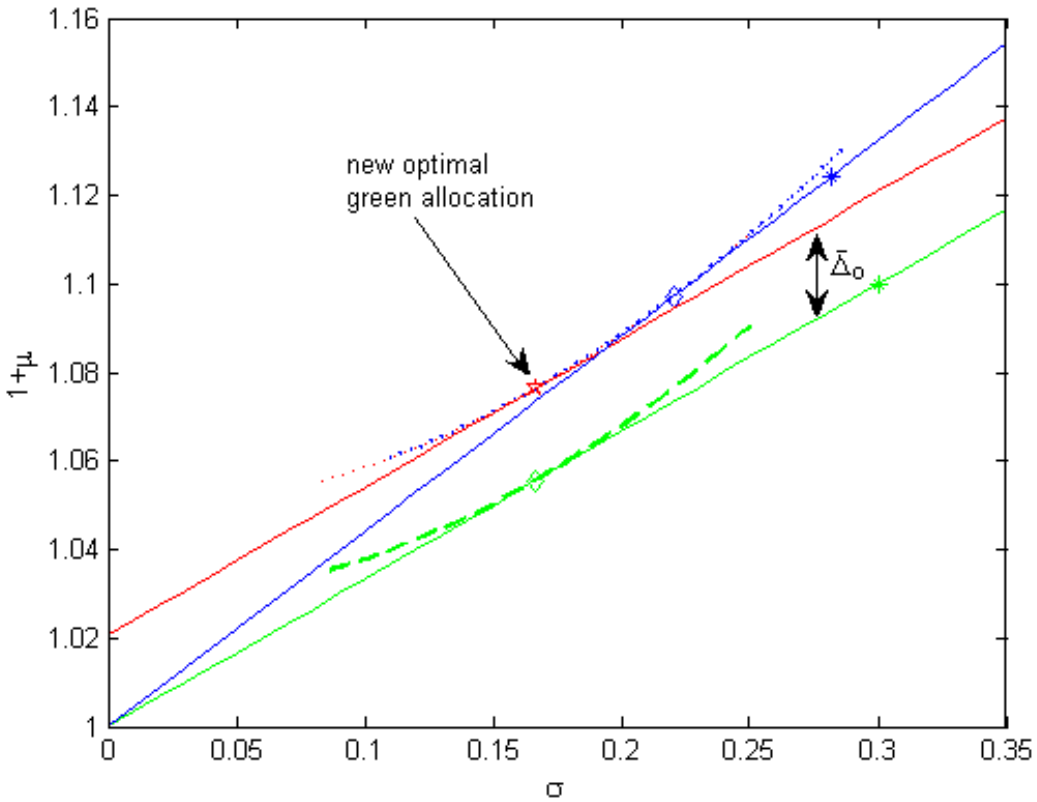
and

$$\mathcal{H} = (\bar{\mathbf{X}} - R\mathbf{1}_n)^T \Sigma^{-1} (\bar{\mathbf{X}} - R\mathbf{1}_n).$$

The effect of $\bar{\Delta}_0$

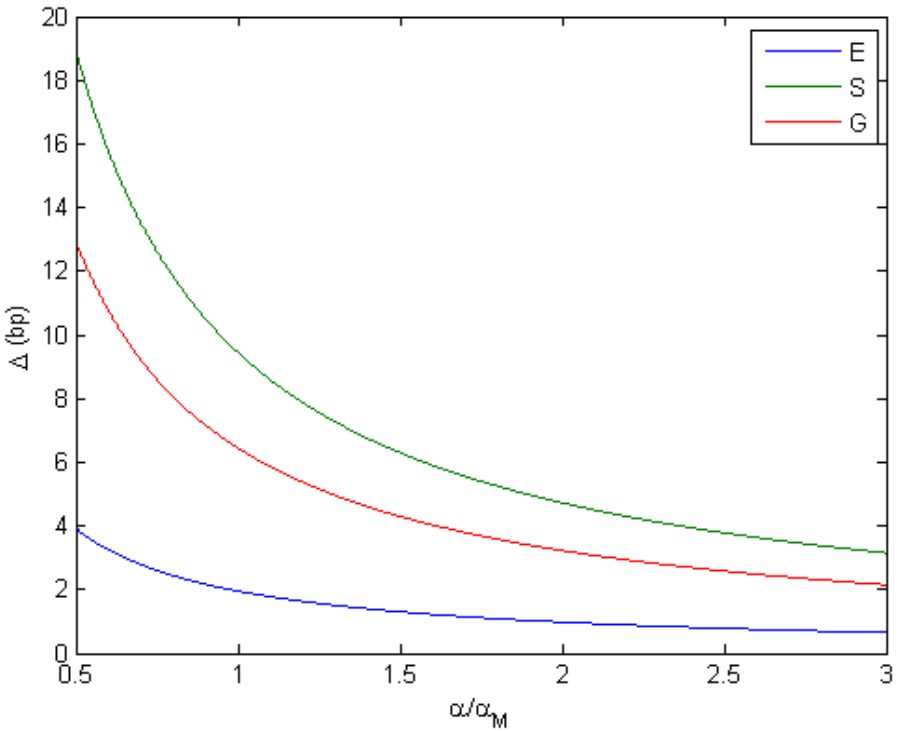


The effect of $\bar{\Delta}_0$



$\bar{\Delta}$ when $\Phi = 0$

Data: S&P500 December 2006 by KLD



E-AllCon $n_p = 341$
G-AllCon $n_p = 152$
S-allCon $n_p = 71$

Green Bonus: the ability term Φ

The compensation for the missed exploitation of part of the signal

$$\Phi = \log\left(\frac{H}{H^g}\right)$$

$$H = \frac{\det(\Sigma)}{\det(V)} \qquad\qquad H^g = \frac{\det(\Sigma_P)}{\det(V_P)}$$

are the global and the green *expertise* of a manager.

Comments on Expertise $H = \frac{\det(\Sigma)}{\det(V)}$

- Two managers with different skills (represented by the variance of the signal) may have the same expertise H.
- Φ is decreasing with respect to H^g, hence higher the green expertise $\longrightarrow$ lower the bonus required. More

$$\lim_{H^g \longrightarrow H} \Phi = 0$$

When the agent's expertise is concentrated in the green assets, no efficiency bonus is required.

Conclusion

Under very simple assumptions we tackle the problem to compensate the screening effects by the use of a green bonus, decomposing it into

- manager's risk aversion
- loss in Sharpe Ratios
- loss in expertise

download: Sirp Working Paper 10-07 on www.sirp.se

thanks: MISTRA, The foundation for strategic environmental research, Sweden

References: DPM

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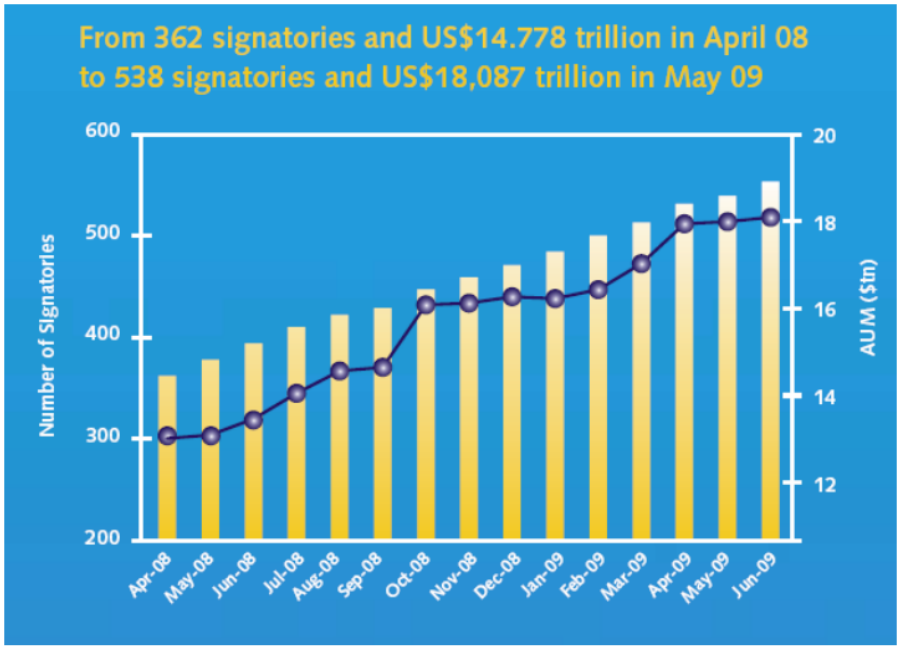
Growing interest in SRI



Source: Annual Report of PRI Initiave, 2009 back