ASSET RETURN PREDICTABILITY AND DELEGATED PORTFOLIO MANAGEMENT

Abraham Lioui ¤ and Patrice Poncet *

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¤ Department of Economics, Bar Ilan University, Israel.

*** *PRISM*, Faculty of Management Sciences, University of Paris-I Panthéon-Sorbonne, France, and**

Finance Department, ESSEC Business School, France.

- **MOTIVATION**

Delegated portfolio management is a **growing** industry, with € billions at the moment and probably much more to come,

Increasingly **competitive**, in particular in EMU.

Final investors face differential transaction costs, are offered complex investment vehicles, and thus need professional **guidance** and **references.**

Benchmarking has become essential to gauge portfolio managers' **performance.**

Compensation schemes constitute important part of interests at stake, for both customers and portfolio management firms.

- **MOTIVATION (cont.)**

In extant literature related to portfolio theory and management, **two** (so far) ***disconnected issues*** have been examined:

- The ***compensation scheme*** of active portfolio ***managers***

- The influence of ***asset return predictability*** on optimal portfolios of ***direct investors***

A) Alternative approaches when part of incentive fee depends on performance relative to a benchmark:

Here : **linear symmetric** contract ; parameters and benchmark are **exogenous***;* Hence, **not** a principal-agent problem.

(i) linear symmetric : legislation in the U.S. and many European countries;

(ii) literature has focused on linear contracts, hence useful comparisons with our results; and

(iii) tractability and economic interpretation of results.

B) Asset return predictability (excluded by construction by static settings).

- Merton (and Breeden) : **stochastic** investment opportunity set (IOS), (**K+1**)**separation theorem**, necessity to **hedge** its unfavorable shifts;

- State variables that drive the IOS are **partially predictable**, in particular financial or macroeconomic variables (interest and exchange rates,…);

- this makes **financial asset returns** partially **predictable;**

- Overall, **convincing evidence** that (direct) portfolio strategies that exploit such a predictability significantly **outperform** those that do not.

Our approach extends or complements the extant literature in 4 directions :

1. CRRA **utility functions**, (neither the standard CARA nor the log).

- Use of **diffusion processes** for asset returns, market prices of risk and riskless rate. Basic sources of risk thus influence the investment opportunity set, which is not deterministic. Strong case for asset returns (partial) **predictability**, which typical investors cannot exploit. Investors pay a fee to access truly optimal portfolios.

3. No constraint relative to the **agent's reservation utility** in the investor's program (manager predetermines the fee parameters and knows which benchmark is imposed by the investor). Since this reservation level is difficult to assess, not needing it is a main advantage of our approach**.**

4. We bring together the **2 strands** of literature : does what is true of direct investment under asset return predictability **remain true for delegated investment?**

Specific related questions that can or could be addressed:

- Is the importance of asset return predictability (ARP) **exacerbated** for delegated investment , and to what **extent**?
- What are the **welfare costs** associated with not taking ARP into full account, for clients? For managers?
- What is the impact of the **investor's risk attitude**? The **manager's** ?
- What is the impact of the investment **horizon**? Conventional wisdom vs standard CAPM theory and separation theorems.
- Impact of results on **optimal benchmarks**?
- On delegated portfolio **performance analysis**?
- On managers' **skills evaluation**?
- On **compensation schemes**?

II. RELATED LITERATURE (partial since enormous)

– With CARA utility and some conditions, **linear contracts are optimal** [Ross (1973), Holmström and Milgrom (1987), Schättler and Sung (1993) and Sung (1995), extension by Ou-Yang (2003)].

– In a general stochastic environment, but perfect information, if manager and investor have the same CRRA coefficients, or possibly different CARA parameters, **the optimal contract is (ex post) linear**.

– However, Admati and Pfleiderer (1997) : using a risky benchmark portfolio of the type commonly adopted **in practice**, is sub-optimal under a linear and symmetric contract (however, **static** framework).

– Lioui and Poncet (2005), in a **first-best contract** situation, solve for the **optimal benchmark** under general VNM utility and derive **explicit solutions for CRRA**.

– Asset return are **partially predictable** as the parameters of the stochastic processes (for riskless rate and market prices of risk) governing the pricing kernel are known.

- Campbell (1987), Campbell and Shiller (1988a, b) and Fama and French (1989): **long term U.S. equity returns** explained by a short term interest rate, some measure of the term premium and the average dividend yield or by the dividend/price and the earnings/price ratios.

- Vila-Wetherilt and Wells (2004) confirm the high predictability of **U.K. equity returns** in the long run.

- Ferson, Heuson and Su (2004) report that taking into account the time variation in expected returns remains **economically important** even after transaction costs.

- Pastor and Stambaugh (2002), Busse and Irvine (2003), Geczy, Levin and Stambaugh (2003) and Jones and Shanken (2005) show that the **predictability** embedded in observed managerial skills can be exploited.

- Avramov (2004) and Avramov and Chordia (2005) claimed that investment strategies involving individual stocks or benchmarks are more profitable when they incorporate **macroeconomic variables as predictors**.

- Avramov and Wermers (2004) provide convincing evidence that portfolio strategies that **exploit asset return predictability** (ARP) significantly outperform those which do not.
- Bacchetta, Mertens, Wincoop (2006): ARP linked to **expectation errors**;

We'll assume **implicitly that skillful managers can exploit** ARP more efficiently than investors do, thereby **justifying** the portfolio delegation.

Word of caution: our problem is **not** set in a principal-agent theoretic framework.

- Under **moral hazard** (unobservability of manager's efforts) and/or **adverse selection** (asymmetric information on manager's quality), search for an **optimal** contract has proved to be **inconclusive** except in very simple settings
- We do not tackle this issue : only (implicitly) **first best**, not second best, contracts.

III. THE ECONOMIC FRAMEWORK

- N+1 financial assets available (1 riskless and N risky).
- Assume M = N, i.e. financial market **complete** (+ frictionless, & arbitrage-free).
- No dividends paid between 0 and T : all admissible portfolios are **self-financing**.

- The market price of risk (hereafter **MPR**) $k_i(t)$ attached to the ith fundamental source of risk (i = 1, …, N) is assumed to obey the following stochastic differential equation (SDE)

$$d\kappa_i(t) = \theta_{\kappa_i}\left(\mu_{\kappa_i} - \kappa_i(t)\right)dt + \sigma_{\kappa_i} dZ_i(t)$$

- The **riskless** interest rate at time t solves the following SDE:

$$dr(t) = \theta_r\left(\mu_r - r(t)\right)dt + \sum_{i=1}^{N} \sigma_{r,i} dZ_i(t)$$

These **Ornstein-Uhlenbeck** processes are standard assumptions in the literature

- In this economy, the **pricing kernel** (stochastic discount factor) L(t) obeys the dynamics:

$$\frac{d\Lambda(t)}{\Lambda(t)} = -r(t)dt - \sum_{i=1}^{N} \kappa_i(t)dZ_i(t)$$

- All asset returns are driven by this (real) pricing kernel.

IV. THE MANAGER'S OPTIMIZATION PROBLEM

Manager imposes on his investor the following compensation scheme:

$$F(T) = f_f V^m(T) + f_v \left(V^m(T) - V^b(T) \right)$$ "linear symmetric"

F(T) = global fee paid to manager at final date T, with f_f and f_v given;

V^m and V^b = value of the managed fund and that of the benchmark, resp.

F(T) is assumed the manager's sole source of wealth. His utility function is **CRRA** (γ^m different from 1, ie not log (myopic) utility):

$$U^m(F(T)) = \frac{F(T)^{1-g^m}}{1-g^m}$$

His optimization program writes:

$$\begin{cases} \max\limits_{V^m} E^P\left[\dfrac{F(T)^{1-g^m}}{1-g^m}\right] \\ s.t. \qquad E^P\left[\Lambda(T)V^m(T)\right] \leq V(0) \\ \qquad\qquad F(T) \geq 0 \\ \qquad\qquad V^m(T) \geq 0 \end{cases}$$

(principal's initial wealth)

Budget constraint; Overall fee constraint; Solvency constraint.

Martingale approach [see Cox and Huang (1989, 1991)].

True probability measure **P**.

Problem : when suboptimal policy, martingale approach does not work : we need **stochastic dynamic programming** and Hamilton-Jacobi-Belman equation.

The manager's portfolio can be written as:

$$\frac{dV^m(t)}{V^m(t)} = \left[r(t) + \alpha(t)' \Sigma_S(t) \kappa(t) \right] dt + \alpha(t)' \Sigma_S(t) dZ(t)$$

The benchmark's dynamics writes:

$$\frac{dV^b(t)}{V^b(t)} = \left[r(t) + \Sigma_b(t)' \kappa(t) \right] dt + \Sigma_b(t)' dZ(t)$$

The value function for the CRRA investor is known to have the particular form:

$$J = \frac{F^{1-\gamma^m}}{1-\gamma^m} \exp\left\{ A + A_r r + A_\kappa' \kappa + \kappa' B_\kappa \kappa \right\}$$

Characterization of manager's optimal solution (4 terms **in principle** : **mean-variance** myopic, myopic **hedge** against benchmark fluctuations, dynamic **hedge** against fluctuations of r, dynamic **hedge** against MPRs fluctuations; cf Breeden-Merton; see Lioui-Poncet 2005)

The manager's welfare loss

Expected welfare losses expressed in percent of initial wealth, not utils.

⇒ ***3 cases : - ignores predictability stemming from both stochastic r and MPRs***

- ignores predictability stemming from stochastic r

- ignores predictability stemming from stochastic MPRs

⇒ ***Compare welfare losses in 3 cases***

⇒ ***Use simulator and Matlab to solve for set of complex differential equations***

Proposition 1:

Under a linear symmetric compensation scheme and with a CRRA utility function, the welfare loss b suffered by the manager who fails partially or totally to take into account the predictability of asset returns when choosing the managed portfolio is equal to:

$$b = 1 - [\exp\{\ldots\hat{}(t, t, g^m)\ldots\} / \exp\{\ldots(t, t, g^m)\ldots\}](1/(1- gm))$$

where t = (T-t) is the investment horizon, $k(t)$ is the column vector of the k_i(t,), and the A(.), A_{ki}(.), B_{ki} (.), and their analogues equipped with a "^", satisfy a system of ordinary differential equations.

Solution both exact and analytical

V. THE INVESTOR'S PROGRAM

$$W(T) = V^m(T) - F(T)$$
$$= (1 - \phi_f - \phi_v) V^m(T) + \phi_v V^b(T)$$

$$U^p(W(T)) = \frac{W(T)^{1-g^p}}{1-g^p}$$

Idea : plug optimal manager's wealth inside investor's program

and solve for the expectation of wealth.

Technical issue : presence of both managed and benchmark portfolios

The investor's welfare loss

Expected welfare losses expressed in percent of initial wealth, not utils.

⇒ 3 cases : - ignores predictability stemming from both stochastic r and MPRs

- ignores predictability stemming from stochastic r

- ignores predictability stemming from stochastic MPRs

⇒ Compare welfare losses in 9 (3x3) cases

⇒ Use simulator and Matlab to solve for set of even more complex differential equations

Proposition 2:

Under a linear symmetric compensation scheme and CRRA utility function, the welfare loss a suffered by the investor whose manager fails partially or totally to take into account the assumed asset return predictability when choosing the managed portfolio is such that:

α ***= 1 - [exp {…^(t, t, g^p)…} / exp {…(t, t, g^p)…}](1/(1- gp))***

where the C(.), C_r(.), C_{ki}(.), D_{ki} (.), and their analogues equipped with a "^", satisfy a system of ordinary differential equations

Solution analytical but approximate

VI. PRELIMINARY RESULTS

We find **welfare losses** to be **quite large** (see Brennan-Xia 2002, Sangvinatsos-Wachter 2005, Lioui-Poncet 2005).

Impact of risky asset volatility and of market prices of risk.

⇒ **Relative decrease** of the proportion of optimal and sub-optimal portfolios invested in the risky asset, when the assets **volatility** increases.

⇒ **Relative increase** of the proportion of optimal and sub-optimal portfolios invested in the risky asset, when the **MPR** increases.

Impact of both the investor’s and the manager’s risk aversion.

⇒ **Increasing divergence** between optimal and sub-optimal portfolios as risk aversion increases.

Impact of both the investor’s and the manager’s time horizon.

⇒ **Increasing divergence** between optimal and sub-optimal portfolios as **H** increases.

⇒ **Practical implication #1**: The fact that asset returns are partially predictable is very important and justifies neatly **portfolio delegation against a fee**.

⇒ **Practical implication #2**: Investors have under this compensation scheme an **incentive to select** those agents whose skills are reputed to fit best their investment objectives.

⇒ **Practical implication #3**: **Commonly observed benchmarks are probably sub-optimal with tangible welfare losses** for investors (see Admati-Pfleiderer (1997) in static framework).

⇒ **Practical implication #4**: and maybe **rather useless to assess actual managerial skills.**

⇒ **Practical implication #5**: If proper account of **asset return predictability** , then **delegation to talented managers makes sense** and **screening managers is both possible and useful.**