Mutual fund competition in the presence of dynamic flows

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\begin{abstract}
This paper analyzes competition between mutual funds in a multiple funds version of the model of Hugonnier and Kaniel (2010). We characterize the set of equilibria for this portfolio management game and show that there exists a unique Pareto optimal equilibrium. The main result of this paper shows that the funds cannot differentiate themselves through portfolio choice in the sense that they should offer the same risk/return tradeoff in equilibrium. This result brings theoretical support to the findings of recent empirical studies on the importance of media coverage and marketing in the mutual funds industry.
\end{abstract}

1. Introduction

In recent decades, the number of mutual funds offered to investors has grown substantially and now exceeds the number of traded assets in most exchanges (see Gruber, 1996; Massa, 1998), while an increasing number of these mutual funds are operating in the same sector. Most of the funds charge a fraction of fund fees whereby the manager receives a fixed fraction of the assets under management (see Golec, 1999; Golec & Starks, 2004), but the level of these fees varies greatly across funds (see Hortaçsu & Syverson, 2004). As a result, in any given market segment various investment vehicles are offered to the investor in the form of mutual funds which differ in their management fees and, presumably, also in their investment strategies.

The aim of this paper is to investigate if mutual funds competing on the same market can differentiate from each other through portfolio management in a world where investors can move their money in and out of mutual funds. To this end, we study a generalization of the model of Hugonnier and Kaniel (2010) with multiple mutual funds. Specifically, we consider a continuous-time economy populated by a small investor and two mutual fund managers. The small investor implicitly faces high costs that preclude her from trading directly in the equity market. These implicit costs can be related, for example, to the fact that the opportunity costs of spending her time in stock-trading related activities are high. For example, one might think that actively trading multiple risky securities requires considerably more attention than trading in one or two mutual funds. While the investor is precluded from holding equity directly, she is allowed to dynamically allocate money between the two mutual funds and a riskless asset. We impose the natural restriction that the investor cannot short the funds and assume that both funds charge fraction-of-funds fees, albeit at different rates.

To focus on the competition between the funds, while maintaining a tractable setup, we make a few simplifying assumptions. First, agents have complete information and observe the actions of each other. Second, from the perspective of the funds markets are complete. Third, the investor is assumed to have a logarithmic utility function. Fourth, the fund managers are strategic whereas the investor is not. Specifically, when the investor determines her holdings in the funds, she takes the funds’ portfolios as given. On the other hand, when a fund manager selects the portfolio of his fund, he takes into account the portfolio of the other and the investors’ reaction to the portfolios of the two funds.

\footnote{The material in this paper was presented at the Workshop on Dynamic Games and Applications, May 2–3 2008, HEC Montreal, Canada. This paper was recommended for publication under the direction of Editor Berç Rüstem. \textsuperscript{*} Corresponding author. Tel.: +1 514 340 6490; fax: +1 514 340 5634. E-mail addresses: michele.breton@hec.ca (M. Breton), julien.hugonnier@unil.ch (J. Hugonnier), tmasmoudi@lacaisse.com (T. Masmoudi).}
In order to solve for the equilibria of the game, we start by studying the investor's utility maximization problem given an arbitrary pair of fund portfolios. Since the investor has logarithmic utility, her optimal strategy depends only on the current characteristics of the funds. In this context, we show that she will invest in both funds, in only one of them or not at all depending on the relative excess returns of the funds with respect to one another. Interestingly, we show that, contrary to the monopolistic case considered in Hugonnier and Kaniel (2010), the investor may find it optimal to invest in a fund whose net-of-fees Sharpe ratio is currently negative. In other words, competition for the investor's money can lead to positive externalities between mutual funds.

In a second step, we take the investor's best response strategy as given and study the Nash game that it induces between the managers. Combining traditional optimization techniques with a change of measure argument we characterize the set of equilibria for this game and show that each of these gives rise to an equilibrium for our delegated portfolio management game. Furthermore, we show that among these equilibria there exists a unique Pareto optimal equilibrium in which the funds offer a unique Pareto optimal equilibrium in which the funds offer an arbitrary pair of fund portfolios. Since the investor has performance fees is conducted in respect to one another. Interestingly, we show that, contrary to at all depending on the relative excess returns of the fund with that she will invest in both funds, in only one of them or not. However, it is important to emphasize we are not taking a stance on whether fraction-of-fund of the funds as given. However, it is important to emphasize consider the case of a single mutual fund, and hence abstract from fees, used in the hedge fund industry, are discussed in asset pricing implications of both fulcrum fees and asymmetric setting where the manager receives an exogenous amount of performance component in their compensation contract.

2. The model

We consider a continuous-time economy with a finite horizon \( [0, T] \). The uncertainty is represented by a filtered probability space \((\Omega, \mathcal{F}, \mathbb{P}, \mathbb{F})\) on which is defined a standard \( n \)-dimensional Brownian motion represented by the column vector \( B \). The filtration \( \mathbb{F} = \{ \mathcal{F}_t : 0 \leq t \leq T \} \) is the usual augmentation of the filtration generated by the Brownian motion and we let \( \mathcal{F}_T \).

In the sequel, all processes are assumed to be adapted to \( \mathbb{F} \) and all statements involving random quantities are understood to hold either almost surely or almost everywhere. We shall also make use of the following vectorial notation: \( a' \) denotes transposition, \( \| \cdot \| \) denotes the usual Euclidean norm in \( \mathbb{R}^n \) and \( 1_k \) is a \( k \)-dimensional vector of ones.

2.1. Securities

There is a single perishable good (the numéraire) in units of which all quantities are expressed. The financial market consists of \( n + 1 \) long-lived securities. The first of these is a locally riskless asset whose price \( S_0^k \) is given by

\[ S_0^k = e^{\gamma t} \]  

for some constant interest rate \( \gamma \). The remaining \( n \) assets are risky and are referred to as the stocks. The price \( S_t^i \) of a share of the \( i \)-th stock evolves according to

\[ S_t^i = S_0^i + \int_0^t S_s^i (a_s d\sigma_s + \sigma_s d\psi dB_s). \]  

for some drift \( a_s \) and some volatility vector \( \sigma_s \in \mathbb{R}^n \) which are both assumed to be constant. We let \( a \in \mathbb{R}^n \) denote the column vector of stock drifts, \( \sigma \in \mathbb{R}^{n \times n} \) denote the square matrix obtained by stacking up the individual stock volatilities and we assume that \( \sigma \) is invertible.

The assumptions imposed on the coefficients of the model imply that the relative risk premium, or market price of risk, \( \xi := \sigma^{-1} (a - r 1_n) \) is well defined. As a result, the formula

\[ \frac{dQ}{dp_{\mathbb{F}}} = M_t := \exp \left( -\xi B_t - \frac{1}{2} \| \xi \|_2^2 t \right) \]  

defines an equivalent risk-neutral probability measure. Since the volatility matrix of the stocks is invertible this risk-neutral probability measure is uniquely defined and it follows that the financial market is dynamically complete in the absence of trading constraints.

2.2. Mutual funds

We consider two mutual funds, indexed by \( i \in \{1, 2\} \), both of which have access to the \( n + 1 \) securities described above. The management fees are assumed to be withdrawn continuously from fund \( i \) at the constant rate \( \gamma_i \) applied to the market value of the assets under management and we denote by \( \gamma = (\gamma_1, \gamma_2) \) the vector of instantaneous fee rates.

A trading strategy for fund \( i \) is a vector process \( \theta_i \) specifying the share of the fund's assets invested in each of the stocks. Given such a trading strategy, the return on investments in fund \( i \) evolves according to

\[ dF^i_t = (1 - \theta^i_1 1_n) F^i_t \frac{dS^0_t}{S^0_t} + \sum_{k=1}^n \frac{F^i_t \theta^i_k dS^k_t}{S^k_t} - \gamma_i F^i_t \, dt \]

\[ = F^i_t \left( r - \gamma_i + \psi^i_1 \xi \right) \, dt + F^i_t \psi^i_1 d\psi dB_s, \]  

where \( \psi^i_1 = \sigma^i_1 \) is the corresponding fund-volatility process. Since the volatility matrix is invertible there is a one-to-one correspondence between fund trading strategies and fund
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