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Career Concerns and Investment Maturity in Mutual Funds*

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Abstract

An important puzzle in financial economics is why fund managers invest in short-maturity assets when they could obtain larger profits in assets with longer maturity. This work provides an explanation to this fact based on labor contracts signed between institutional investors and fund managers. Using a career concern setup, we examine how the optimal contract design, in the presence of both explicit and implicit incentives, affects the fund managers decisions on investment horizons. A numerical analysis characterizes situations in which young (old) managers prefer short-maturity (long-maturity) positions. However, when including multitask analysis, we find that career concerned managers are bolder and also prefer assets with long maturity.

Key words. Contract theory; career concerns; financial equilibrium; investment maturity

Journal of Economic Literature. Classification Number: G29, J44, J24

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1 Introduction

One of the most puzzling results in financial economics is why fund managers invest in short-maturity assets even though they could obtain larger profits in assets with longer maturity.[1] This puzzle may become particularly important as long as the large recurrence of this phenomenon may eventually affect the equilibrium prices in financial markets. In this paper, we propose an explanation for this puzzling behavior based mainly upon two facts. First, during the last decades institutional investors have increased dramatically their participation in the financial system.[2] Consequently, it is reasonable to conjecture that labor contracts signed by this class of investors and their managers may play an important role as determinants of the stock prices' dynamics. Second, there is a recent evidence supporting the fact that young managers exhibit a clear bias in favor of short-maturity securities. This suggests the usefulness of considering a theoretical framework in which decisions on investment maturity may be driven by an age-based agent heterogeneity.

We combine these two facts in a career concern-based model in which the *institutional investor* (the principal) designs an optimal contract that considers both *explicit* and *implicit* incentives of two class of *funds managers* (the agents): young and old traders. While the former is a trader who cares about how the current performance affect his future compensation, the latter is a trader without career concerns. The major prediction of our model is that, under certain conditions, this optimal contract leads the young (old) managers to prefer short-maturity (long-maturity) investments. Under the career concerns set-up, the intuition behind this result is quite simple. Since the history of old traders' performance have already been revealed, the principal's prediction about their ability is better than that made when they are young. This implies that a young trader has to show good returns in the short-run in order to improve the principal's belief about his ability, and to increase both the probability of being retained and his future compensation. As a consequence, he ends up selecting short-maturity assets less profitable than the long-maturity ones.

The main implication of our model is that this investment maturity bias may eventually explain some episodes of stock price overreactions observed in practice.[3] This means therefore that our setting is able to shed light on a very relevant financial puzzle by characterizing an interesting and so far unexplored link between both the *labor market* and the *financial market.*

[1] See Chevalier and Ellison (1999).

[2] For instance, in the New York Stock Exchange, the percentage of outstanding corporate equity held by institutional investors has increased from 7,2% in 1950 to 49,8% in 2002 (NYSE Factbook 2003).

[3] See Dasgupta and Prat (2005).

Furthermore, we extend our model by performing a sensibility analysis of the results when we include both *career-risk concerns* - how the agent's current performance affects the *variability* of his future compensation - and *multitask analysis.* Under the assumption that implicit incentives are strong and the presence of an information collection effort, we observe that both young and old managers prefer to invest in long-maturity assets. In addition, both kind of traders choose the same contract when the ratio of variances of long-maturity to short-maturity assets increases. The intuition of this result is that the higher the career-risk concerns, the smaller the information collection effort level. As a consequence, the mutual fund's owner may find optimal to increase the manager's pay-for-performance sensitivity, leading young managers to adopt bolder positions in favor of securities with long maturity.

Our work is in connection with plenty of literature, both theoretical and applied one. For instance, one of the works that supports empirically the fund managers' preferences for short-maturity positions is that of Chevalier and Ellison (1999). They find that young fund managers are more risk averse in selecting their portfolios - by choosing short-maturity securities - than the old ones, even though in this way, they obtain less profits by comparison with what they could get holding more mature assets. Furthermore, their results suggest a *nonlinear* relationship between managerial turnover and mutual fund's performance. This means that for young traders the managerial turnover is more performance-sensitive than the old ones, which leads to a U-shape in the relationship between managerial turnover and trader's performance. Chevalier and Ellison explain this fact through the differences in the career concerns among them. In this way, as well as Dutta and Reichelsen (2003) and Sabac (2006), our work tries to explain theoretically this empirical evidence through the differences in the *pay-for-performance sensitivity* between young and old managers.

A large literature in economics and finance have studied the determinants of the executive compensation contracts. Nevertheless, only a minority part has focused on how the implicit incentives of the fund managers affect the design of these contracts, and through this, the investment maturity decisions. The exceptions are Gibbons and Murphy (1992), Meyer and Vickers (1997), Dutta and Reichelsen (2003), Christensen et al. (2005) and Sabac (2006). All of these works study how optimal contracts including manager's career concerns can explain the aforementioned nonlinear managerial turnover-performance relationship for young and old managers. In general, this literature analyzes dynamic settings with short-term contracts based on the career concerns model developed by Holmström (1999). For instance, Gibbons and Murphy (1992) assume that the principal's bargaining power is null, i.e. that the principal's expected surplus is zero in equilibrium. On the contrary, Meyer and Vickers (1997) develop a model in which the bargaining power is on the principal's hands, i.e. in equilibrium the agent's certainty equivalent is zero at each contracting date. Another difference between both works is that while the former shows the equivalence between short-term contracts and renegotiation-proof contracts, the latter proves that the agent's effort in equilibrium and the total surplus are independent of the bargaining power. Trying to encompass these models, Sabac (2006) characterizes the optimal short-term contract which satisfies renegotiation-proof including long-term actions, when today actions affect not only today but also tomorrow performance. Unlike all this literature, we attempt to explain how the fund manager's investment maturity decisions are determined by the design of the optimal labor contracts regarding *both* short and long-term actions.

Finally, our paper is also related to some corporate finance literature. In particular, Von Thadden (1995) constructs a dynamic model with asymmetric information between risk neutral investors and firms. Under his framework, it makes impossible to implement long-term projects which are more profitable. This work then tries to explain why some myopic lenders could induce their borrowers - an entrepreneur firm - to invest in short-term projects. However, unlike our setting, Von Thadden takes *only* into account the risk-neutral agent's *explicit* incentives but *not* his *implicit* incentives.

The paper is organized as follows. Section 2 sets up a career concern model that includes investment maturity decisions in the context of an institutional investor, and characterizes the optimal contract. Section 3 presents a numerical analysis that shows situations in which fund managers with (without) career concern prefer assets with short (long) maturity. In the next section, we examine the robustness of these results when including human capital risk and multitask analysis. Finally, Section 5 concludes and discusses other possible extensions.

2 The Model

The output performance process

Consider an agency model in which the principal is the mutual fund's owner and the agent corresponds to the trader, who for simplicity we assume that is the mutual fund manager as well. The trader works for two periods. At the begining of period 1, the trader selects his investment portfolio. That is, he invests an amount of money I. At each period t, the output performance of this process corresponds to the variation of the value of such an investments (i.e.the return) denoted by z_t. This is given by an additive formulation of the trader's ability (η), the trader's non-negative effort (a_t)

and a noise (δ_t^H), as follows

$$z_t \equiv \triangle I_t = \eta + a_t + \delta_t^H, \tag{2.1}$$

where η is normally distributed with mean m_0 and variance σ_0^2.

Similarly, we assume that the noise δ_t^H is normally distributed with mean $\mu_{\delta_t^H}$ and variance $\sigma_{\delta^H}^2$. The index H denotes the horizon of the investment so that $H = S$ ($= L$) means that the trader selects short-maturity (long-maturity) securities. Thus, the agent decides not only the effort level, but also the horizon of his investment.

Following Von Thadden (1995), we assume that the short-maturity investment gives more benefits in the first-period than the long-maturity one. However, regarding the total gains for the two periods, long-maturity assets are more profitable than short-maturity ones. Moreover, we suppose that the long-maturity investment is more risky than the short-term one. These ideas are formalized by means of the next assumptions:

(A1) $\mu_{\delta_1^S} > \mu_{\delta_1^L}$,
(A2) $\mu_{\delta_2^S} < \mu_{\delta_2^L}$,
(A3) $\mu_{\delta_1^S} + \gamma\mu_{\delta_2^S} < \mu_{\delta_1^L} + \gamma\mu_{\delta_2^L}$, and
(A4) $\sigma_{\delta^S}^2 < \sigma_{\delta^L}^2$,

where $\gamma \in (0, 1)$ represents a discount factor.

In addition, we adopt some standard assumptions in the career concerns literature. First, independence both among δ_t^H's, and with ability η, is supposed to be hold. Second, we assume that the true ability of the trader is unknown even for himself. As a consequence, the principal adjusts her beliefs on the mean and the variance of this ability based only upon the information revealed through the investment returns observed in the previous period.

The payoff functions

The trader is risk-averse with the following exponential utility function:

$$U(w_1, w_2; a_1, a_2) = -\exp(-r\left\{\sum_{t=1}^{2} \gamma^{t-1}\left[w_t - g(a_t)\right]\right\})$$

where w_t is the agent's wage, $g(.)$ measures the disutility of effort and r corresponds to the absolute risk-aversion index. We assume that $g(.)$ is convex and satisfies $g'(0) = 0$, $g'(\infty) = \infty$ and $g''' \geq 0$.

We consider two kind of agents: young traders and old traders, While the former have career concerns, the latter do not care about their future careers.

The fund's owner is risk-neutral with a profit function given by[4]

$$\pi(z_1, z_2; w_1, w_2) = \sum_{t=1}^{2} \gamma^{t-1}\left(z_t - w_t\right).$$

[4] We normalize the price of output to unity.

Type of Employment Contracts

We assume throughout the paper that all employment contracts offered by fund's owners to traders correspond to linear contracts of the form $w_t(z_t) = c_t + b_t z_t$. On the one side, c_t, the fixed part, represents the insurance wage since traders are risk-averse. On the other side, b_t, the variable component, is called the pay-for-performance sensitivity.

Within this linear formulation, we specify two different types of labor contracts: contingent and non-contingent contracts, as follows.

(1) *Contingent contract with termination after bad news* (CC). This arrangement consists of two one-period labor contracts, one for each period. However, if the first-period results are less than certain threshold $\underline{z}$, the whole contract finishes and is not renewed to the second period.[5] In this sense, it is a contingent contract because the second-period contract is exerted only under the condition $z_1 > \underline{z}$. According to this contract, the trader can only select short-maturity assets.

(2) *Non-contingent contract with continuation after bad news* (NC). This is a two-period labor contract in which no matter what happens to the first-period output. In this sense, it is non-contingent because the continuation of the contract to the second-period does not depend on the first-period results. According to this contract, the trader can only select long-maturity assets.[6]

Therefore, each labor contract allows the trader to invest in assets with different maturity. Thus, the risk-expected return profiles associated to contingent and non-contingent contracts differ. One motivation for this assumption comes from the fact that employment arrangements very similar to these two kind of contracts are observed in the real world. This is the case of institutional investors which must offer different labor contracts to its traders because they face customers with different risk-return profiles and investment horizons. Thus, while some investors looks for high returns in the short-term (who put their savings in hedge funds, money management companies, and aggressive mutual funds), others are willing to wait for larger gains in the long-term (who put their savings in insurance companies, pension fund companies, and private equity firms).

Timing of the contracting game

We assume that all the bargaining power is on agent's hands. The timing of this game depends on the type of labor contract chosen by the trader (and thereby, on the horizon investment selected by him).

[5] For instance, $\underline{z}$ could be equal zero. Thus, after bad results, the contract is not renegotiated.

[6] Gibbons and Murphy (1992) demonstrate a renegotiation proof for this kind of contracts. First, they characterize a two short-term labor contracts. Then, they construct an optimal long-term labor contract offering a different explicit incentives in each period.

In the case of contingent labor contracts, the timing is as follows. At the beginning of the first period, prospective employers simultaneously offer the trader single-period linear wage contracts $w_1(z_1)$ as defined before and he chooses the most attractive one. The trader selects a short-maturity asset and exerts a level of effort. At the end of the first period, the first-period wage is paid. At the same time, the principal and the market observe the output z_1. At the beginning of period 2, if they observe good results ($z_1 > \underline{z}$), they simultaneously offer the trader another single-period linear wage contract $w_2(z_2)$. After that, the trader exerts a new level of effort. At the end of the second period, investment returns are known, wages are paid, and the game is over. In contrast, if bad news on the first-period result are revealed ($z_1 < \underline{z}$), no new contract for the second-period is offered to him by any principal.

In the case of non-contingent labor contracts, the timing is very similar with two exceptions. First, the trader selects instead a long-maturity asset. Second, the second-period contract $w_2(z_2)$ is *always* offered no matter what happens to the investment return in the previous period.

Characterization of the Optimal Contract

Given the compensation contracts described above, the trader's expected utility is a function of the first and second period effort as follows

$$-E\left\{\exp(-r\left[c_1 + b_1 z_1 - g(a_1)\right] - r\gamma\left[c_2(z_1) + b_2 z_2 - g(a_2)\right])\right\}. \tag{2.2}$$

In order to solve this problem, consider the Subperfect Nash Equilibrium (SPNE) concept. Consequently, we apply backward induction so that we begin characterizing the second-period effort problem.

Second-period contract. The characterization of the second-period contract assumes implicitly that the second-period result is larger than the threshold $\underline{z}$ in the case of the contingent contract. From the perspective of the second-period trader, after the first-period effort a_1 and the horizon investment H have been chosen, and z_1 has been observed, his effort choice problem is given by

$$\max_{a_2} -E\left\{\exp(-r\left[c_2 + b_2 z_2 - g(a_2)\right])|z_1\right\}. \tag{2.3}$$

Hence, $a_2^*(b_2)$, the optimal second-period agent's effort choice satisfies

$$g'(a_2) = b_2 \tag{2.4}$$

Note that we assume that all the bargaining power is on the agents' hands. As a consequence, competition among prospective second-period employers implies that the contract the trader accepts for the second period must generate zero expected profits. Therefore, the principal's zero profit condition at period 2 is given by

$$\pi_2 = E\left\{z_2|z_1\right\} - \left[c_2^*(z_1, b_2) + b_2 E\left\{z_2|z_1\right\}\right] = 0. \tag{2.5}$$

Hence, and according to (2.1), the optimal fixed part of the second-period wage can be obtained using the following condition:

$$\begin{aligned} c_2(z_1, b_2) &= (1-b_2)E\{z_2|z_1\} \\ &= (1-b_2)\left[E\{\eta|z_1\} + a_2^*(b_2) + \mu_{\delta_2^H}\right] \end{aligned} \tag{2.6}$$

Using De Groot (1970), it can be stated that the conditional distribution of η given the observed first-period output z_1 is Normal with mean

$$E\{\eta|z_1\} \equiv m_1(z_1,\hat{a}_1) = \frac{\sigma_{\delta^H}^2(m_0 + \mu_{\delta_1^H}) + \sigma_0^2(z_1 - \hat{a}_1)}{\sigma_0^2 + \sigma_{\delta^H}^2} \tag{2.7}$$

and variance

$$V\{\eta|z_1\} \equiv \sigma_1^2 = \frac{\sigma_0^2\sigma_{\delta^H}^2}{\sigma_0^2 + \sigma_{\delta^H}^2}, \tag{2.8}$$

where $\hat{a}_1$ represents the market's conjecture about the first-period effort. Let $\Sigma_{z_2|z_1}^{2^H} \equiv \sigma_1^2 + \sigma_{\delta^H}^2$, the conditional variance of $\eta + \delta_2^H$ given the observed first-period output z_1.

Applying the first-order approach, we can substitute (2.4) and (2.6) into (2.3) to restate the effort choice problem. Accordingly, for an arbitrary b_2 and given the first-period output z_1, (2.3) can be rewritten as:

$$\max_{b_2} -E\{\exp(-r\left[c_2^*(z_1,b_2) + b_2 z_2 - g(a_2^*(b_2))\right])|z_1\}.$$

Using (2.7) and (2.8), this problem becomes

$$\max_{b_2} m_1(z_1,\hat{a}_1) + a_2^*(b_2) + \mu_{\delta_2^H} - g(a_2^*(b_2)) - 1/2r\left[b_2^2\Sigma_2^{2^H}\right].$$

Now, using the first order conditions of this optimization problem, we get the following expression for b_2:

$$b_2^C = \frac{1}{\left[1 + r\Sigma_{z_2|z_1}^{2^H} g''(a_2)\right]}, \tag{2.9}$$

where $C = NC$ and CC. Note from (2.9) that the second-period explicit incentives depend on the conditional variance of the second-period output $\Sigma_{z_2|z_1}^{2^H}$. This means that the pay for performance is sensitive to the type of employment contract, and thereby, to the horizon investment.

First-period contract. Now, we analyze separately contingent and non-contingent labor arrangements. We start finding out what is the optimal contract in the first case. Given the optimal second-period contract derived above, the trader's incentive problem at the first-period is to choose a_1 to maximize:

$$-E\{\exp(-r\left[c_1 + b_1 z_1 - g(a_1)\right] - r\gamma\left[c_2(z_1,b_2^*) + b_2^* z_2 - g(a_2^*(b_2^*))\right])\}. \tag{2.10}$$

From the first-order condition of this problem, we obtain

$$\begin{aligned} g'(a_1) &= b_1 + \gamma \frac{\partial c_2(z_1, b_2^*)}{\partial a_1} \\ &\equiv B_1. \end{aligned} \tag{2.11}$$

So far, we have taken $\hat{a}_1$ as given. Thus, the last expression characterizes implicitely the trader's best response to the market's second-period conjecture about the first-period effort, $\hat{a}_1$. Since equation (2.11) does not depend on $\hat{a}_1$, in equilibrium the market's conjecture coincides with the optimal first period effort. Therefore, the equilibrium conjecture is

$$\hat{a}_1 = a_1^*(b_1).$$

As was established before, the principal's expected profit must be zero in each period. Hence, we have that

$$\begin{aligned} c_1(b_1) &= (1 - b_1) E\{z_1\} \\ &= (1 - b_1)(m_0 + a_1^*(b_1) + \mu_{\delta_1^H}) \end{aligned} \tag{2.12}$$

Notice that the terms inside the two exponential functions of expression (2.10) correspond to variables normally distributed. Thus, we can apply the property of the log-normal random variables.[7] Then, substituting $a_1^*(b_1)$ and $c_1(b_1)$ into (2.10) yields the first-period trader's expected utility for an arbitrary b_1:

$$-\exp\left(-r\left[\mu_{z_1} - g(a_1^*(b_1))\right] - r\gamma\left[\mu_{z_2} - g(a_2^*(b_2))\right] - \frac{1}{2}r^2\left[(B_1 + \gamma b_2^*)^2 \Sigma_{z_1}^{2^H} - 2B_1\gamma b_2^* \sigma_{\delta^H}^2\right]\right)$$

with $\mu_{z_1} = E(z_1)$, $\mu_{z_2} = E(z_2)$ and $\Sigma_{z_1}^{2^H} = V(z_1)$. The first-order condition of this problem with respect to b_1 gives us the following expression:

$$b_1^C = \underbrace{\frac{1}{1 + r\sum_{z_1}^{2^H} g''(a_1^*(b_1))}}_{\textit{Noise reduction effect}} - \underbrace{\gamma(1 - b_2^*)\frac{\sigma_0^2}{\sigma_0^2 + \sigma_\delta^{2^H}}}_{\textit{Career concern effect}} - \underbrace{\frac{r\gamma b_2^* \sigma_0^2 g''(a_1^*(b_1))}{1 + r\sum_{z_1}^{2^H} g''(a_1^*(b_1))}}_{\textit{Career risk effect}} \tag{2.13}$$

where $C = NC, CC$.

We observe three class of effects on the pay-for-performance component: (i) a noise reduction effect, (ii) a career concerns effect, and (iii) a career risk effect. The noise reduction effect means that the higher the conditional variance of output, the smaller the variable compensation. In other words, the trader prefers less noise in the investment process. The career concerns effect reflects the substitutability between explicit and implicit incentives. Thus, the higher the career concern-based incentives measured by the second term of the r.h.s. of equation (2.13), the smaller the pay-for performance.

[7] These terms are essentially linear combinations of z_1, and z_2, which are normally distributed.

Lastly, the career risk effect formalizes the idea that a risk-averse trader wants to be compensated for high variances in his performance due to low realizations of ability.

It is worthy to note how differences in labor contracts, and so differences in investment horizons, affect this substitutability between explicit and implicit incentives. Therefore, we observe different linear wages depending on contingency or non-contingency of employment contracts, and thereby, on the maturity (long vs. short) of the assets.[8]

The relevance of the risk aversion assumption can be stated from the following simple analysis. It is easy to verify from (2.13) that under risk neutrality ($r = 0$), the first-period explicit incentives of both contingent and non-contingent labor contracts becomes

$$b_1^{*C} = 1 - \left[\gamma \left(1 - b_2^{*C} \right) \left(\frac{\sigma_0^2}{\sigma_0^2 + \sigma_{\delta^H}^2} \right) \right].$$

Since now from (2.9) $b_2^{*C} = 1$, it follows that $b_1^{*C} = 1$ for $C = CC, NC$. Therefore, this illustrates that in order to explain how the presence of these two class of contracts affects the trader´s investment horizon decision, one *must* assume risk aversion.

Old Trader's Optimal Contracts

As was mentioned before, while the young agents cares about their future career, the old ones has no such reputational concerns. We formalize this difference in our setup by assuming that ability of the old trader has already been fully revealed, and thus, its variance σ_0^2 is equal to zero. As a result, it yields the following optimal explicit incentives for old traders at the second-period

$$b_2^C = \frac{1}{\left[1 + r\sigma_{\delta^H}^2 g''(a_2) \right]},$$

and at the first-period

$$b_1^C = \frac{1}{1 + r\sigma_{\delta^H}^2 g''(a_1^*(b_1))}$$

for $C = CC, NC$. The last expression shows clearly that optimal contracts for old traders only exhibit a noise reduction effect, but neither career concern nor risk career effect come to play a role. The absence of reputational concerns then implies that all incentives are driven by the pay for performance component, and no substitutability between explicit and implicit incentives emerges.

[8] In the next section we endogeneize the career-risk concern (or human capital risk concerns), which also affects this substitutability.

3 Investment Maturity Decision: Numerical Results

The main purpose of this paper is to characterize conditions under which traders (young and old) prefer to invest in either long or short maturity assets. To this end, we perform a comparison in terms of the surplus obtained by these agents from the two class of labor contracts analized in our setting: non-contingent (NC) and contingent (CC) contracts.

Let S_Y^C and S_O^C be the surplus obtained from the labor contract C by young and old traders, respectively. Also, let us define surplus differences DY and DO as $DY = S_Y^{CC} - S_Y^{NC}$ and $DO = S_O^{CC} - S_O^{NC}$, respectively. A positive surplus difference evaluated at the optimal contract then indicates that a trader (young or old) prefers to sign a contingent employment contract instead of a non-contingent one. Equivalently, this means that he also prefers to invest in a short-maturity assets instead of a long-maturity ones.

In order to assess the trader's surplus from both labor contracts, one need to choose realistic numerical values for all model parameters. Ravin (2000) developed a set of parameter values that approximates decisions that resemble real-world investment choices by assuming a CARA utility function. The specific parameter values employed are the following.

First, we assume the following preference parameters: a risk aversion parameter $r = .05$ and a discount factor $\gamma = .9$. Second, our analysis has shown that optimal contracts (and so traders surplus differences) depend crucially on both expected return and riskiness of investments - for both long and short maturity ones -. Based upon U.S. historical data, we suppose that the long-maturity asset is normally distributed with mean return 6.4% and standard deviation 10%.[9] In contrast, we assume that the short-maturity asset follows a normal distribution with mean return 0.5% and standard deviation of 0.3%.

Given these parameters, we construct the *variance ratio* KV as follows

$$KV = \frac{\sigma^2_{\delta^L}}{\sigma^2_{\delta^S}},$$

and KM, the following *mean return ratio*

$$KM = \frac{\mu_{\delta_1^L} + \gamma\mu_{\delta_2^L}}{\mu_{\delta_1^S} + \gamma\mu_{\delta_2^S}}.$$

Since the bargaining power is on agent's hands, the trader surplus is the expected CARA utility function evaluated at the optimal contract characterized in the previous section. Table 1 shows the effects of both the variance ratio and the mean return ratio on surplus differences of old and young traders.

[9] Ravin (2000) works with a standard deviation of 20%. Our assumption is thus more conservative.

TABLE 1
Surplus difference between non-contingent and contingent labor contract

case	KM = 12	KM = 13	KM = 14
KV = 20	DY = 0.00135 DO = -0.00007	DY = 0.00110 DO = -0.00031	DY = 0.00085 DO = -0.00055
KV = 40	DY = 0.00189 DO = -0.00090	DY = 0.00165 DO = -0.00112	DY = 0.00140 DO = -0.00136
KV = 60	DY = 0.00234 DO = -0.00169	DY = 0.00209 DO = -0.00233	DY = 0.00184 DO = -0.00216

KM = ratio between long-maturity and short-maturity expected return.
KV = ratio between long-maturity and short-maturity variance.
DY=Young manager's surplus difference.
DO=Old manager's surplus difference.

We observe that under a variance ratio sufficiently high ($KV \geq 20$), young traders prefer a contingent labor contract instead of a non-contingent one. This result follows from the substitutability between explicit and implicit incentives in our model. Then, the higher the career concerns they face, the smaller the non-contingent labor contract explicit incentives. This implies that they are more conservative in their investments, and thereby, choose short-maturity assets.

Moreover, the higher the long-maturity asset variance, the higher the preference by young traders for contingent labor contracts, and so, for short-maturity assets. Since managers concern about his future job opportunities, they care about career-risk concerns. This last effect implies less non-contingent explicit incentives again. Thus, the higher the preference to invest in less risky assets.

On the contrary, since old traders do not have career concerns, they only care about explicit incentives. Thus, there is no substitutability between explicit and implicit incentives. As a result, they hold riskier assets. Furthermore, the higher the long-maturity asset variance - the higher KV -, the higher the preference for non-contingent labor contracts, and thus, for long-maturity assets.

It is important to note that these numerical results account for one of the main stylized facts described by Chevalier and Ellison (1999) for the U.S. mutual fund market. In fact, they present evidence that suggests that old managers prefer assets with longer maturity than those assets selected by the young ones. Interestingly, Chevalier and Ellison also attributes these differences in investment maturity to reputational concerns.

4 Extensions

4.1 Including Human Capital Risk

In the previous section we take into account reputation concerns, i.e. how the manager's current performance affects the level of his future compensation. However, the agent's current performance can also affect the variability of his prospective compensation, what we call career-risk concerns or human capital risk.[10] To study this effect, in this section we introduce two innovations to the baseline model: (i) different degrees of career concern, and (ii) an additional class of effort called *information effort.*

The main implication of this extension is that we can observe *complementarity* between implicit and explicit incentives instead of substitutability as we have seen before. Following Chen and Jiang (2008), we introduce a multitask analysis and generalize the last career concern setup. A numerical analysis points out that now both old and young fund managers prefer to invest assets with long maturity.

4.1.1 Degree of Career Concerns

In order to implement this extension, we introduce a correlation in the ability process. Now, the ability or productivity measure follows a normal stationary autoregressive process with one lag, i.e., AR(1). In this way, η_t is correlated over time through the next system:

$$\begin{aligned} \eta_1 &= \theta \\ \eta_2 &= \rho\theta + \sqrt{1-\rho^2}\epsilon. \end{aligned}$$

As in previous section, we assume both the principal and the agent share the common prior that θ is normal distributed with variance σ_θ. For simplicity, we assume throughout this section that $E(\theta) = m_0 = 0$. Further, ϵ is a zero mean gaussian normal process independent of θ, with variance equal to σ_θ. Therefore, η_1 and η_2 have the same unconditional variance equal to σ_θ^2.

Notice that ρ plays an important role in this process because when $\rho = 1$, we are in the baseline model in which career concerns are maximum. In addition, ρ captures the degree of persistence of the agent's career concerns since a higher ρ implies higher sensitivity of the agent's future compensation to current-period performance. Furthermore, when we model the second period as a reduced-form representation of all future periods, the career concerns parameter, ρ, captures the tenure effect. The smaller the expected tenure implies the lower correlation between the agent's ability

[10] See Mukherjee (2005) and Chen and Jiang (2004).

and the firm's future productivity. Then, by introducing $\rho \in [0,1]$ we analyze the relationship between explicit incentives and the degree of the agent's career concerns.

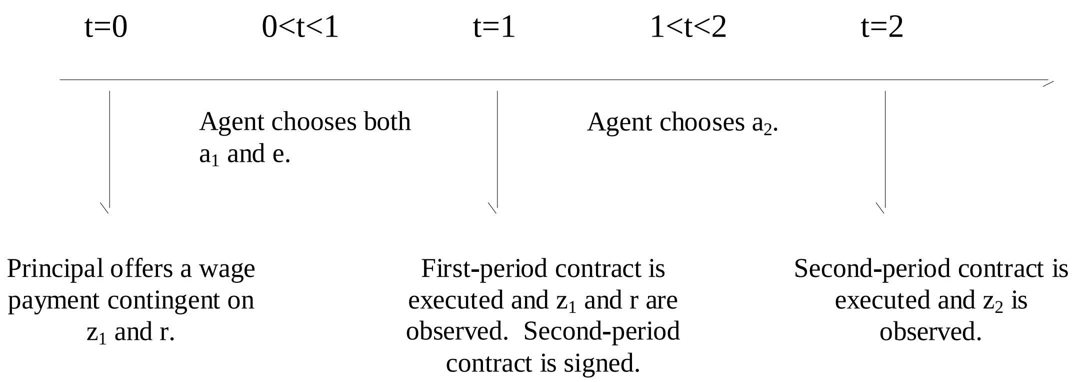
4.1.2 Multitask and Career-Risk Concerns

Following Chen and Jiang (2004), we introduce a new class of effort: *information collection effort*, $e \in [0,1]$. In this way, the trader can exert another type of effort in order to produce a publicly verifiable report, r, about his ability η. There exists some linear relationship between the report and the ability: $r = \eta_1 + \Delta$, where Δ is a zero mean normal innovation term orthogonal to η_1 with variance $\frac{(1-e)}{e}\sigma_\delta$. This variance implies that the higher information collection effort, the higher the precision of the report to forecast η_1. We assume that the principal only uses the report r for contracting goals.

As in our baseline model, we assume that the contract takes the linear form $w_t = c_t + b_t z_t + \lambda_t r$ where c_t, b_t and λ_t are constants. Notice that we introduce r as a variable that can help the principal to forecast the next period ability. In this way, the wage system can be rewritten as:

$$\begin{aligned} w_1 &= c_1 + b_1 z_1 + \lambda_1 r \\ w_2 &= c_2(r, z_1) + b_2 z_2 \end{aligned}$$

We assume that e is not contractible, i.e. it is chosen by the agent after the contract is offered to him and is non-verifiable. The timeline of this game is described by Figure 1.



In order to solve the model, we consider again the Subperfect-Nash equilibrium concept. Then, using backward induction, at the beginning of the second-period, z_1 and r are observed. Afterwards, the trader chooses a_1 and e. Finally, the principal chooses c_2 and b_2 to maximize the expected profit subject to the agent's participation and the incentive compatibility constraint. Then, the second period effort choice problem is:

$$\max_{a_2} -E\left\{\exp -r\left(w_2 - g(a_2)\right)|r, z_1\right\}.$$

Thus, $a_2^*(b_2)$ satisfies $g'(a_2) = b_2$. As in the previous section, normalizing the price of output to unity and using zero profit condition, we obtain:

$$\begin{aligned} c_2^*(z_1, r, b_2) &= (1-b_2)\,E\left\{z_2 \mid z_1, r\right\} \\ &= (1-b_2)\left[\rho E\left\{\theta \mid z_1, r\right\} + a_2^*(b_2) + \mu_{\delta_2^H}\right], \end{aligned} \tag{4.1}$$

with

$$\begin{aligned} E(\theta|z_1, r) &\equiv m_1(z_1, r, \hat{a}_1) \\ &= \frac{(1-e)\sigma_0^2(z_1 - a_1) + e\sigma_{\delta^H}^2 r + (1-e)\sigma_{\delta^H}^2 \mu_1^H}{(1-e)\sigma_0^2 + \sigma_{\delta^H}^2} \end{aligned} \tag{4.2}$$

and variance

$$\begin{aligned} V(\theta|z_1, r) &\equiv \sigma_1^2 \\ &= \frac{(1-e)\sigma_0^2\sigma_{\delta^H}^2}{(1-e)\sigma_0^2 + \sigma_{\delta^H}^2}. \end{aligned} \tag{4.3}$$

In this way, we observe how the reputation concerns, ρ, and career-risk concerns, e, affect the agent's fixed wage in the second period. Now, replacing $c_2^*(z_1, b_2)$ and $a_2^*(b_2)$ in the agent's maximization problem, we obtain

$$b_2^* = \frac{1}{\left[1 + r\Sigma_2^{2^H} g''(a_2)\right]}, \tag{4.4}$$

with $\Sigma_2^{2^H} = \sigma_1^2 + \sigma_{\delta^H}^2$. We observe a positive implicit relationship between information collection effort and second-period explicit incentives through total conditional variance.

Given the optimal second-period contract derived above, the trader's first-period incentive problem is to choose a_1 to maximize the following problem:

$$-E\left\{\exp(-r\left[c_1 + b_1 z_1 + \lambda_1 r - g(a_1)\right] - r\gamma\left[c_2^*(z_1, b_2) + b_2^* z_2 - g(a_2^*(b_2))\right])\right\}.$$

Then, we get

$$\begin{aligned} g'(a_1) &= b_1 + \gamma\frac{\partial c_2^*(z_1, b_2)}{\partial a_1} \\ &= b_1 + \gamma\left\{(1-b_2)\left[\frac{\rho(1-e)\sigma_0^2}{(1-e)\sigma_0^2 + \sigma_{\delta^H}^2}\right]\right\} \\ &\equiv B_1. \end{aligned} \tag{4.5}$$

So far we have taken $\hat{a}_1$ as given. Thus, the last expression characterizes the worker's best response to the market's second-period conjecture about first-period effort, $\hat{a}_1$. Since equation (4.5) does not depend on $\hat{a}_1$, in equilibrium, the market's conjecture coincides with the optimal first period effort.

Therefore, the equilibrium conjecture is:

$$\hat{a}_1 = a_1^*(b_1).$$

As we established before, the fund owner's expected profits must be zero in each period. Hence, assuming $a_0 = 0$,

$$\begin{aligned} c_1^*(b_1) &= (1-b_1)E\{z_1\} \\ &= (1-b_1)\left[m_0 + a_1^*(b_1) + \mu_1^H\right] + \lambda_1 E(r). \end{aligned} \tag{4.6}$$

Since $E(r) = 0$, we then obtain the same expression as our baseline model.

Substituting $a_1^*(b_1)$ and $c_1^*(b_1)$ in the first-period maximization problem yields the following first-period expected utility for an arbitrary b_1:

$$\begin{aligned} &-\exp\big(-r\left[m_0 + a_1^*(b_1) + \mu_1^H - g(a_1^*(b_1))\right] - r\gamma\left[\rho m_0 + a_2^*(b_2) + \alpha a_1^* + \mu_2^H) - g(a_2^*(b_2))\right] \\ &-(1/2)r^2\gamma\left[(B_1+\gamma b_2^*)^2\Sigma_1^{2^H} - 2B_1\gamma b_2^*\sigma_{\delta^H}^2 + (\lambda+\gamma b_2)^2\sigma_0^2 + \lambda^2\left[\frac{(1-e)}{e}\right]^2\sigma_{\delta^H}^2 - \gamma^2 b_2^2\sigma_0^2\right]\big) \end{aligned}$$

with $\Sigma_1^{2^H} = \sigma_0^2 + \sigma_{\delta^H}^2$.

From the first order condition with respect to b_1 we get

$$b_1^{*^C} = \frac{1}{1 + r\Sigma_1^{2^H} g''(a_1(b_1))} - \gamma\left(1 - b_2^{*^C}\right)\frac{\rho(1-e)\sigma_0^2}{(1-e)\sigma_0^2 + \sigma_{\delta^H}^2} - \frac{r\gamma b_2^{*^C}\sigma_0^2 g''(a_1^*(b_1))}{1 + r\Sigma_1^{2^H} g''(a_1(b_1))} \tag{4.7}$$

with $C = CC$, NC.

4.2 Numerical Analysis

To assess the trader's surplus from contingent and non-contingent labor contracts, we need to choose realistic numerical values for all model parameters. We assume λ and ρ equals to 0.5.[11] In order to observe a degree of substitutability between explicit and implicit incentives, we assume an information effort level $e = .1$. The rest of parameters are the same as in our baseline model. The following table presents the surplus difference between both class of contracts for traders with and wihout career concerns.

[11] When we only consider different levels of career concerns, we obtain the same results as in our baseline model. This means that our previous analysis is robust to intertemporal correlations in the ability process. Only when we include Chen and Jiang's modifications about different kind of effort - multitask analysis - we observe changes in our baseline model results.

TABLE 2
Surplus difference between non-contingent and contingent labor contract

case	KM = 12	KM = 13	KM = 14
KV = 20	DY = -0,11061 DO = -0,00801	DY = -0,11083 DO = -0,00825	DY = -0,11106 DO = -0,00849
KV = 40	DY = -0,11949 DO = -0,01624	DY = -0,11972 DO = -0,01647	DY = -0,11994 DO = -0,01671
KV = 60	DY = -0,12822 DO = -0,02439	DY = -0,12844 DO = -0,02463	DY = -0,12866 DO = -0,02486

KM = ratio between long-maturity and short-maturity expected return.
KV = ratio between long-maturity and short-maturity variance.
DY=Young manager's surplus difference.
DO=Old manager's surplus difference.

With degrees of career-concern and multitask analysis, we observe that both young and old managers prefer to invest in long-maturity assets, as $DO, DY < 0$. Moreover, both types of traders behave in the same way when the variance ratio increases. Thus, the higher the variance of long-maturity assets, the higher the preference to non-contingent labor contracts. The intuition of this result is that the higher the career-risk concerns, the smaller the information effort level. As a consequence, the mutual fund's owner may find optimal to increase the pay-for-performance sensitivity. All of this implies that young managers become bolder as they also follow investment strategies with long maturity.

5 Concluding Remarks

This paper addresses an important puzzle in financial economics: why fund managers invest in short-maturity assets even though they could obtain more profits by holding positions in securities with longer maturity. We provide an explanation to this phenomenon based on the labor contracts signed between institutional investors and their traders.

In particular, we examine how differences in the pay-for-performance's sensitivity of young and old traders affect their investment horizon decisions when career concerns are considered. In our framework, only young traders care about their career concerns. By analyzing the substitutability between explicit and implicit incentives contained in the optimal labor contracts, we then perform a numerical analysis showing that young (old) managers prefer short-maturity (long-maturity) positions. The higher the career concerns they face, the smaller the non-contingent labor contract explicit incentives. This implies they are not bold in their investments, and thus, they choose short-maturity assets.

The intuition behind this result is as follows. Since the history of old traders' performance have already been revealed, the principal's prediction about their ability is better than that made on the young ones. As a consequence, young traders prefer contingent labor contracts that implicitly lead them to select assets with a higher mean return in the short run. This allows young traders to improve the principal's belief about his ability, and thus, increase both the chances of being retained and his second-period compensation. However, as short-maturity assets exhibit lower mean return than long-maturity ones in the long run, we eventually have a situation in which less profitable assets are selected. Interestingly, this prediction is consistent with the recent evidence found by empirical literature focused on the U.S. mutual fund market (Chevalier and Ellison, 1999).

Furthermore, we extend our model by performing a sensibility analysis of the results when we include both *career-risk concerns* - how the agent's current performance affects the variability of his future compensation - and multitask analysis. A numerical analysis suggests that traders with and without career concerns prefer a non-contingent labor contract. The intuition of this result is that the higher the career-risk concerns, the smaller the information effort level. Then, the mutual fund's owner may find optimal to increase the manager's pay-for-performance sensitivity. As a result, young managers become eventually bolder in their investment strategies.

Some extensions of this work may take into account other aspects of the optimal contracts: switching costs when traders decide to change the job; other kind of remunerations in order to know more about the trader's ability, for instante, stock options; and so on. Furthermore, it should be considered other classes of performance process which also imply differences in the pay-for-performance sensitivity between young and old managers. For instance, the variation of investments could follow a long memory process instead of a normal stationary AR(1) process, which is more closed to the empirical works in GDP time series.[12]

[12] Mayoral (2004) presents evidence that GNP per capita follows a long-memory process.

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