ISSN 1518-3548

BANCO CENTRAL DO BRASIL

Working Paper Series 199

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December, 2009

ISSN 1518-3548
CGC 00.038.166/0001-05

Working Paper Series	Brasília	n. 199	Dec.	2009	p. 1-59

Working Paper Series

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Delegated Portfolio Management and Risk Taking Behavior[1]

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Abstract

Standard models of moral hazard predict a negative relationship between risk and incentives; however empirical studies on mutual funds present mixed results. In this paper, we propose a behavioral principal-agent model in the context of professional managers, focusing on active and passive investment strategies. Using this general framework, we evaluate how incentives affect the risk taking behavior of managers, using the standard moral hazard model as a special case; and solve the previous contradiction. Empirical evidence, based on a comprehensive world sample of 4584 mutual funds, gives support to our theoretical model.
Keywords: Agency Model, Prospect Theory, Mutual Funds.
JEL Classification: M52

[1] We would like to thank Luis Gomez-Mejia and Jose Rodrigues-Neto for very helpful comments. The paper also benefited from discussions with Magnus Dahlquist and seminar participants at the XIV Foro Finanzas in Spain, 2006, the Financial Management Association International (FMA) European conference in Stockholm, 2006; and the 2004 International Management Conference, Tehran. Peña thanks financial support from MEC grant SEJ2005-05485.
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Introduction

This study deals with a relevant financial phenomenon that occurs in several markets. There has been tremendous and persistent growth in the prominence of mutual funds and professional investors over the recent years, which is relevant for both academics and policy makers (Bank for International Settlements, 2003). Nowadays, most real world financial market participants are professional portfolio managers (traders), which means that they are not managing their own money, but rather are managing money for other people (e.g. pension funds, hedge funds, central banks, mutual funds, insurance companies)[5]. The value of the assets managed by mutual funds rose from $50 billion in 1977 to $4.5 trillion in 1997. Similarly, the assets managed by pension plans have grown from around $250 billion in 1977 to 4.2 trillion in 1997 (Cuoco and Kaniel, 2003). Considering only the United States market during the nineties, assets managed by the hedge fund industry experienced exponential growth; assets grew from about US$40 billion in the late eighties to over US$650 billion in 2003. Assets managed by mutual funds exceed those of hedge funds, as total assets managed by mutual funds are in excess of US$6.5 trillion [6](2003). US equity mutual funds had total net assets of US$ 4.4 trillion at the end of 2004 (Sensoy, 2006). Related to Central Banks, the foreign exchange reserves grew from US$ 2 trillion in 2002 to US$ 5.5 trillion in 2007[7].

The main reasons for the investor to delegate the right of investing their money to traders include: customer service (including record keeping and the ability to move money around among funds); low transaction costs; diversification; and professional management (traders task). Individual investors expect to receive better results, as they are provided a professional investment service. However, an important stylized fact of the delegated portfolio management industry is the poor performance of active funds compared to passive ones (Stracca, 2005). Fernández et al. (2007a,b) found that just 23 of 649 Spanish funds outperformed their benchmarks. Gil-Bazo and Ruiz-Verdú (2007) found that for active US funds, the ones that charge higher fees often obtained lower performance. Also, Aragon et. al (2007), considering the complete trading history of all stocks listed on the Istanbul Stock Exchange over 1999-2003 period, found no evidence

[5] Just 40% of corporate equities are held by individuals (Cuoco and Kaniel, 2003).
[6] Data provided by HedgeCo.net
[7] Data provided by IMF – International Financial Statistics

that institutions have superior information about the direction of future stock prices if compared to individuals. Thus, active management appears to subtract, rather than add value[8]. A way to justify the previous empirical evidence is to assume that the delegated portfolio management context generates an agency feature that has relevant negative consequences. As investors usually lack specialized knowledge (information asymmetry), they may evaluate the trader just based on his performance, generating early liquidation of the trader's strategy, and can lead to mispricing. This is called the "separation of capital and brains" (Shleifer and Vishny, 1997). Also, Rabin and Vayanos (2007), show that investors move assets too often in and out mutual funds, and exaggerate the value of financial information and expertise.

Despite relevant research on incentives produced in both scientific areas, management and economics, the search for integrative models has been neglected. In general, management papers usually provide good intuition and interpretation but lack a more precise methodology and often reach ambiguous results. On the other hand, economic papers are usually tied to classical rationality assumptions and just capture one side of the issue. Moreover, standard models of moral hazard predict a negative relationship between risk and incentives, but empirical work has not confirmed this prediction (Araújo, Moreira and Tsuchida, 2004).

Building on agency and prospect theory, Wiseman and Gomez-Mejia (1998) first proposed a behavioral agency model (BAM) of executive risk taking suggesting that the executive risk propensity varies across and within different forms of monitoring, and that agents may exhibit risk seeking as well as risk averse behaviors. However, this study considered only a single period model applied to the case of company CEOs.

In this study, considering BAM to the professional portfolio manager's context, and using the theory of contracts and behavior-inspired utility functions, we propose an integrative model that aims to explain the risk taking behavior of the traders with respect to active or passive investment strategies. Our focus is on relative risk taking measured against a certain benchmark. We argue that BAM can better explain the situation of professional portfolio managers, elucidating the way incentives in active or

[8] Fernandez et al. (2007) show that during the last 10 years (1997-2006), the average return of mutual funds in Spain (2.7%) was smaller than average inflation (2.9%).

passive investment strategies affect the attitudes of traders towards risk[9]. Our propositions suggest that managers in passively managed funds tend to be rewarded without an incentive fee and are risk averse. On the other hand, in actively managed funds, whether incentives reduce or increase the riskiness of the fund will depend on how hard is to outperform the benchmark. If the fund is likely to outperform the benchmark, incentives reduce the manager's risk appetite, while the opposite is true if the fund is unlikely to outperform the benchmark. Furthermore, the evaluative horizon influences the trader's risk preferences, in the sense that if traders performed poorly in a period, they tend to choose riskier investments in the following period given the same evaluative horizon. Conversely, if traders performed well in a given time period, they tend to choose more conservative investments following that period. We test our propositions in a world sample of equity mutual funds, finding supportive results.

The remainder of this paper is structured as follows. In Section 2, we first offer a brief literature review. Section 3 describes the professional portfolio manager's context and formally presents the model, positing the propositions. Section 4 provides some empirical evidence supporting the model and Section 5 concludes with a summary of the main findings.

Literature Review

The traditional finance paradigm seeks to understand financial markets using models in which agents are "rational". Barberis and Thaler (2003) suggest that rationality is a very useful and simple assumption. This means that when agents receive new information, they instantaneously update their beliefs and preferences in a coherent and normative way such that they are consistent, always choosing alternatives which maximize their expected utility. Unfortunately, this approach has been empirically challenged in explaining several financial phenomena, as demonstrated in the growing behavioral finance literature[10]. The increase in price of a stock which has been included in an Index (Harris and Gurel, 1986) and the case of the twin shares which were priced

[9] A portfolio manager decides the scale of the response to an information signal (he also decides the required effort) and so influences both the level of the risk and the portfolio returns. As pointed out in Stracca (2005), in a standard agency problem, the agent controls either the return or the variance, but not both. The previous specific characteristic offers its own challenges as the fact that the agent controls the effort and can influence risk makes it more difficult for the principal to write optimal contracts.

[10] Allias paradox and Ellsberg paradox are two well documented cases where the classical normative approach fails to describe the real individual choices.

differently (Barberis and Thaler, 2003) are examples of the empirical market anomalies found in the literature.

Agency theory has its foundations in traditional economics assuming the previous “rationality” paradigm. The perspective of a separation between ownership and management creates conflict as some decisions taken by the agent may be in his own interest and may not maximize the principal’s welfare (Jensen and Meckling, 1976). This is known as “moral-hazard”, and it is a consequence of the information asymmetry between the agent and the principal. We say that an agency relationship has arisen between two (or more) parties when one, designated as the agent, acts for the other, designated as the principal, in a particular domain of decision problems (Eisenhardt, 1989).

Related to the main assumptions, agency theory considers that humans are rationally bound, self-interested and prone to opportunism. It explores the consequences of power delegation and the costs involved in this context characterized by an agent which has much more information than the principal about the firm (information asymmetry). The delegation of decision-making power from the principal to the agent is problematic in that: (i) the interests of the principal and agent will typically diverge; (ii) the principal cannot perfectly monitor the actions of the agent without incurring any costs; and (iii) the principal cannot perfectly monitor and acquire information available to or possessed by the agent without incurring any costs. If agents could be induced to internalize the principal’s objectives with no associated costs, there would be no place for agency models (Hart and Homstrom, 1987).

Moreover, while focusing on divergent objectives that principals and agents may present, agency theory considers principals as risk neutrals in the individual actions of their firms, because they can diversify their shareholding across different companies. Formally, principals are assumed to be able to diversify the idiosyncratic risk but they still bear market risk. On the other hand, since agent employment and income are tied to one firm, they are considered risk averse in order to diminish the risk they face to their individual wealth. (Gomez-Mejia and Wiseman, 1997).

Hence, current agency literature considers that principals and agents have predefined and stable risk preferences and that risk seeking attitudes are irrational. Highlighting this fact, Grabke-Rundell and Gomez-Mejia (2002) posit that agency theorists give little consideration to the processes in which individual agents obtain their preferences and make strategic decisions for their firms. Some empirical studies have shown that people systematically violate previous risk assumptions when choosing risky investments, and depending on the situation, risk seeking attitudes may be present. This occurrence of risk seeking behavior was already identified by several studies related to choices between negative prospects, and the most prominent of these studies is that of Kahneman and Tversky (1979) which proposes the prospect theory.

In general, prospect theory[11] posits four novel concepts in the framework of individuals risk preferences: investors evaluate financial alternatives according to gains and losses and not according to final wealth (mental accounting); individuals are more averse to losses than they are attracted to gains (loss aversion); individuals are risk seeking in the domain of losses, and risk averse in the gains domain (asymmetric risk preference); and individuals evaluate extreme events in a sense of overestimating low probabilities and underestimating high probabilities (probability weighting function). In this study, we consider a behavior inspired utility function, in the framework of delegated portfolio managers, which takes into account the first three stated concepts.

Coval and Shumway (2005) found strong evidence that CBOT traders were highly loss-averse, assuming high afternoon risk to recover from morning losses. In an interesting experiment, Haigh and List (2005) used traders recruited from the CBOT and found evidence of myopic loss aversion, supporting behavioral concepts. They conclude that expected utility theory may not model professional trader behavior well, and this finding lends credence to behavioral economics and finance models as they relax inherent assumptions used in standard financial economics. Aveni (1989) in a study about organizational bankruptcy posit that creditors wish to avoid recognizing losses and thus tend to assume more risk then they would otherwise take.

Wiseman and Gomez-Mejia (1998) argue that prospect and agency theories can be understood as complementing each other for reaching better predictions of risk taking by managers. Fernandes et al. (2008), in an analysis of risk factors in forty-one international stock markets, show that tail risk is a relevant risk factor. We argue that tail risk can be associated with loss aversion and therefore the BAM offers more fruitful results in the professional managers' context.

[11] And in its latter version (Tversky and Kahneman, 1992) known as cumulative prospect theory.

Now, we will comment on the main criticism received by this approach. Traditional rational theorists believe that: (i) people, through repetition, will learn their way out of biases; (ii) experts in a field, such as traders in an investment institution, will make fewer errors; and (iii) with more powerful incentives, the effects will disappear. While all these factors can attenuate biases to some extent, there is little evidence that they can be completely eliminated[12]**.** Thaler (2000) suggests that "homo economicus" will become a slower learner due to the greater weight to the role of environmental factors, such as the difficulty of the task and the frequency of feedback[13]. In this paper, we address the argument of incentives (iii), showing that in some cases, compensation contracts may even induce risk seeking attitudes.

As noted by Hart and Holmstrom (1987), underlying each agent model is an incentive problem caused by some form of asymmetric information. The literature on incentives and compensation contracts is very extensive, both on theoretical and empirical studies. Among them there is a consensus about the usefulness of piece-rate contracts in order to increase productivity[14]. In our study, we approach the professional portfolio manager's setting considering a widely used piece-rate contract.

Baker (2000) concludes that most real-world incentive contracts pay people on the basis of risky and distorted performance measures. This is powerful evidence that developing riskless and undistorted performance measures is a costly activity. We extend the previous argument showing that the use of risky performance measures might be in the interest of companies to induce risk seeking behavior of the agent.

Araujo, Moreira and Tsuchida (2004) discuss the negative relationship between risk and incentives, predicted by conventional theory but not verified by empirical studies. They propose a model with adverse selection followed by a moral hazard, where the effort and degree of risk aversion is the private information of an agent who

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[12] Behavioral literature suggests two types of biases: cognitive and emotional. Cognitive biases (representativeness, anchorism, etc) are related to misunderstanding and lack of information about the prospect, and can be mitigated through learning. On the other hand, emotional biases (loss aversion, asymmetric risk taking behavior, etc) are human intrinsic reactions and may not be moderated.

[13] Thaler (2000) posits that in life, each day is different, and the most important of life's decisions, such as choosing a career or spouse, offer only a few chances for learning.

[14] Lazear (2000a), analyzing a data set for the Safelite Glass Corporation found that productivity increased by 44% as the company adopted a piece-rate compensation scheme. Bandiera, Barankay and Ransul (2004) found that productivity is at least 50% higher under piece rates, considering the personnel data from a UK soft fruit farm for the 2002 season. Lazear (2000b) stresses that the main reason to use piece-rate contracts is to provide better incentives when the workforce is heterogeneous.

can control the mean and the variance of profits, and conclude that more risk adverse agents provide more effort in risk reduction.

Palomino and Prat (2002) develop a general model of delegated portfolio management, where the risk neutral agent can control the riskiness of the portfolio. They show that the optimal contract is simply a bonus contract. In an empirical study, Kouwenberg and Ziemba (2004) evaluate incentives and risk taking in hedge funds, finding that returns of hedge funds with incentive fees are not significantly more risky than the returns of funds without such a compensation contract.

Our approach is distinguished from the previous approaches as we consider changes in risk preference of the agents depending on how they frame their optimization problem rather than assuming risk aversion or risk neutrality from the beginning. Agents are still considered to be value maximizers, but we are using behavior-inspired utility functions, based on prospect theory. We also focus on relative risk measured against a certain benchmark (tracking error), instead of total risk, as this is the relevant variable of interest for individual investors to decide whether to put their money in passive or active funds.

The key element to apply prospect theory to our context is to identify what the trader perceives as a loss or a gain, in other words, to determine what their reference point should be. In the mutual funds industry, benchmarks are widely used and are published in their prospects. It is safe to assume the return of the benchmark as the trader's reference point. If he can anticipate a negative frame problem, his loss aversion behavior will lead him to go on riskier actions in order to avoid his losses even if there are other less risky alternatives which could minimize the loss. This is based on a behavioral effect called "escalation of commitment". The intuition is that, due to the convex shape of the value function in the range of losses, risk seeking behavior will prevail in the case of prior losses.

Daido and Itoh (2005) propose an agency model with reference-dependent preferences to explain the Pygmalion effect (if a supervisor thinks her subordinates will succeed, they are more likely to succeed) and the Galatea effect (if a person thinks he will succeed, he is more likely to succeed). They show that the agent with high expectations about his performance can be induced to choose a high effort with low-powered incentives. Empirical evidence of the escalation situation can be found in Odean (1998) and Weber and Camerer (1998). They found that investors sell stocks that trade above the purchase price (winners) relatively more often than stocks that trade below the purchase price (losers). Both papers interpreted this behavior as evidence of decreased risk aversion after a loss and increased risk aversion after a gain.

The Decision Making Model

We consider professional portfolio managers to be traders who are responsible for managing the financial resources of others who work for financial institutions such as: pension funds, mutual funds, insurance companies, banks, and central banks. Their jobs consist of investing financial resources, selecting assets (e.g. stocks, bonds), and often using an index as a reference. Despite high competition in financial markets, we argue that traders, as any human beings, are continuously dealing with their own emotional biases which make their attitudes toward risk different depending on how they frame the situation they face.

A characteristic that can affect trader behavior is if the funds they manage have a passive or active investment strategy. Under active management, securities in the portfolio and other potential securities are regularly evaluated in order to find specific investment opportunities. Managers make buy/sell decisions based on current and projected future performance. This strategy, while tending toward more volatile earnings and transaction costs, may provide above-average returns. In this case, traders must be much more specialized because results are directly related to how they choose among different assets and allocate the resources of the fund in order to obtain better profits.

On the other hand, in the passive strategy, the portfolio is settled to follow a predetermined index, such as the S&P500 or the FTSE100, with the idea of mimicking market performance (tracking the index). Traders are much more worried about constructing a portfolio similar to the index than in trying to find investment opportunities. In this situation, a trader’s activity can be specified in advance as it consists of allocating the resources closely to a predetermined public index, and then it is much more programmable and predictable, which raises the possibility for better control. This strategy requires less administrative costs, tends to avoid under-market returns and lessens transaction costs. However, because of their commitment to maintaining an exogenously determined portfolio, managers of these funds generally retain stocks, regardless of their individual performance.

The approach suggested by Eisenhardt (1985) yields task programmability, information systems, and uncertainty as determinants of control strategy (outcome or behavior based). Outcome-based contracts transfer risk from the principal to the agent and it is viewed as a way of mitigating the agency costs involved. But this rewarding package has a side effect, as appropriate behaviors can lead to good or bad outcomes. It is a very complex problem to isolate the effect of the specific agent's behavior on the outcome, especially in businesses with high risk. Contingent pay will be more effective in motivating agents when outcomes can be controlled or influenced by them. Bloom and Milkovich (1998) posit that higher levels of business risk not only make it more difficult for principals to determine what actions agents take, but also make it more difficult for principals to determine what actions agents should take.

In line with the agency literature (Holmstrom and Milgrom, 1987; 1991), we model the interaction between a risk neutral, profit maximizer principal and a value-maximizing agent in a competitive market. The principal delegates the management of his funds to the agent, whose efforts can affect the probability distribution of the portfolio excess return - differential return for a given portfolio, relative to a certain benchmark[15], $x = x_p - x_b \rightarrow N\left(\mu(t), \sigma^2(t)\right)$. The agent's task is related to obtaining information about expected returns and defining portfolio strategies. The agent chooses an effort level "*t*" incurring in a personal cost *C(t)*. We consider the general differential assumptions for *C(t)*: *C'(t) > 0* and *C''(t) > 0*. Also, let's call C_0 the agent's minimum cost of effort required to follow a passive strategy and just replicate the benchmark[16]. Consider:

$$C(t) = C_0 + \frac{t^2}{2} \qquad (1)^{17}$$

And, the portfolio excess return is given by:

$$x = \mu(t) + \varepsilon(t) \qquad (2)$$

[15] x_p is the portfolio return and x_b is the return of the benchmark.

[16] This cost is related to the index tracking activity and can be estimated considering the ETF's (Exchange Traded Funds) total management fee.

[17] The expression of the cost of effort is slightly different for the multi task case presented latter in the paper.

where $\mu(t)$ is concave and increasing, referring to the part of the return due to his level effort *(t)*. Also take $\varepsilon(t) \sim N(0, \sigma^2(t))$. In order to simplify, we assume that the performance of the trader has a linear relationship with his efforts plus a random variable, so that: $\mu(t) = \mu t$, and then:

$$x = \mu t + \varepsilon(t) \qquad (3)$$

Moreover, the timing of the proposed principal-agent game is: (i) the principal proposes a contract to the agent; (ii) the agent may or may not accept the contract, and if he accepts, he receives an amount of funds to invest; (iii) the reference point of the agent is defined; (iv) the agent chooses the level of effort (related to his personal investment strategy) to spend; (v) the outcome of the investment is realized and the principal pays the agent using part of the benefits generated by the chosen strategy and keeps the remaining return.[18]

In this case the certainty equivalent of the agent's utility, as proposed in Holmstrom and Milgrom (1991), can be given by:

$$CE_a = E[w(x)] - C(t) + \frac{1}{2}\sigma(t)^2 \alpha^2 \frac{v''(x)}{v'(x)} \qquad (4)$$

where E[w(x)] is the expected wage of the trader, considered as a function of the information signal (excess return), α is the performance pay factor, and $v(x)$ is the trader's value function, which depends on x, the agent's perceived gain or loss related to his reference point (benchmark). In the previous model, $w(x) = \alpha x + \beta = \alpha\mu t + \alpha\varepsilon(t) + \beta$, and so $Var[w(x)] = \alpha^2 \sigma(t)^2$.

The value function was proposed in the prospect theory of Kahneman and Tversky (1979) and is an adaptation of the standard utility function in the case of the behavior approach. The ratio $\frac{v''(\mu)}{v'(\mu)}$ is the coefficient of absolute risk aversion. For a risk averse agent, this ratio is negative and the certainty equivalent is less than the expected value of the gamble as he prefers to reduce uncertainty. This is the origin of the negative relationship between risk and incentives in moral hazard models.

[18] It's important to highlight that this timing is appropriate in the institutional investor's framework. For the case of individual investor's, the fund usually offer a pre-specified product for the individual, and the later has little power to influence in it.

Let t^* denote the agent's optimal choice of effort, given α. Note that t^* is independent of β. The resulting indirect utility is given by: $V(\alpha,\beta)=\beta+v(\alpha)$, where $v(\alpha)=\alpha\mu(t^*)-C(t^*)+\frac{1}{2}\alpha^2\frac{v''(x)}{v'(x)}\sigma(t^*)^2$ is the non-linear term. The marginal utility of incentives can then be derived:

$$\frac{\partial v}{\partial \alpha}=v_\alpha=\mu(t^*)+\alpha\frac{v''(x)}{v'(x)}\sigma(t^*)^2 \qquad (5)$$

and if we were considering risk averse agents, it would represent the mean of the excess profits minus the marginal risk premium.

The effort of the agent leads to an expected benefits function *B(t)* which accrues directly to the principal. Let's consider *B(t)* = x_b + x. The principal's expected profit (which equals certainty equivalent as he is risk neutral) is given by:

$$CE_p=B(t)-E[w(x)] \qquad (6)$$

Hence the total certainty equivalent (our measure of total surplus) is:

$$TCE=CE_a+CE_p=x_b+x-C_0-\frac{t^2}{2}+\frac{1}{2}\alpha^2\frac{v''(x)}{v'(x)}\sigma(t)^2 \qquad (7)$$

The optimal contract is the one that maximizes this total surplus subject to the agent's participation constraint ($CE_a \geq 0$). Adapting the previous model to the professional manager's case and considering mental accounting, loss aversion and asymmetric risk taking behavior, we assume the value function as follows:

$$v(x)=\begin{cases}1-e^{-rx}, & \text{if} \quad x\geq 0\\ \lambda e^{rx}-\lambda, & \text{if} \quad x<0\end{cases} \qquad (8)$$

where r is the coefficient of absolute risk preference, λ is the loss aversion factor which makes the value function steeper in the negative side; and x is the perceived gain or loss, rather than final states of welfare, as proposed by Kahneman and Tversky (1979). It is useful to consider the previous form for the value function because of the existence of a CAPM equilibrium (Giorgi et al., 2004) and because we reach constant coefficients of risk preference. The following graph indicates $v(x)$ when r = 0.88 and λ = 2.25 (using values suggested by Kahneman and Tversky).

Insert Figure 1 about here

We assume a general symmetric compensation contract applied to the situation presented in this paper. Starks (1987) shows that the "symmetric" contract, while it does not necessarily eliminate agency costs, dominates the convex (bonus) contract in aligning the manager's interests with those of the investor. Also, Grinblatt and Titman (1989) posit that penalties for poor performance should be at least as severe as the rewards for good performance[19].

$$w(x) = \alpha x + \beta \qquad (9)$$

This indicates that the agent is paid a base salary β plus an incentive fee calculated as a proportion α of the total excess return of the fund (the performance indicator) compared to a certain benchmark. The previous contract arrangement follows the optimal compensation scheme defined in Holmstrom and Milgrom (1987), and was also used in Carpenter (2000). Lazear (2000b) argues that continuous and variable pay is appropriate in case of worker heterogeneity as in the case of professional portfolio managers. Finally, let's call ψ the probability that the fund outperforms the benchmark and (1 – ψ) the likelihood that it performs poorly. So, we can re-write the TCE, CE_a and CE_p as follows:

$$TCE = \psi\left(x_b + x - C_0 - \frac{t^2}{2} - \frac{1}{2}\alpha^2 r\sigma(t)^2 \right) + (1-\psi)\left(x_b + x - C_0 - \frac{t^2}{2} + \frac{1}{2}\alpha^2 r\lambda\sigma(t)^2 \right) \qquad (10)$$

$$CE_a = \psi\left(\alpha x + \beta - C_0 - \frac{t^2}{2} - \frac{1}{2}\alpha^2 r\sigma(t)^2 \right) + (1-\psi)\left(\alpha x + \beta - C_0 - \frac{t^2}{2} + \frac{1}{2}\alpha^2 r\lambda\sigma(t)^2 \right) \qquad (11)$$

$$CE_p = x_b + (1-\alpha)x - \beta \qquad (12)$$

[19] In 1970, US Congress amended the Investment Advisors Act of 1940 allowing contracts with registered investment companies to specify compensation based on performance, provided that it is of the "fulcrum" type, that is, provided that it includes penalties for underperforming a given benchmark that are symmetric to the bonuses for exceeding it.

The Case of Passive Funds

Investors in passive funds have expectations of receiving average market returns ($E(x_p) = E(x_b)$ and $E(x) = 0$), and trader actions are limited and tied in relation to the process of buying and selling assets to adjust stock weights in the portfolio in order to follow the benchmark. The agent's task is more programmable and his behavior is easy to monitor ("*t*" is observable by the principal). As the principal has no interest that the agent goes on riskier strategies than that of the benchmark, he should set $\alpha = 0$. Thus, the certainty equivalent of the agent would be given by:

$$CE_a = \psi\left(\beta - C_0 - \frac{t^2}{2}\right) + (1-\psi)\left(\beta - C_0 - \frac{t^2}{2}\right) \qquad (13)$$

which implies that $t^* = 0$. Optimally, the agent will make no effort to beat the benchmark. An important aspect considered in this paper is the competitive situation in the market of professional portfolio managers, which is of crucial importance in determining who extracts the surplus from the agency contract. We considered, as it is usual in the delegated portfolio managers' literature, a perfect competition among agents with the entire surplus accrued to the principal. This situation implies that: $CE_a = 0$ and $\beta = C_0$. The certainty equivalent of the principal would be given by: $CE_p = x_b - C_0$.

The principal pays the agent a base salary which is equal to the agent's cost of effort to ensure the investor receives the return of the benchmark (say the agent's choice of effort represents the minimum level needed to replicate the benchmark portfolio). Moreover, if the agent chooses a level of effort different from C_0, the performance of the fund will not be tied to the performance of the benchmark and so $\sigma^2(x) > 0$ (increased the risk). If the agent just receives the base salary alone, he doesn't have any incentive to choose a level of effort different from C_0 and so performs in a risk averse way. Also, because of employment risk, managers tend to decrease risk in order to prevent potential job loss (Kempf et al, 2007).

In this incentive scheme, there's no risk premium associated with the agent's decisions. Recall that in this case t is observable, and then if the trader chooses $t \neq 0$, the investor will notice and just fire him. Finally, in this case, there is no reason for using incentive fees, as the trader is not responsible for the earnings of the fund, which should be equal to the performance of the benchmark. Observe that the previous result is robust for different levels of risk preference as it is independent of the value function of the agent, regardless of whether he is risk averse or risk seeking. Summing up, we can construct the following table:

Insert Table 1 about here

Proposition One: Traders in passively managed funds tend to be rewarded with a base salary (α = 0).

Proposition Two: Traders in passively managed funds are more likely to perform as risk adverse agents (t = 0).

In practice, funds charge their clients a management fee, which they use to cover their operational costs and compensate their traders. We expect to find that in the case of passive funds, the management fee might be lower when compared to active funds, as there's no need for variable pay to compensate their traders.

The Case of Active Funds

In the case of an active fund, investors are usually expecting to receive above-average risk adjusted returns as they consider it linked to the expertise of the traders. The trader has to make investment decisions, and a great number of these decisions are based on his own point of view of the market, raising a relevant problem of information asymmetry (moral hazard). In this case, the first best results are no longer feasible and outcome-based rewards are often used as part of their contracts and the agent is stimulated to go on risky alternatives in order to reach above-average returns. Hence, the idea of the contract is to reduce objective incongruence between the principal (investor) and agent (trader), and to transfer risk to the agent.

We now examine two cases. In the single task case, the agent's effort affects only the mean of the excess return. In the multitask case, the agent's effort influences both the expected return and the risk of the portfolio.

Single task

We first analyze the case in which the agent's effort controls only the mean of the excess profits and so the risk is exogenous: $\sigma^2(t) = \sigma^2$. Consider a loss averse agent with a value function given by (Eq. 08). The main point in applying prospect utility is to define the reference point by which the manager measures his gains and losses. It seems reasonable in the funds industry to assume the returns of the public benchmark published by the fund as a reference point, since it is the one used by individual investors when deciding which fund to invest in. Thus, the total certainty equivalent would be given by:

$$TCE = \psi\left(x_b + \mu t - C_0 - \frac{t^2}{2} - \frac{1}{2}\alpha^2 r\sigma^2 \right) + (1-\psi)\left(x_b + \mu t - C_0 - \frac{t^2}{2} + \frac{1}{2}\alpha^2 r\lambda\sigma^2 \right)$$

.(14)

Taking into account the agent's maximization problem, we reach the following results:

$$\max_{t_a}\left[CE_{aA}\right] = \psi\left(\alpha\mu t + \beta - C_0 - \frac{t^2}{2} - \frac{1}{2}\alpha^2 r\sigma^2 \right) + (1-\psi)\left(\alpha\mu t + \beta - C_0 - \frac{t^2}{2} + \frac{1}{2}\alpha^2 r\lambda\sigma^2 \right)$$

(15)

so, $t^* = \alpha\mu$ and $C(t^*) = C_0 + \frac{t^*}{2}$. As expected, efforts in outperforming the benchmark increases with incentives. The agent's marginal utility of incentives is given by:

$$v_\alpha = \alpha\mu^2 - \alpha r\sigma^2(\psi - (1-\psi)\lambda) \qquad (16)$$

So the effect of incentives on the agent's utility will depend on whether the benchmark is likely to be outperformed. Suppose that the fund can easily outperform the benchmark. In this case, the probability that the return of the fund is greater than the benchmark, ψ, is close to one and $\mu > 0$. Then, $v_\alpha = \alpha\mu^2 - \alpha r\sigma^2$, which is the usual solution found by moral hazard models. This implies that an increase in incentives has both positive and negative effects on the utility of the agent. The positive effect results from the share of the positive excess return, and the negative effect comes from the increased risk of the wage. Finally, when we maximize the total surplus:

$$\max_t TCE = \psi\left(x_b + \mu t - C_0 - \frac{t^2}{2} - \frac{1}{2}\alpha^2 r\sigma^2 \right) + (1-\psi)\left(x_b + \mu t - C_0 - \frac{t^2}{2} + \frac{1}{2}\alpha^2 r\lambda\sigma^2 \right)$$

$$\frac{\partial TCE}{\partial t} = \mu - \alpha\mu + \frac{(1-\psi)\alpha\lambda r\sigma^2}{\mu} - \frac{\psi\alpha r\sigma^2}{\mu} = 0$$

then

$$\alpha = \frac{\mu^2}{\mu^2 + \sigma^2 r[\psi - (1-\psi)\lambda]} \qquad (17)$$

So the relationship between risk and return is ambiguous, depending on how likely it is to outperform the benchmark. As previous experiments have shown that the value for λ is around 2 (Kahneman and Tversky, 1979) if ψ is higher than 67%, then a negative relationship between risk and incentives is predicted by the model. However, as we decrease ψ, a positive relation between risk and return appears.

If we consider a benchmark that is easy to be outperformed, then ψ approaches 1 and so

$$\alpha = \frac{\mu^2}{\mu^2 + \sigma^2 r} \qquad (18)$$

and therefore, increases in σ^2 and r imply decreases in α. The previous negative relationship between risk (σ^2) and incentives (α) is the usual standard result obtained by moral hazard models. However our model generalizes this, and the previous result is simply a special case. If we consider a benchmark that is difficult to outperform, then ψ approaches 0 and so

$$\alpha = \frac{\mu^2}{\mu^2 - \sigma^2 r\lambda} \qquad (19)$$

and, therefore, increases in σ^2 and r imply increases in α. Some empirical papers have found previous positive relationships between risk and return (Sensoy, 2006).

Recall that σ^2 in our model represents a variance in the differential portfolio which uses the benchmark as its reference (tracking error). The performance of the benchmark x_B and the performance of the chosen portfolio x_P are respectively given by:

$$x_B = E(x_B) + \varepsilon_B \ , \quad \text{with } \varepsilon_B \sim N(0, \sigma_B^2)$$

$$x_P = E(x_P) + \varepsilon_P, \quad \text{with } \varepsilon_P \sim N(0, \sigma_P^2)$$

Also we consider that the expected return of the benchmark is normalized to zero $\{E(x_B) = 0\}$ and the expected return of the portfolio is a function of the agent's choice of effort $\{E(x_P) = \mu t\}$. Therefore, the return of the differential portfolio is given by:

$$\left(x_P - x_B\right) = \mu t + (\varepsilon_P - \varepsilon_B)$$

then

$$\left(x_P - x_B\right) \sim \mathrm{N}\left(\mu t, \sigma_{\mathrm{B}}^2 + \sigma_{\mathrm{P}}^2 - 2\rho\sigma_B\sigma_{\mathrm{P}}\right)$$

so

$$\sigma_{\mathrm{B}}^2 + \sigma_{\mathrm{P}}^2 - 2\rho\sigma_B\sigma_{\mathrm{P}} = 2\sigma_{\mathrm{P}}^2(1-\rho) \qquad (20)$$

Finally, consider the simplified assumption that $\sigma_{\mathrm{B}}^2 = \sigma_{\mathrm{P}}^2$ (*i.e.* the total risk of the portfolio selected by the manager is the same as the total risk of the benchmark portfolio, so based on portfolio theory, both portfolios should be equivalent in terms of risk/return trade-off), where ρ is the correlation coefficient between the chosen portfolio and the benchmark. Therefore, α can be rewritten as:

$$\alpha = \frac{\mu^2}{\mu^2 + 2\sigma_{\mathrm{P}}^2(1-\rho)r\left[\psi - (1-\psi)\lambda\right]} \qquad (21)$$

which suggests that increases in α imply increases in $\sigma_{\mathrm{P}}^2(1-\rho^2)$, and also implies a decreasing correlation (ρ), for low values of ψ. Thus, using the benchmark as a filter reduces uncontrollable risk by (1 – ρ). If the agent just reproduces the benchmark (passive strategy), the correlation is equal to 1 (perfect correlation), all risk can be filtered out, and the first best can be achieved. Because of the agency problem, we see that the agent's choice will depend on the degree of idiosyncratic risk associated with his contract, as measured by $\sigma_{\mathrm{P}}^2(1-\rho)$. Unlike standard portfolio theory (Markowitz, 1952), idiosyncratic risk will play a role in incentive schemes.

Proposition Three: Traders in actively managed funds tend to be rewarded in incentive-base pay (α > 0).

Proposition Four: The relationship between incentives and risk can either be positive or negative depending on the likelihood ψ of outperforming the benchmark. High (low) values of ψ imply a negative (positive) relationship.

Insert Table 2 about here

Multi task

We now introduce the possibility that the agent can also influence the risk of the portfolio's excess return. Let t_μ and t_σ be the effort in mean increase and in variance reduction. We assume the cost is quadratic and separable: $C(t) = C_0 + \frac{t_\mu^2}{2} + \frac{t_\sigma^2}{2}$. Also, let $\mu(t) = \mu t_\mu$ and $\sigma^2(t) = (\sigma_0 - t_\sigma)^2$, where the exogenous variance σ_0^2 is the variance of the excess return when no effort is provided to change it. Taking into account the agent's maximization problem, we reach the following results:

$$\max_{t_\mu, t_\sigma}[CE_{aA}] = \psi\left(\alpha\mu t_\mu + \beta - C_0 - \frac{t_\mu^2}{2} - \frac{t_\sigma^2}{2} - \frac{1}{2}\alpha^2 r(\sigma_0 - t_\sigma)^2\right)$$
$$+ (1-\psi)\left(\alpha\mu t_\mu + \beta - C_0 - \frac{t_\mu^2}{2} - \frac{t_\sigma^2}{2} + \frac{1}{2}\alpha^2 r\lambda(\sigma_0 - t_\sigma)^2\right)$$

so, $t_\mu^* = \alpha\mu$ and $t_\sigma^* = \frac{\alpha^2 r(\psi - (1-\psi)\lambda)}{1 + \alpha^2 r(\psi - (1-\psi)\lambda)}\sigma_0$. As expected, efforts to outperform the benchmark increase with incentives. The endogenous variance is then given by:

$$\sigma^2(t) = \left(\frac{1}{1 + \alpha^2 r(\psi - (1-\psi)\lambda)}\right)^2 \sigma_0^2 \qquad (22)$$

which implies that endogenous risk can be lower or greater than exogenous risk depending on whether the agent is framing a gain or loss situation. If the benchmark is easily outperformed, ψ approaches 1 and $\sigma^2(t) = \left(\frac{1}{1+\alpha^2 r}\right)^2 \sigma_0^2$, and so endogenous risk and incentives are negatively related. On the other hand, if the agent is framing a loss situation, the endogenous risk would be given by $\sigma^2(t) = \left(\frac{1}{1-\alpha^2 r\lambda}\right)^2 \sigma_0^2$, and a positive relationship between risk and incentives is predicted.

Summing up, our model predicts that when the fund manager is facing a situation of high likelihood to outperform the benchmark, he will frame the portfolio construction problem in the gain domain, and will act in a risk averse way, and incentives will stimulate him to exert efforts to reduce risk and improve the expected excess return. Incentives are lower in riskier portfolios. On the other hand, when he is facing a situation of low likelihood to outperform the benchmark, the agent is likely to frame the investment problem in the loss domain, and incentives will make him look for riskier alternatives. Incentives are higher in riskier portfolios.

Multi-period analysis

In this section, we discuss the effect of previous outcomes in the future risk appetite of the agent. Wright, Kroll and Elenkov (2002) posit that institutional owners exerted a significant positive influence on risk taking in the presence of growth opportunities. Gruber (1996) showed that in the American economy, actively managed funds assumed greater risk, but reached lower average returns compared to passively managed funds.

Hence, in some sense, we have the investment strategy and the contract arrangements disciplining the risk taking behavior of the agent. However we are aware that the trader's cognitive biases moderate this relationship. In this study, we do not deal with the way these biases moderate the relationship as a deeper psychological analysis of the trader in his context is required, and we also assume that cognitive biases can be moderated.

Going further in the analysis of the relationship with risk-return, we can apply Miller and Bromiley´s (1990) multiperiod approach to the professional investor environment, taking into account the evaluative period. We assume that a company has a target performance level which for instance corresponds to the performance of a chosen index and the firm provides a report annually to the investors. Investors and traders are likely to consider this target as the reference point for gain/loss analysis.

Supposing that in the first semester, this company performed poorly and so the likelihood of outperforming the benchmark is lower, the loss aversion of the agent will make him choose risky projects in the second semester hoping to convert losses into gains until the end of the year. On the other hand if the company performed well in the first period, the agent will only accept an increase in risk if the investment opportunity offers high expected returns. In this case, the trader tends to reduce his relative risk exposure and follow the index in the second semester in order to guarantee the return obtained in the previous period. This is based on a behavioral effect called "escalation of commitment". In other words, if the fund performed well in the first period, the likelihood of outperforming the benchmark is higher (greater ψ) and the trader is more likely to perform in a risk averse way (gain domain). Weber and Zuchel (2003) found that subjects in the "portfolio treatment" take significantly greater risks following a loss than a gain.

Deephouse and Wiseman (2000) found supportive evidence to these risk-return relationships in a large sample of US manufacturing firms. Odean (1998) and Weber and Camerer (1998) provide empirical evidence of the escalation situation; these studies found that investors sell stocks that trade above the purchase price (winners) relatively more often than stocks that trade below purchase price (losers). Both works interpreted this behavior as evidence of decreased risk aversion after a loss and increased risk aversion after a gain. Chevalier and Ellison (1997) also found supportive empirical evidence that an agent with a low interim result is tempted to look for high-risk investments.

> *Proposition Five: If traders performed (well) poorly in a period, they tend to choose (less risky) riskier investments in the following period, considering both in the same evaluative horizon.*

Basak et al. (2003) state that as the year-end approaches, when the fund's year-to-date return is sufficiently high, fund managers set strategies to closely mimic the benchmark; however they argue that this is because of the convexities in the manager's objectives. We extend this approach, stating that the previous proposition is a direct consequence of the individual behavior inspired utility function.

Asymmetric contract

Despite the fact that most mutual funds adopt a symmetric compensation contract, there are a few which use asymmetric option-based contract as follows:

$$w(x) = \begin{cases} (\alpha+\gamma)x+\beta & ,\text{if } x \geq 0 \\ \alpha x+\beta & ,\text{if } x < 0 \end{cases} \qquad (23)$$

where γ is usually called the performance fee. If we considered an incentive scheme, as defined in Eq. 23, the main conclusions of our model would remain with the expression (21) now given by:

$$\alpha = \frac{\mu^2(1-\psi\gamma)-\psi\gamma r\sigma^2}{\mu^2+\sigma^2 r\left[\psi-(1-\psi)\lambda\right]} \qquad (24)$$

As can be seen, the only effect of γ would be to increase the negative relation between incentives and risk, in the case of an easy to be outperformed benchmark. If the benchmark is difficult to outperform, the performance fee has no effect. Probably due to its diminished effect on risk, the performance fee is not common. Empirical papers (Kouwenberg and Ziemba, 2004; Golec and Starks, 2002) found mixed results related to the impact of performance fees on risk taking behavior.

Table 3 provides a summary of the main formulas for α in all the cases considered. From the model, we can state the following predictions to be tested in the empirical section of this paper:

1. Passive funds have lower management fees than active funds[20];
2. Asymmetric contracts are less common than symmetric contracts;
3. Active funds which are likely to outperform the benchmark show a negative relationship between relative risk (tracking error) and incentives.
4. Active funds which are likely to under perform the benchmark will show a positive relationship between relative risk (tracking error) and incentives;

[20] We can consider the management fee of a passive fund as a proxy for the β in our compensation scheme, and in this case, as predicted by the model, the management fee for passive funds should be lower than for active funds. The management fee is a percentage of the wealth under management and consists of two components: a fixed flat fee and a performance adjusted fee. The performance adjusted ratio is calculated as a percentage of the portfolio's excess return over the benchmark.

5. Active funds under performing the benchmark in one given period tend to increase their relative risk (tracking error) in the subsequent period.

Insert Table 3 about here

Empirical Analysis

Data

For our empirical investigation, we used the Bloomberg cross-sectional equity mutual funds database for February 2007[21]. There are 4584 funds using 26 different equity benchmarks (stock indices) from 15 countries[22]. The database includes emerging markets (Brazil, Mexico) as well as developed countries (United States, United Kingdom, Germany)[23]. As the theoretical model proposed in this paper is always dependent on the reference considered, all the analysis is performed separately for each benchmark. As in the funds market, the use of a public benchmark is widespread (Elton et al., 2003), we assume that fund managers tend to be evaluated and compensated using the benchmark as the reference point, to which gains and losses are defined.

Table 4 provides some descriptive statistics of the funds in the database. The funds were grouped by the benchmark they use to evaluate their performance, and so we can consider that they compete for the same class of investors. The number of funds for each benchmark varies from 32 (Austrian Stock Exchange) to 1332 (S&P500). From the list of funds, just 261 (5.67%) use performance fees indicating that this sort of asymmetric compensation contract is not common, except for Brazil (IBOVESPA), where 18.10% of the funds charge performance fees.

The mean management fee among the entire sample is 1.36% (median 1.25%). Mexican funds charge the highest management fees (mean 4.84%) and U.S. funds,

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[21] Despite the fact that we are considering data for an specific month (cross section analysis), we still believe in the external validity of the main findings due to the diverse sample and stable econometric results.

[22] All funds in the database are alive in January, 2007. Unfortunately data on the dead funds for the sample used was not available.

[23] We also used daily data from January 2002 to February 2007 for 739 funds from France, United States, Brazil and Japan in a total of 787.216 day-fund-return data from the Bloomberg time series database in order to validate the results based on the cross-sectional Bloomberg data.

which use the Russell 3000 index benchmark, have the lowest management fee (mean 0.68%). The average volatility of management fees is 0.97, highest in Brazil (1.77) and lowest in Taiwan (0.25). In terms of net asset value (given in the country's currency), the mean is usually much higher than the median indicating the concentration of the market, with few large funds and many small ones. In terms of fund's age, we have a sample of established funds with an average age of 10.55 years and a median ranging from 5.99 (IBOVESPA) to 16.79 (Germany REX Total Index).

Insert Table 4 about here

We have a representative cross country sample of established mutual funds, diversified in terms of size. The global nature of the data can surely provide good insight for testing the theoretical model proposed previously in this study.

Empirical Results

In order to test our propositions, we will first distinguish between active and passive funds. From our predictions, passive funds should have a lower variable pay factor (Propositions 1 and 3) when compared to active funds. Typically, funds may charge investors management fees as a proportion of the total assets value, and performance fees, paid if the return of the fund outperforms the one obtained by the benchmark. We already observed that performance fees (asymmetric contracts) are not common. Thus, funds charge the management fee and use it to compensate the traders and face other operational costs. As we previously discussed in the theoretical model, management fees and performance fees act in the same direction in terms of influencing trader behavior, and thus the latter is not really a requirement. We expect that passive funds charge lower management fees as they use it to set the trader's base salary (β), since incentives (α) are not necessary.

Table 5 provides the average mean of the management fee for the funds for each benchmark, distinguishing between active and passive[24] funds. The last column shows the t statistics and p-values for the differences among means.

[24] Passive funds are the mutual funds classified as Index Funds by Bloomberg.

Insert Table 5 about here

From the results, it can be seen that active funds charged higher management fees in 14 of the 16 cases and that this difference is significant at the 5% level in 7 of the 16 indices considered. If we consider the entire sample of mutual funds (All), evidence suggests that active funds charge higher fees. In this sense, propositions 1 and 3 are given empirical support, and the level of the management fee for passive funds can be used as a proxy for the base compensation considered in the model. For instance, considering the benchmark SPX, funds charge 0.66% of the total assets value to pay the trader's base salary and other operational costs, and any increments on the management fee are used as incentives[25].

Consider the implications of proposition 2, which implies that in general, active managed funds assume a higher risk than passive funds (passive fund managers are risk averse). Recall, that the risk we are considering in the model is relative to the benchmark (tracking error). We use the variable $(\beta - 1)^2$ as a proxy of the tracking error[26]**.** Table 6 provides the average mean of the previous risk variable for the funds for each benchmark, distinguishing between active and passive funds. We considered both a short term beta calculated over the previous 6 months (using daily data) and a long term beta calculated over the previous 2 years (using monthly data).

The results indicate that both the short-term and long-term tracking error for passive funds are lower than for active funds, as predicted by proposition 2[27]. The difference is statistically significant (5% level) for 22 out of 32 cases. If we consider the entire sample, the results are similar.

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[25] In the case of benchmarks DJST (US) and MEXBOL (Mexico), the management fee for passive funds is higher than for active funds; however the difference is not statistically significant.

[26] This proxy is valid if we assume CAPM and the same market portfolio (benchmark) for all funds. $TE = \sqrt{(\beta - 1)^2 \sigma^2_{Bench}}$. (Carroll et al., 1992)

[27] The two indexes where the tracking error was greater for passive funds than for active funds is in the case of the Dow Jones Industrial Index (INDU) (the difference is not significant) and in the case of MEXBOL (significant difference).

Insert Table 6 about here

From our model (proposition 4), the relationship between incentives and risk depends upon the likelihood of outperforming the benchmark. In order to test this, we assume that, considering the sample of funds for each benchmark, the group of funds with better past-performance is more likely to frame a gain situation and so risk and incentives should have a negative relationship. On the other hand, the group of funds with the worse past-performance is more likely to frame a loss situation and act in a risk seeking way (risk and incentives should have a positive relationship). In this sense, we evaluated both the short term and long term relative risk strategies of the fund managers.

For the short term strategy we considered the returns in the first half of the year. The funds classified as winners are those with a previous return in the top 25% percentile, and the losers are those with returns in the bottom 25%[28]. We then regressed[29] the following 6-month tracking error, taking the management fee as the explanatory variable, as follows[30]:

$$\log(\beta_i - 1)^2 = C_0 + C_1 \cdot dl_i \cdot mf_i + C_2 \cdot dw_i \cdot mf_i + \varepsilon_i$$
$$for$$
$$i = 1..N$$

where i is the reference the fund, N is the number of funds for a specific benchmark, C_0, C_1 and C_2 are the regression coefficients, β is the 6-month beta for the second half of the year, *mf* is the fund's management fee, *dl* is a dummy variable which equals 1 if the fund is a loser (considering the past 6 month return) and zero otherwise, and *dw* is a dummy variable which equals 1 if the fund is a winner (considering the past 6 month return) and zero otherwise. This is a cross-sectional regression for all funds in each benchmark index. The results are presented in Table 7.

[28] This definition for the dummy variables will be the same for the remaining regressions. Observe that they are not complementary as there are funds which are classified neither as losers nor as winners.
[29] We used White's (1980) heteroskedasticity consistent covariance matrix.
[30] Our measure of tracking error is non-negative by definition and then we run the regression on the natural logarithm of the measure in order to improve the normality of the residuals

We can observe that C_1 is positive in 24 out of 26 cases and significant in 14 cases. C_2 is negative in 12 out of 26 cases and significant in 11 out of 26. Therefore the data suggest that for loser funds, the relationship between incentives and risk is positive, and for winners this relationship is negative. The empirical results give some support to proposition 4, especially in the case of loser funds. However, both C_1 and C_2 were significant with the expected signs in only four cases.

Insert Table 7 about here

For the long term strategy we considered the returns obtained in the first 2 years of the last 4 years, and classified them as winners and losers, depending on whether the fund was in the top 25% or in the bottom 25% of funds. We then regressed the tracking error for the following 2 years taking the management fee as the explanatory variable, as follows:

$$\log(\beta_i - 1)^2 = C_0 + C_1 \cdot dl_i \cdot mf_i + C_2 \cdot dw_i \cdot mf_i + \varepsilon_i$$
$$for$$
$$i = 1..N$$

where i refers to the fund, N is the number of funds for a specific benchmark, C_0, C_1 and C_2 are the regression coefficients, β is the 2 years beta for the last 2 years, *mf* is the fund's management fee, *dl* is a dummy variable which equals 1 if the fund is a loser (considering the past 2 years return) and zero otherwise, and *dw* is a dummy variable which equals 1 if the fund is a winner (considering the past 2 years return) and zero otherwise. This is a cross sectional regression for all funds in each benchmark index. The results are presented in the following Table.

Insert Table 8 about here

We may observe that C_1 is positive in 24 out of 26 cases and significant in 16 cases, while C_2 is negative in 16 out of 26 cases and significant in only 2 out of 26. Therefore the data suggest that for loser funds, the relationship between incentives and risk is positive, but for winners the evidence is weaker. The empirical results give some support to proposition 4, especially in the case of loser funds. However, only in two cases are both C_1 and C_2 significant with the expected signs.

If we add to control variables for size and the age[31] of the fund the regression as the following equation:

$$\log(\beta_i - 1)^2 = C_0 + C_1 \cdot dl_i \cdot mf_i + C_2 \cdot dw_i \cdot mf_i + C_3 AGE_i + C_4 SIZE_i + \varepsilon_i$$
$$for$$
$$i = 1..N$$

we reach the results presented in Table 9:

C_1 is positive in 24 out of 26 cases and significant in 17 cases, while C_2 is negative in 17 out of 26 cases and significant in only 5 out of 26. Results are similar to Table 8. The empirical results give some support to proposition 4, especially in the case of loser funds. However, only in three cases are both C_1 and C_2 significant with the expected signs. Also, C_3 is negative (positive) in 16 (10) out of 26 cases and significant in 4 (3) cases, so no clear pattern emerges. C_4 is negative in 19 out of 26 cases and significant in 10 out of 26, which suggests that smaller funds have larger tracking errors.

Insert Table 9 about here

The previous result sheds light on the problem of relating incentives to risk taking behavior, indicating that the mixed results found in previous empirical papers are probably due to a framing problem. Sensoy (2006) found that tracking error is greater, among funds with stronger incentives, while the agency theory predicts a negative relationship. The relationship between incentives and risk seems to depend on the reference, and this result is robust over various financial markets (developed and emerging markets). The asymmetry in the risk taking behavior is likely to be an invariant of the decision making process. Another interesting result is that typically the

[31] We actually used the natural logarithm of age and size.

coefficient for C_1 is higher than that for C_2, indicating the loss aversion in human behavior[32].

Empirical studies of incentives and risk taking in the literature typically test if funds with poor performance in the first half of the year increase risk in the second half of the year (Chevalier and Ellison, 1997). In the framework of prospect theory, this will happen because loss averse managers will always increase risk as their wealth drops below the threshold, and this effect will be more pronounced for funds with higher fees.

Related to proposition 5, we implemented the following cross-sectional regression:

$$\log(\beta_i - 1)^2 = C_0 + C_1 \cdot dl_i + C_2 \cdot dw_i + \varepsilon_i$$

, where C_0, C_1 and C_2 are the regression coefficients, β is the 6 month beta for the second half of the year, *dl* is a dummy variable which equals 1 if the fund is a loser (considering the past 6 month return), and *dw* is a dummy variable which equals 1 if the fund is a winner (considering the past 6 month return). The results are presented in Table 10.

Typically, we verify the relationship that a fund increases the risk if it under performs in the first half of the year and decreases risk if it outperforms. This supports proposition 5, and is in line with other empirical papers (Elton et al., 2003).

Insert Table 10 about here

Finally, in terms of the use of the performance fee, we already commented that it is not common in the sample and that less than 6% of funds use this fee. However, for Brazil (IBOVESPA) and the United States (S&P500), we could observe more funds using the performance fee. From the model, funds with a performance fee should have a higher tracking error. We tested this for the previous two indices and found supportive results[33].

[32] The mean value for abs(C1) in Table 7 is 0.69 while that of abs(C2) is 0.51 (the p value for the difference = 0.05).
[33] Funds that use performance fees have a higher tracking error, indicating that the performance fee acts to magnify the management fee.

Conclusions

In this study we applied the Behavior Agent Model to the professional investor environment, using the theory of contracts, and focused on the situation of active or passive investment strategies. In a deductive way, we formulated five propositions linking investment strategy, compensation and risk taking in a professional investor's context.

Our propositions suggest that managers in passively managed funds tend to be rewarded without incentive fee and are risk averse. On the other hand, in actively managed funds, whether incentives that reduce or increase the riskiness of the fund depends on how hard it is to outperform the benchmark. If the fund is likely to outperform the benchmark, incentives reduce the manager's risk appetite; conversely, if the benchmark is unlikely to be outperformed, incentives increase the manager's risk appetite. Furthermore, the evaluative horizon influences the trader's risk preferences, in the sense that if traders performed poorly in a period, they tend to choose riskier investments in the following period given the same evaluative horizon. On the other hand, more conservative investments are chosen after a period of good performance by a trader. To the best of our knowledge, this is the first time these results have been illustrated in the literature using a behavioral framework.

We tested the model in an empirical analysis over a large world sample of mutual equity funds, including developed and emerging markets, and we reached supportive results to the propositions established in the theoretical model.

Further extensions of this work may include the type of financial institution the trader works for (banks, insurance companies, pension funds) to take into account regulatory and institutional effects. Also, delegated portfolio management often involves more than one agency layer and future work could examine how this feature affects incentives? More generally, studies about general equilibrium implications and price impact should be interesting, especially for policy-makers, given the relevance of these funds in all developed financial markets. Also, the consideration of other contract schemes should be of interest (Sundaram and Yermack, 2006, suggest the use of debt contracts). Indeed, Mohnen and Pokorny (2004) show that factors other than the performance-dependent part of the compensation influence an individual's effort decision. Their experimental data show significantly higher effort levels for very low or very high fixed payments.

Despite the fact that we use prospect theory assumptions, the impact of cognitive biases in an agent's risk preference still needs to be better understood in order to understand the way psychological states may affect risk preferences in this context. We applied BAM specifically to the trader's situation. An extension of this study to other institutional contexts would be interesting in order to find some external validity to the propositions settled. Also, in the compensation analysis, only financial compensations were considered, and we think that including non-financial rewards like recognition and prestige would enrich the theory and enable better predictions. Finally, inclusion of career concerns in the model could also improve multi-period analysis. Kempf et al. (2007) suggest that when employment risk is high, managers that lag behind tend to decrease risk relative to leading managers in order to prevent potential job loss. All of these aspects are left for future research.

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Figure 1

Prospect theory value function for r = 0.88 and λ = 2.25

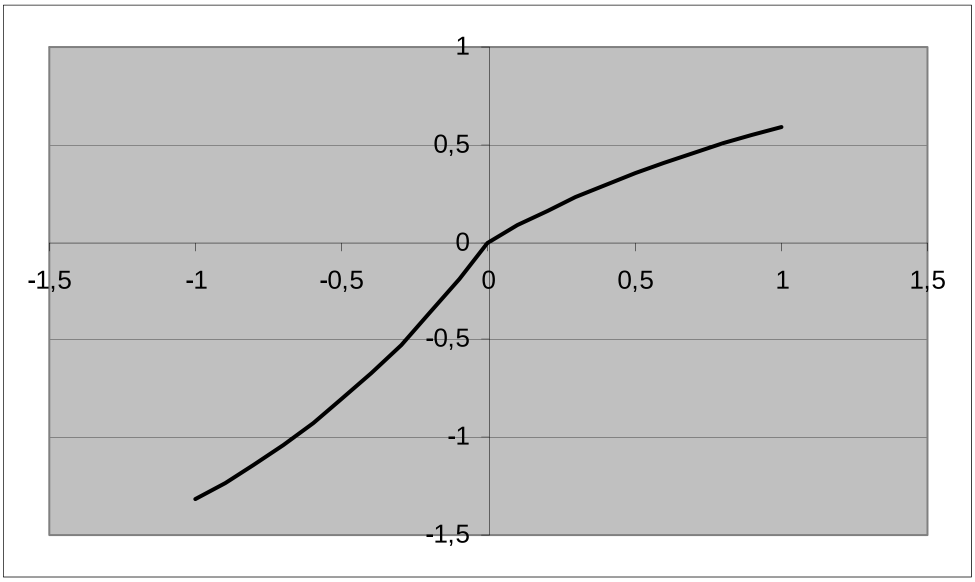

Table 1

Agent's Choice of Effort in a Passive Fund

This Table presents the agent's choice of active management effort "t" considering that he works for a passive fund. His compensation contract is fixed based (β) and his performance is measured against a benchmark (x_b). The risk σ^2 is given by the square root of the tracking error. As demonstrated in the text, the trader's optimal choice of active management effort is "zero".

Agent's choice of t	Compensation	Performance	Risk	Result
t = 0	w = β	x = xb	σ2= 0	optimum
t ≠ 0	w = β	x ≠ xb	σ2> 0	agent is fired

TABLE 2

Agent's Choice of Effort in an Active Fund

This Table presents the agent's choice of active management effort "t" considering that he works for an active fund. His compensation contract is performance based ($\alpha x + \beta$) and his performance is measured against a benchmark (x_b). The risk σ^2 is given by the square root of the tracking error. As demonstrated in the text, the trader's optimal choice of active management effort is greater than "zero".

Agent's choice of t	Compensation	Performance	Risk	Result
t = 0	w = β	x = 0	σ2= 0	agent is fired
t = t*	w = αx + β	x > 0	σ2> 0	optimum
t = t*	w = αx + β	x < 0	σ2> 0	agent is fired

TABLE 3

Summary of the Equations

This Table presents the summary of the main equations for the variable pay (α) in the trader's compensation contract, provided in the text, for the special cases of passive and active funds. In the case of passive funds, there's no need of variable pay. For the case of active funds, the variable pay will have different equations whether we are considering a symmetric or asymmetric contract.

<table>
<tr><td>Passive Funds</td><td colspan="2">$\alpha = 0$</td></tr>
<tr><td rowspan="3">Active Funds</td><td rowspan="2">Symmetric Contract
$\alpha = \frac{\mu^2}{\mu^2 + \sigma^2 r[\psi - (1-\psi)\lambda]}$</td><td>Out Performing Bench
$\alpha = \frac{\mu^2}{\mu^2 + \sigma^2 r}$</td></tr>
<tr><td>Under Performing Bench
$\alpha = \frac{\mu^2}{\mu^2 - \sigma^2 r \lambda}$</td></tr>
<tr><td colspan="2">Asymmetric Contract $\alpha = \frac{\mu^2(1-\psi\gamma) - \psi\gamma r \sigma^2}{\mu^2 + \sigma^2 r[\psi - (1-\psi)\lambda]}$</td></tr>
</table>

TABLE 4

Descriptive Statistics of the Funds' Data

Descriptive statistics of the funds in the database are displayed. The cross-sectional mean, median and standard deviation of the management fee (values in %), the net asset value (millions unit in the country's currency), and the age (in years) are listed, respectively, for each country. The number of funds for each country, and those using a performance fee are also displayed. Data from February, 2007.

				Perf	Management Fee			Total Assets			Age		
Index Mnemonic	Index	Country	OBS	Fee	Mean	Median	Std.	Mean	Median	Std.	Mean	Median	Std.
'ASE'	Athens Stock Exchange	Greece	36	1	1.75	1.50	0.96	106.09	32.41	161.63	10.72	10.08	5.61
'ASX'	FTSE All Share Index	UK	256	12	1.17	1.25	0.64	272.97	77.12	607.08	13.04	9.28	11.04
'ATX'	Austrian Traded Index	Austria	32	7	1.28	1.38	0.66	125.11	61.62	155.37	12.35	9.09	8.45
'CAC'	CAC 40 Index	France	262	9	1.65	1.50	0.70	227.54	59.68	494.75	10.33	8.82	6.89
'CCMP'	NASDAQ	US (Nasdaq)	40	6	1.59	1.50	0.96	610.58	38.91	1,848.38	9.54	7.23	6.11
'DAX'	DAX	Germany	106	4	1.22	1.20	0.56	347.06	92.37	742.08	16.52	13.44	11.45
'DJST'	Dow Jones	US	227	6	1.53	1.50	0.63	100.29	28.95	295.93	7.07	6.45	4.68
'E100'	FTSE EuroGroup 100	Europe	38	3	1.34	1.50	0.61	172.12	47.78	711.57	8.77	8.80	2.09
'IBEX'	IBEX35	Spain	215	1	1.45	1.45	0.62	78.21	37.47	142.61	9.06	9.51	4.26
'IBOV'	IBOVESPA	Brazil	337	61	2.09	2.00	1.77	98.87	32.56	187.31	7.00	5.99	6.26
'INDU'	Dow Jones Indust	US	47	4	1.92	1.50	1.61	237.01	32.25	953.53	7.98	7.67	3.84
'KLCI'	Kuala Lumpur Cap Index	Malaysia	122	0	1.45	1.50	0.25	145.13	49.51	225.23	11.11	7.42	9.28
'MEXBOL'	Mexico Bolsa Index	Mexico	80	0	4.84	5.00	0.72	982.81	373.29	1,963.08	10.49	11.52	5.02
'MID'	S&P400 Mid Cap	US	46	0	0.80	0.75	0.44	1,522.18	140.02	3,499.62	8.24	7.10	5.10
'NKY'	NIKKEI 225	Japan	170	8	1.25	1.20	0.69	13,035.77	150.31	50,786.16	10.82	7.98	7.60
'RAY'	Russell 3000 Index	US	45	1	0.68	0.63	0.51	664.05	256.58	1,121.88	9.09	8.27	6.10
'REX'	Germany REX Total	Germany	56	2	0.88	0.70	0.55	210.72	67.01	424.07	18.18	16.79	8.93
'RLG'	Russell 1000 Growth	US	48	0	0.75	0.72	0.40	1,196.50	357.88	2,113.63	17.99	10.47	18.19
'RLV'	Russell 1000 Value	US	65	0	0.74	0.66	0.53	2,275.07	434.88	6,932.95	13.98	7.59	17.90
'RTY'	Russell 2000 US	US	182	10	1.06	1.00	0.50	858.81	150.41	3,301.48	10.65	8.92	8.56
'SENSEX'	Mumbai Stock Index	India	72	0	1.07	1.19	0.26	4,241.40	932.46	7,279.66	9.61	9.04	3.87
'SET'	Stock Exchange of Thailand	Thailand	126	2	1.29	1.50	0.34	706.07	286.15	1,580.99	8.59	9.55	4.73
'SPX'	S&P500	US	1332	98	1.05	0.85	0.75	1,265.58	101.55	7,437.18	11.85	8.61	11.00
'TPX'	Topix Index	Japan	427	19	1.28	1.48	0.50	14,521.65	1,792.00	60,286.21	8.32	7.02	6.02
'TWSE'	Taiwan Stock Exchange	China	109	2	1.48	1.60	0.25	1,454.02	897.58	1,565.13	10.58	9.32	3.88
'UKX'	UK Index	UK	107	5	1.47	1.50	0.63	91.10	13.32	272.76	9.05	8.69	4.70
All			**4584**	**261**	**1.36**	**1.25**	**0.97**				**10.55**	**8.36**	**9.03**

TABLE 5

Passive vs. Active Funds: Management Fee

Management fees for active and passive funds for the various benchmarks considered. Indices with less than 10 passive funds were excluded from the analysis. The management fee is non-negative by definition and in this case we run the test on the natural logarithm of the measure in order to improve the normality of the variable. Data from February, 2007.

	Management Fee		t-Test	
Index	Passive	Active	t-stat	p-value
'ASX'	0.88	1.18	2.00	0.05
'CAC'	1.39	1.68	3.27	0.00
'DAX'	0.86	1.25	3.29	0.00
'DJST'	1.57	1.52	0.17	0.86
'IBEX'	1.25	1.46	0.39	0.70
'IBOV'	2.07	2.09	0.15	0.88
'INDU'	0.81	2.19	0.41	0.69
'KLCI'	1.33	1.46	1.55	0.12
'MEXBOL'	4.21	4.14	-0.20	0.84
'MID'	0.42	0.88	0.51	0.61
'NKY'	0.78	1.58	4.04	0.00
'RTY'	0.40	1.10	3.91	0.00
'SPX'	0.66	1.08	3.71	0.00
'TPX'	0.56	1.38	7.90	0.00
'UKX'	1.18	1.52	0.04	0.97
All	1.06	1.37	3.57	0.00

TABLE 6

Passive vs. Active Funds: Tracking Error

The tracking error proxy $(\beta-1)^2$ for active and passive funds for the various benchmarks considered. Indices with less than 10 passive funds were excluded from the analysis. The proxy used was non-negative by definition, and in this case we run the test on the natural logarithm of the measure in order to improve the normality of the variable. Data from February, 2007.

	(Beta6M - 1)^2		t-Test		(Beta2Y - 1)^2		t-Test	
Index	Passive	Active	t-stat	p-value	Passive	Active	t-stat	p-value
'ASX'	0.05	0.12	2.04	0.04	0.03	0.08	1.24	0.22
'CAC'	0.07	0.17	3.23	0.00	0.07	0.16	2.34	0.02
'DAX'	0.08	0.11	1.09	0.28	0.05	0.08	1.48	0.14
'DJST'	0.11	0.15	2.48	0.01	0.07	0.11	1.38	0.17
'IBEX'	0.00	0.12	6.03	0.00	0.00	0.10	5.42	0.00
'IBOV'	0.07	0.13	2.57	0.01	0.00	0.04	3.37	0.00
'INDU'	0.11	0.09	-0.57	0.57	0.22	0.38	-0.69	0.49
'KLCI'	0.02	0.07	2.18	0.03	0.01	0.07	3.17	0.00
'MEXBOL'	0.40	0.26	-2.52	0.01	0.02	0.16	3.93	0.00
'MID'	0.02	0.18	1.92	0.06	0.06	0.26	-0.79	0.44
'NKY'	0.06	0.21	14.28	0.00	0.05	0.12	15.88	0.00
'RTY'	0.05	0.12	10.63	0.00	0.13	0.13	-1.76	0.08
'SPX'	0.08	0.13	7.23	0.00	0.07	0.11	7.73	0.00
'TPX'	0.01	0.09	16.27	0.00	0.00	0.05	15.39	0.00
'UKX'	0.02	0.07	11.15	0.00	0.07	0.14	1.16	0.25
All	0.08	0.13	13.84	0.00	0.05	0.10	19.24	0.00

TABLE 7

Active Funds: Short Term Tracking Error

Tracking error proxy $(\beta - 1)^2$ for active funds for the various benchmarks considered. The explanatory variables are management fee and dummies for past performance which equals 1 if the fund is a loser (considering the past 6-months return) and zero otherwise, and equals 1 if the fund is a winner (considering the past 6-months return) and zero otherwise. Data from February, 2007.

Index	C0	p-value	C1	p-value	C2	p-value	R2
'ASE'	-3.27	0.00	0.00	0.99	-0.26	0.12	0.03
'ASX'	-2.76	0.00	0.23	0.08	0.09	0.44	0.01
'ATX'	-1.00	0.00	0.06	0.56	0.05	0.62	0.01
'CAC'	-4.29	0.00	1.22	0.00	-0.60	0.20	0.14
'CCMP'	-2.78	0.00	0.28	0.01	-0.03	0.90	0.05
'DAX'	-3.27	0.00	0.75	0.02	0.42	0.15	0.05
'DJST'	-3.84	0.00	1.12	0.00	0.65	0.01	0.10
'E100'	-2.26	0.00	0.84	0.01	-0.62	0.02	0.25
'IBEX'	-4.29	0.00	1.87	0.00	-1.48	0.00	0.34
'IBOV'	-2.39	0.00	0.03	0.25	0.16	0.00	0.08
'INDU'	-2.25	0.00	0.26	0.00	0.24	0.13	0.06
'KLCI'	-3.88	0.00	0.48	0.12	-1.33	0.00	0.19
'MEXBOL'	-1.16	0.00	0.05	0.18	0.05	0.08	0.03
'MID'	-5.34	0.00	0.83	0.36	-0.97	0.61	0.03
'NKY'	-1.69	0.00	0.07	0.39	-0.56	0.05	0.15
'RAY'	-4.38	0.00	0.88	0.16	0.28	0.59	0.02
'REX'	-0.76	0.00	-0.01	0.65	-0.06	0.45	0.06
'RLG'	-5.92	0.00	2.11	0.00	-0.46	0.74	0.19
'RLV'	-6.76	0.00	1.73	0.00	1.48	0.03	0.09
'RTY'	-4.49	0.00	0.48	0.15	0.30	0.39	0.01
'SENSEX'	-4.37	0.00	0.87	0.04	-0.95	0.10	0.15
'SET'	-6.08	0.00	-0.12	0.86	0.43	0.59	0.01
'SPX'	-4.06	0.00	0.81	0.00	0.63	0.00	0.04
'TPX'	-5.96	0.00	1.18	0.00	0.55	0.11	0.05
'TWSE'	-6.36	0.00	1.24	0.00	-0.38	0.31	0.11
'UKX'	-2.54	0.00	0.47	0.07	0.13	0.68	0.04

TABLE 8

Active Funds: Long Term Tracking Error (without control variables)

Tracking error proxy $(\beta - 1)^2$ for active funds for the various benchmarks considered. The explanatory variables are the management fee and dummy variables for past performance, which equal 1 if the fund is a loser (considering the past 2 years return) and equal 1 if the fund is a winner (considering the past 2 years return). Data from February, 2007.

Index	C0	p-value	C1	p-value	C2	p-value	R2
'ASE'	-3.35	0.00	0.13	0.64	-0.33	0.21	0.05
'ASX'	-4.44	0.00	0.82	0.00	0.96	0.00	0.13
'ATX'	-1.65	0.00	0.47	0.01	-1.53	0.00	0.60
'CAC'	-4.55	0.00	1.45	0.00	0.31	0.18	0.30
'CCMP'	-4.14	0.00	0.72	0.03	0.28	0.56	0.08
'DAX'	-3.70	0.00	1.04	0.00	-0.28	0.33	0.13
'DJST'	-3.99	0.00	0.92	0.00	-0.05	0.85	0.10
'E100'	-3.22	0.00	1.38	0.00	0.23	0.51	0.17
'IBEX'	-4.44	0.00	1.79	0.00	-1.00	0.00	0.30
'IBOV'	-5.53	0.00	0.39	0.00	0.00	0.99	0.09
'INDU'	-2.53	0.00	0.25	0.09	-0.98	0.21	0.13
'KLCI'	-3.99	0.00	0.52	0.09	-0.39	0.28	0.07
'MEXBOL'	-2.71	0.00	0.11	0.30	-0.11	0.18	0.06
'MID'	-4.53	0.00	-0.38	0.67	0.89	0.53	0.04
'NKY'	-2.47	0.00	0.11	0.38	-0.12	0.44	0.02
'RAY'	-4.51	0.00	1.49	0.00	-0.75	0.59	0.18
'REX'	-0.78	0.00	-0.24	0.16	-0.05	0.34	0.24
'RLG'	-6.51	0.00	1.87	0.00	2.23	0.01	0.18
'RLV'	-7.16	0.00	2.80	0.00	1.29	0.03	0.14
'RTY'	-3.76	0.00	0.09	0.67	-0.15	0.68	0.00
'SENSEX'	-5.79	0.00	0.99	0.29	-0.41	0.45	0.05
'SET'	-6.56	0.00	1.87	0.00	1.23	0.05	0.21
'SPX'	-4.25	0.00	1.20	0.00	0.08	0.69	0.13
'TPX'	-5.52	0.00	1.40	0.00	-0.12	0.62	0.10
'TWSE'	-4.42	0.00	0.09	0.80	-0.26	0.34	0.01
'UKX'	-3.67	0.00	1.04	0.00	-0.25	0.31	0.13

TABLE 9

Active Funds: Long Term Tracking Error (with control variables)

Tracking error proxy $(\beta - 1)^2$ for active funds for the various benchmarks considered. The explanatory variables are the management fee and the dummy variables for past performance which equal 1 if the fund is a loser (considering the past 2 years return) and zero otherwise, and equal 1 if the fund is a winner (considering the past 2 years return) and zero otherwise. Control variables for log(age) and log(size) are included. Data from February, 2007.

Index	C0	p-value	C1	p-value	C2	p-value	C3	p-value	C4	p-value	R2
'ASE'	-3.94	0.00	0.16	0.48	-0.13	0.63	0.94	0.09	-0.45	0.01	0.23
'ASX'	-3.73	0.00	0.77	0.00	0.90	0.00	0.21	0.40	-0.27	0.02	0.16
'ATX'	-1.63	0.01	0.53	0.03	-1.66	0.00	-0.43	0.22	0.26	0.04	0.66
'CAC'	-3.22	0.00	1.33	0.00	0.32	0.16	-0.18	0.60	-0.19	0.06	0.32
'CCMP'	-1.67	0.47	0.76	0.04	0.20	0.69	-1.46	0.11	0.18	0.11	0.17
'DAX'	-2.26	0.06	0.90	0.00	-0.21	0.52	-0.53	0.19	0.00	0.98	0.15
'DJST'	-1.62	0.08	0.82	0.00	-0.19	0.52	-1.01	0.00	-0.03	0.76	0.14
'E100'	-7.45	0.01	1.42	0.00	0.34	0.33	2.10	0.05	-0.09	0.73	0.25
'IBEX'	-4.47	0.00	1.81	0.00	-0.76	0.01	0.61	0.31	-0.40	0.02	0.33
'IBOV'	-3.51	0.00	0.41	0.00	-0.06	0.55	-0.87	0.01	-0.02	0.79	0.13
'INDU'	-1.94	0.23	0.26	0.08	-1.02	0.19	0.46	0.55	-0.43	0.29	0.23
'KLCI'	-2.94	0.00	0.37	0.28	-0.39	0.29	-0.03	0.91	-0.23	0.01	0.13
'MEXBOL'	-1.40	0.10	0.21	0.05	-0.11	0.14	-0.94	0.01	0.16	0.02	0.17
'MID'	-5.60	0.00	-0.58	0.52	1.10	0.46	0.91	0.09	-0.16	0.27	0.10
'NKY'	-1.22	0.05	0.04	0.73	-0.10	0.56	-0.42	0.09	-0.06	0.46	0.10
'RAY'	-3.21	0.14	0.70	0.03	-1.26	0.30	1.23	0.16	-0.70	0.00	0.34
'REX'	-1.04	0.00	-0.25	0.10	-0.01	0.61	0.13	0.01	-0.03	0.05	0.33
'RLG'	-3.66	0.05	1.46	0.01	1.95	0.01	-0.73	0.26	-0.13	0.51	0.24
'RLV'	-5.06	0.01	2.29	0.00	0.91	0.15	-0.01	0.98	-0.31	0.17	0.17
'RTY'	-1.27	0.08	-0.08	0.74	-0.27	0.45	-0.75	0.01	-0.12	0.13	0.07
'SENSEX'	-5.28	0.04	0.94	0.31	-1.03	0.07	-1.38	0.22	0.40	0.06	0.11
'SET'	-3.84	0.39	1.25	0.05	1.91	0.02	-2.28	0.11	0.45	0.36	0.27
'SPX'	-2.16	0.00	1.00	0.00	0.06	0.76	-0.27	0.08	-0.28	0.00	0.20
'TPX'	-6.61	0.00	1.04	0.00	-0.17	0.51	1.30	0.00	-0.23	0.00	0.17
'TWSE'	-5.13	0.01	0.11	0.73	-0.26	0.33	0.09	0.86	0.07	0.71	0.01
'UKX'	-0.29	0.84	0.82	0.01	-0.48	0.05	-0.97	0.12	-0.29	0.08	0.26

TABLE 10

Active Funds: Short Term Tracking Error (without management fee)

Tracking error proxy $(\beta - 1)^2$ for active funds for the various benchmarks considered. The explanatory variables are dummies for past performance which equals 1 if the fund is a loser (considering the past 6 month return) and equals 1 if the fund is a winner (considering the past 6 month return). Data from February, 2007.

Index	C0	p-value	C1	p-value	C2	p-value	R2
'ASE'	-3.68	0.00	1.21	0.05	0.01	0.96	0.20
'ASX'	-2.70	0.00	0.21	0.29	-0.04	0.82	0.01
'ATX'	-1.03	0.00	0.16	0.43	0.10	0.59	0.02
'CAC'	-4.09	0.00	2.38	0.00	-1.55	0.04	0.17
'CCMP'	-2.61	0.00	0.35	0.50	-0.52	0.52	0.04
'DAX'	-3.56	0.00	1.66	0.00	0.93	0.04	0.11
'DJST'	-3.99	0.00	2.05	0.00	1.14	0.02	0.12
'E100'	-2.43	0.00	1.29	0.01	-0.86	0.12	0.26
'IBEX'	-4.23	0.00	2.83	0.00	-2.95	0.00	0.44
'IBOV'	-2.42	0.00	0.00	0.98	0.52	0.00	0.13
'INDU'	-2.34	0.00	0.92	0.27	0.50	0.34	0.05
'KLCI'	-3.94	0.00	0.83	0.06	-1.93	0.00	0.19
'MEXBOL'	-1.14	0.00	0.15	0.48	0.22	0.10	0.02
'MID'	-5.21	0.00	0.48	0.58	-1.09	0.48	0.04
'NKY'	-1.61	0.00	0.04	0.77	-1.03	0.02	0.19
'RAY'	-4.21	0.00	0.91	0.29	-0.68	0.46	0.05
'REX'	-0.76	0.00	-0.03	0.11	-0.07	0.30	0.04
'RLG'	-5.76	0.00	2.14	0.00	-1.10	0.24	0.22
'RLV'	-7.10	0.00	2.20	0.03	1.46	0.11	0.08
'RTY'	-4.26	0.00	0.19	0.67	-0.26	0.59	0.00
'SENSEX'	-4.48	0.00	1.27	0.01	-0.94	0.14	0.17
'SET'	-6.18	0.00	0.14	0.88	0.72	0.57	0.01
'SPX'	-3.66	0.00	0.21	0.28	-0.33	0.11	0.01
'TPX'	-6.33	0.00	2.35	0.00	1.44	0.00	0.09
'TWSE'	-6.57	0.00	2.33	0.00	-0.38	0.51	0.16
'UKX'	-2.43	0.00	0.52	0.27	-0.10	0.85	0.02

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