Why Mutual Funds "Underperform"

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Abstract

I derive a rational model that reproduces the negative risk-adjusted performance of actively managed U.S. equity mutual funds, the funds' systematically better performance in bad states of the economy than in good states, and the relatively high fees that poorly performing funds charge. The model focuses on the optimal active management policies of a skilled fund manager facing rational investors. Since funds perform well in bad states, mutual fund investing can be rationalized despite the measurement of negative unconditional performance. Using data on U.S. funds, I document novel empirical evidence consistent with the model's predictions.

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1 Introduction

Jensen (1968), Malkiel (1995), and Gruber (1996), among others, document that actively managed U.S. equity mutual funds significantly underperform passive investment strategies, net of fees. Yet, according to the 2008 Investment Company Fact Book, more than 4 trillion dollars were invested in these funds by the end of 2007, despite their apparent inferiority to passive investment strategies.[1] This paper shows that investing in actively managed funds expected to perform poorly unconditionally can be optimal for fully rational investors, if these funds are also expected to outperform passive investment strategies in bad states of the economy, as Moskowitz (2000), Kosowski (2006), and Staal (2006) document.[2]

I derive a partial equilibrium model of optimal fee setting and active management by a skilled fund manager. The model builds on insights from Berk and Green (2004) and assumes rational investors who competitively supply money to the fund manager. But unlike Berk and Green (2004), I allow the fund manager in my model to generate active returns that are specific to the state of the economy. I investigate how the fund manager's ability to generate state-dependent active returns influences the fee he will charge and the performance an econometrician will measure. The model shows that one could simultaneously observe mutual fund investing and negative expected fund performance in an equilibrium with skilled fund managers and fully rational investors. Also consistent with the model is the previously documented empirical finding that poorly performing funds charge high fees compared to other funds (see, e.g., Carhart, 1997).

The intuition behind my model is that a fund manager who can generate active returns, but at a given disutility of effort, will be better off doing so in states in which investors are willing to pay more for these returns. Thus, the fund manager will optimally generate active returns that covary positively with the pricing kernel and will partially insure investors against bad states of the economy (i.e., states in which the pricing kernel is high). Investors

[1] See http://www.icifactbook.org/.

[2] See also Avramov and Wermers (2006), Lynch and Wachter (2007), and Mamaysky, Spiegel, and Zhang (2007) for more evidence of predictability in mutual fund performance.

will be willing to pay for this insurance. Given the competitive supply of money by investors, the fee the fund manager charges in equilibrium will equal the certainty equivalent of the value active management adds. As originally anticipated by Moskowitz (2000), I show that a *misspecified* performance measure, i.e., one that imperfectly specifies the true pricing kernel, will underestimate the value created by active management when active returns are positively correlated with the true pricing kernel. Consequently, the skilled fund manager in my model will wrongly appear to underperform passive investment strategies. A parameterized version of the model predicts that a fund manager who provides investors with a better insurance will charge them higher fees, but will also exhibit worse apparent risk-adjusted performance unconditionally.

In addition to deriving the model, I document empirically its implications. First, I use data on 3,260 funds over the 1980–2005 period to illustrate the empirical facts my model rationalizes. Second, I calibrate the model to the U.S. economy and reproduce quantitatively the measured underperformance of U.S. funds. Third, I document novel empirical evidence consistent with the model's auxiliary predictions. Fund managers seem to be more active in bad states of the economy than in good states (in terms of portfolio risks). Also, mutual funds with poor unconditional performance also tend to provide a good insurance against NBER recessions, which might explain the survival of these funds and might suggest the existence of a recession-related misspecification in popular performance measures.

That misspecification in the performance measure leads to the measurement of abnormal performance should not come as a surprise (see, e.g., Berk, 1995). What is both unique and non trivial about the argument developed here is the demonstration that a misspecification should lead to the measurement of *negative abnormal performance* in equilibrium when the fund manager provides investors with a *partial insurance against bad states.* This paper should, however, not be regarded as claiming that negative abnormal performance, per se, is desired by investors or that in reality all fund managers are skilled. It rather demonstrates that well-documented facts often considered as anomalous can be reproduced in a fully rational model.

Ideally, the risk-adjusted performance of a fund would be measured by the difference between the fund's realized excess return and the risk premium required given the covariance between the fund's return and the pricing kernel. In practice, the most popular measure of mutual fund performance is the intercept (alpha) from a regression of a fund's excess returns, net of fees, on the excess returns of passive investment strategies. The linear combination of these passive excess returns represents a proxy for the empirically unobservable pricing kernel. Gruber (1996) argues that, since these passive excess returns are associated with zero-cost portfolios, alpha should be zero for random portfolios. When he finds that mutual funds' average alpha is negative and smaller in absolute value than the average fee these funds charge, Gruber determines that fund managers add value on average but charge investors more than the value they add. According to this argument, the widely documented negative alphas, net of fees, indicate that mutual fund investing destroys value and is irrational from an investor's standpoint.

My model rationalizes mutual fund investing despite the negative alphas. In equilibrium, a skilled fund manager will make active management decisions that maximize his expected utility while satisfying an investors' participation constraint. These optimal decisions will, however, result in the measurement of a negative alpha unless the performance measure the econometrician uses allows for a perfect specification of the pricing kernel. We should not expect perfect specification to occur in empirical practice, as Roll (1977), Berk (1995), and Fama (1998) argue. Hence, my model might shed some light on why on average actively managed U.S. equity mutual funds "underperform", or at least appear to, and why people keep investing in them.

My paper is closely related to three strands of literature, though no other paper aims at reconciling theoretically the negative unconditional performance of actively managed funds with their systematically better performance in bad states than in good states. The first strand of literature consists of empirical papers, such as Moskowitz (2000), Kosowski (2006), and Staal (2006), that document how mutual fund performance moves over the business cycle. These papers postulate that unconditional performance measures understate the value actively managed funds create because these funds provide good performance when investors' marginal utility of wealth is expected to be high, i.e. in recessions. However, these papers do not study the theoretical asset pricing mechanisms underlying this postulate, or the origins of the observed state dependence in performance. My paper studies both elements theoretically through a parsimonious rational model, which reproduces salient empirical findings about mutual fund performance. I show theoretically that the above postulate is not always correct, but argue that it should hold in practice. The paper also investigates empirically the auxiliary implications of the model. The second strand of literature consists of theoretical papers, such as Admati and Ross (1985), Dybvig and Ross (1985), Grinblatt and Titman (1989), Kothari and Warner (2001), and Mamaysky, Spiegel, and Zhang (2007), that analyze the effects of active investment management on performance measurement, but do not consider the delegation of portfolio management decisions, or the related idea that fund managers should exert effort depending on how investors value this effort (which in my model depends on the state of the economy). The third strand of literature consists of theoretical papers, such as Brennan (1993), Garcia and Vanden (2006), and Cuoco and Kaniel (2007), that analyze the delegation of portfolio management decisions, but do not consider its effects on performance measurement. My paper studies simultaneously the delegation of portfolio management decisions and its effects on performance measurement, using insights from Berk and Green (2004). But unlike them, I endogenize in my model the production of active returns by a fund manager over different states of the economy. This feature partially explains why my model, but not theirs, rationalizes mutual fund investing even though expected risk-adjusted performance is negative.

It is important to notice that the mechanism at work in my model does not rely on the market-timing behavior that Treynor and Mazuy (1966), Henriksson and Merton (1981), or Ferson and Schadt (1996) document. Market timing consists of changing a portfolio's risk loadings over time with the intent of profiting from changes in predicted returns. The empirical findings of state-dependent mutual fund performance by Kosowski (2006) and Staal (2006) as well as those in Section 2 are, however, robust to state-dependent risk exposure (i.e., time-varying betas). Hence, the state dependence in fund performance that is central to this paper is unlikely to be the consequence of market timing strategies by mutual fund managers.

The paper is organized as follows. The next section presents empirical evidence concerning three facts of interest about mutual fund performance. Section 3 presents the elements of a simple model that rationalizes these three facts. Sections 4 and 5 derive, respectively, the optimal active management policy of a fund manager and the unconditional risk-adjusted performance an econometrician will measure in the model. Section 6 presents quantitative implications of a parameterized and calibrated version of the model. Section 7 presents empirical results linked to the model's auxiliary implications. Section 8 concludes.

2 Empirical Evidence

This section presents simple empirical tests that illustrate three facts my model rationalizes. Similar tests and robustness checks can be found in Malkiel (1995), Gruber (1996), Carhart (1997), Moskowitz (2000), Kosowski (2006), and Staal (2006), among others.

The empirical analysis uses data from the CRSP Survivorship-Bias-Free Mutual Fund database. The sample consists of 3,260 actively managed U.S. equity funds and covers the 1980–2005 period. The Appendix provides a detailed description of the sample. Table 1 reports summary statistics for the main fund attributes.

The first empirical fact of interest is the negative risk-adjusted performance, net of fees, of actively managed U.S. equity funds. Table 2 presents results from panel regressions measuring the unconditional performance of these funds. I measure the risk-adjusted performance of funds, net of fees, using the one-factor model of Jensen (1968), the three-factor model of Fama and French (1993), and the four-factor model of Carhart (1997). I use quarterly data. To account for the possible correlation between the residuals of a particular fund, I cluster standard errors by funds.

I find that the average risk-adjusted performance of funds is significantly negative, both in statistical and economic terms. This finding is consistent with the findings of Jensen (1968), Malkiel (1995), Gruber (1996), and Carhart (1997), among others, and suggests at first that investors would be better off picking passively managed funds instead of actively managed ones. Yet, according to the 2008 Investment Company Fact Book, 80.4 percent of the assets invested in U.S. equity funds by the end of 2007 were invested in actively managed funds.[3] Altogether, these numbers either suggest that investors are behaving suboptimally when picking mutual funds or that actively managed U.S. equity funds provide investors with benefits standard performance measures ignore. This paper advocates the latter.

The second empirical fact of interest is that actively managed funds exhibit a better performance in bad states of the economy than in good states. Consistent with Moskowitz (2000), Kosowski (2006), and Staal (2006), I use NBER recessions to proxy for bad states of the economy. I also derive an alternative proxy for bad states using the standard result from consumption-based asset pricing theory that the pricing kernel should be negatively related to consumption growth. I use quarterly data on real per-capita consumption of nondurables and services from the Bureau of Economic Analysis and consider as a bad state any period in which real per-capita consumption exhibited a negative growth. The next tables use the indicator function $I(BadState)_t$ to identify interchangeably both proxies of bad states. Table 3 presents results from panel regressions measuring the performance of actively managed U.S. equity funds, allowing regression coefficients to take values that differ between bad and good states as in Kosowski (2006).

Consistent with the findings of Moskowitz (2000), Kosowski (2006), and Staal (2006), results in Table 3 suggest that fund performance is significantly better in bad states than in good states.[4] For the one-factor model (columns (1) and (4)), alpha is positive in bad states regardless of the proxy for bad states I use. For the three-factor model (columns (2) and

[3]See http://www.icifactbook.org/.

[4]Lynch and Wachter (2007) also investigate the state dependence of mutual fund performance, by using data on 188 funds and using dividend yield and term spread to characterize the state of the economy. Their conclusions differ from those of Moskowitz (2000), Kosowski (2006), and Staal (2006) who use significantly more mutual fund data (from the CRSP database) and more direct indices of economic activity, e.g., the NBER recession indicator, to characterize the state of the economy.

(5)), alpha is positive in quarters of negative consumption growth but not in NBER recession quarters. For the four-factor model (columns (3) and (6)), alpha is positive in bad states regardless of the proxy for bad states I use. For example, the average four-factor alpha goes from -0.309 percent in quarters of positive consumption growth to 0.204 percent in quarters of negative consumption growth, an annualized difference of over 2 percent. I also find that funds' market risk exposure is higher in bad states than in good states. This finding is consistent with Ferson and Warther (1996) who find that mutual fund inflows decrease in bad states, resulting in lower cash balances and higher market risk exposure. Allowing factor loadings to change in bad states ensures that the superior performance one observes in bad states is not due to differences in the risk exposure of mutual funds, as a market timing story along the lines of Treynor and Mazuy (1966) and Henriksson and Merton (1981) would suggest.

The third empirical fact of interest is that poorly performing funds charge high fees compared to other funds. To illustrate this fact, I first measure the unconditional monthly alpha of each fund over its entire life span. I also compute each fund's average expense ratio and total fee, that is, expense ratio + (1/7)*front-load fee, as in Sirri and Tufano (1998) and Barber, Odean, and Zheng (2005).[5] Then I classify all funds into 10 decile portfolios based on their unconditional alphas. Table 4 presents the mean alpha, expense ratio, and total fee for each decile portfolio.

Whether I adjust for front-load fees or not, the difference between the average fee of the first decile portfolio and that of the tenth decile portfolio is economically and statistically significant. Poorly performing funds charge high fees compared to other funds. For example, the average expense ratio for the decile of worst-performing funds (in terms of the four-factor model) is 1.68 percent, whereas it is 1.47 percent for the decile of best-performing funds. The empirical relationship between fees and alphas is, however, not strictly decreasing, as Carhart

[5]Barber, Odean, and Zheng (2005) provide two reasons for not including back-load fees into the computation of the total fee: back-load fees were not reported in the CRSP database prior to 1993 and back-load fees are often waived if an investor holds a fund for a specific period of time.

(1997) documents. It is strictly decreasing for deciles with negative alphas (highlighted in the table) but not for deciles with positive alphas.

In the next sections of this paper, I develop a model that reproduces the three empirical facts just documented: the negative risk-adjusted performance of actively managed U.S. equity mutual funds, the funds' systematically better performance in bad states than in good states, and the relatively high fees that poorly performing funds charge.

3 Model

To understand the three empirical facts the previous section documents, I solve a simple model with rational agents. I study a one-period economy with states of the world I denote by $s \in S$. For clarity and brevity, I add the subscript s to a random variable only when referring to a state-specific realization of this random variable. I use r^e to denote the excess return on a passive investment strategy. This passive strategy represents an alternative investment opportunity available to investors. It need not be a proxy for the market portfolio as in Jensen (1968). It can be any specification of the risk-return relationship, such as Carhart's (1997) four-factor model.

3.1 The Mutual Fund Manager

The model assumes optimal behavior by investors and focuses on the policies of the mutual fund manager. In each state $s \in S$, the fund manager can exert effort a_s to generate, over the realized passive return r^e_s, a state-specific active return normalized to also be a_s. Other agents do not possess this nontradable technology. The model is agnostic about the origins of active returns. The active management technology is a reduced-form approach to capturing superior skills or investment opportunities the fund manager has. I assume the fund's realized return also contains an idiosyncratic component υ, which has mean zero and is independently distributed across states. The fund manager controls the active return a but does not control the idiosyncratic component v. I investigate how the fund manager's ability to generate state-dependent active returns will influence the fee he charges and the performance an econometrician measures.

Exerting effort to generate active returns imposes a non-monetary cost or disutility on the fund manager. As in Cadenillas, Cvitanić, and Zapatero (2004), Prescott and Townsend (2006), and Dittmann and Maug (2007), I assume the disutility-of-effort function to be independent from the state of the economy and additively separable from the utility-of-consumption function. The assumption of separability captures the notion that the disutility of exerting effort should not change with the fund manager's consumption level. Thus, a manager consuming x and exerting effort y will enjoy a total utility of $U(x) - D(y)$, where $U(\cdot)$ measures the utility of consumption and $D(\cdot)$ measures the disutility of effort. The utility function $U : \mathbb{R}^+ \rightarrow \mathbb{R}$ is twice-differentiable and concave, whereas the disutility function $D : \mathbb{R}^+ \rightarrow \mathbb{R}^+$ is twice-differentiable, strictly convex, and satisfies the following regularity conditions: $D(0) = 0$, $D'(0) = 0$, and $\lim_{a \rightarrow +\infty} D'(a) = +\infty$.

The fund manager owns no capital and capital requirements prevent him from investing independently in the market. By managing the wealth of other agents, the fund manager charges a fee f, constant across states, that is a fraction of the value of assets under management at the beginning of the period.[6] Investors competitively supply money to the fund manager, who collects all the value he creates through f. Berk and Green (2004) convincingly advocate this assumption. The ability to generate positive active returns is the resource in scarce supply, thus a fund manager who possesses this ability should set f such that he collects all the rewards from his active management skills. Unlike Berk and Green (2004), I do not consider the time-dependent mechanisms of learning and fund flows and focus instead on the state dependence of active management policies. I normalize the value of assets under

[6] Golec (2003) argues that SEC regulations make alternative fee structures either illegal or unattractive to mutual fund companies. See also Christoffersen (2001), Golec and Starks (2004), and Kuhnen (2004) who document the popularity in the mutual fund industry of fees as fractions of assets under management.

management to be one dollar at the beginning of the period. This simpler setting aims at keeping the model tractable and intuitive.

The timeline of the model is summarized as follows. At the beginning of the period, the fund manager offers a policy $(f, \{a_s\}_{s \in S})$ to investors and commits himself to generate an active return a_s over the realized passive return r_s^e if state s is realized. Before knowing which state will be realized, investors decide whether to pay the constant fee f, which is paid at the end of the period, in exchange for the state-dependent active return to be generated during the period. After the contract has been accepted by both parties, the fund manager learns the state that will be realized and exerts enough effort to generate the promised state-specific active return. Returns are then realized over the period and investors pay their fund manager the agreed-on fee.

That the fund manager *perfectly* learns in advance the state that is going to be realized is an assumption that greatly simplifies the solution of my model. It aims to capture, in the simplest way possible, the idea that the fund manager can adjust his effort depending on the anticipated state of the economy. Surely, one could add an extra layer of idiosyncratic noise to the model and weaken the precision of the signal the fund manager observes, or similarly, relate the idiosyncratic component υ to a prediction mistake the fund manager makes about the anticipated realization of the true pricing kernel. However, the added complexity should not change the qualitative predictions of the model, since all that matters is how the fund's active return is expected to move with the true pricing kernel.

3.2 The Equilibrium Condition

So far, the model has focused on the mutual fund manager. Here, I describe the investor side of the economy and, more specifically, how financial markets reach an equilibrium in terms of mutual fund investing.

A financial market equilibrium implies no arbitrage, which itself implies the existence of at least one strictly positive pricing kernel that prices all tradeable assets (see, e.g., Harrison and Kreps, 1979; Hansen and Richard, 1987; Cochrane, 2001). In order to reach an equilibrium, the excess return between any two assets must satisfy the following condition:

$$E\left[m(r^i - r^j)\right] = 0, \tag{1}$$

where r^i and r^j are returns on any two assets and m is a pricing kernel ($m > 0$). Hansen and Richard (1987) show that a unique portfolio yielding a payoff x^* that prices any asset and can serve as a pricing kernel exists. If a risk-free asset also exists, the return on the unique portfolio will be perfectly correlated with that of any risky portfolio belonging to the mean-variance frontier. Hence, the return r^p on any risky portfolio p will be on the mean-variance frontier if and only if a pair (γ_0, γ_1) exists such that $x^*_s = \gamma_0 + \gamma_1 r^p_s$ holds in all states. If r^p is not on the mean-variance frontier, projecting any pricing kernel m on r^p and a constant will yield nonzero error terms (see Roll, 1977).

Let r_0 denote the *gross* risk-free rate. The passive strategy's realized return is denoted $r_0 + r^e$ and the fund's realized return is denoted $r_0 + r^e + a - f + \upsilon$. The difference in realized returns between the fund and the passive strategy is $a - f + \upsilon$. In equilibrium this excess return needs to satisfy the following condition:

$$E\left[m(a - f + \upsilon)\right] = 0. \tag{2}$$

Suppose instead that the left-hand side of equation (2) was higher than zero. Then the demand for mutual fund services would be infinite and the fund manager would be able to improve his profits by increasing f marginally. Now suppose the left-hand side of equation (2) was lower than zero. Then no one would invest in the mutual fund and the fund manager would collect no revenues. Hence, equation (2) has to hold in equilibrium.[7]

The random variable υ has mean zero and is uncorrelated with the pricing kernel. From equation (2), the fee in equilibrium is $f = r_0 E\left[ma\right]$, which represents the certainty equivalent

[7]The equilibrium condition does not preclude the *nontradeable* active management technology to have a positive Net Present Value.

of the value active management adds to a portfolio. This result differs from $f = E[a]$, derived by Berk and Green (2004), who do not consider the possibility of state-dependent active returns. Instead, they assume that, for a given level of assets under management, the active return is independent of the state of the economy and uncertainty in realized returns is purely idiosyncratic. As will become evident in Section 4, this difference explains why my model, but not theirs, rationalizes mutual fund investing even when expected risk-adjusted performance is negative.

A convenient property of the current framework is that it does not require a parameterization of the pricing kernel or equivalently of the investors' utility function. The only assumptions imposed on m are that $var(m) > 0$ and that the realized pricing kernel m_s is higher in bad states of the economy than in good states, similar to what a consumption-based model with risk aversion would predict.

4 Optimal Active Management

The fund manager acts in his own interests and maximizes expected utility subject to an equilibrium condition, which is also the investors' participation constraint. Thus, the fund manager picks a policy $(f^*, \{a_s^*\}_{s \in S})$ that solves:

$$\max_{f, \{a_s\}_{s \in S}} E[U(f) - D(a_s)], \tag{3}$$

subject to $f = r_0 E[m_s a_s]$.

Before deriving and analyzing the implications of the model, I present a lemma useful for the analysis.

Lemma 1. *Let z be a random variable with $var(z) > 0$ and $G : \mathbb{R} \to \mathbb{R}$ be a strictly increasing function. Then $cov(z, G(z)) > 0$.*

Proof.

$$\begin{aligned} cov(z, G(z)) &= E[(z - E[z])(G(z) - E[G(z)])] \\ &= E[(z - E[z])(G(z) - G(E[z]))] \\ &+ E[(z - E[z])(G(E[z])) - E[G(z)])] \\ &= E[(z - E[z])(G(z) - G(E[z]))]. \end{aligned} \tag{4}$$

Since $G(\cdot)$ is strictly increasing, it follows that $cov(z, G(z)) > 0$ when $var(z) > 0$. □

The following proposition derives the optimal policy $(f^*, \{a_s^*\}_{s \in S})$.

Proposition 1. *The optimal mutual fund policy satisfies:*

$$U'(f^*) r_0 m_s = D'(a_s^*), \tag{5}$$

in each state $s \in S$*. Therefore,* a^* *is positively correlated with the pricing kernel* m*.*

Proof. Inserting the equilibrium fee f into the fund manager's optimization function (3) gives the following optimization function:

$$\max_{\{a_s\}_{s \in S}} \; E\left[U(r_0 E\left[m_s a_s\right]) - D(a_s)\right]. \tag{6}$$

The first-order conditions with respect to a_s are $U'(f^*) r_0 m_s = D'(a_s)$, for each state $s \in S$, and are necessary and sufficient for an optimum given the assumptions made on $D(\cdot)$ and $U(\cdot)$.

Now define the function $H(\cdot) \equiv D'^{-1}(\cdot)$ as the inverse of the marginal disutility of generating active returns. Due to the strict convexity of $D(\cdot)$, the function $H(\cdot)$ exists and is strictly increasing over $\mathbb{R}^+$. Since $cov(m, a^*) = cov(m, H(U'(f^*) r_0 m))$, Lemma 1 implies that $cov(m, a^*) > 0$ if $var(m) > 0$. □

Since $U'(f^*)r_0$ is strictly positive and constant across states, the optimal active return a^* is strictly positive and positively correlated with m. Consequently, $a^* - f^* + \upsilon$, the fund's excess return over the passive strategy, is also positively correlated with the pricing kernel. The fund manager knows that investors value active returns more in bad states than in good states. Thus, it becomes optimal to generate higher active returns when investors are willing to pay more for returns. Using equation (2), I decompose the fee in the following way:

$$f^* = E[a^*] + r_0 cov(m, a^*). \tag{7}$$

The fund manager is not only compensated for the level of active returns he produces but also for the *timing* of these returns. Hence, my model suggests a novel source of cross-sectional differences in mutual fund fees (see Chordia, 1996; Christoffersen and Musto, 2002). The fund's expected excess return over the passive strategy is:

$$E[a^* - f^* + \upsilon] \quad = \quad -r_0 cov(m, a^*). \tag{8}$$

Partially insuring investors against variations in the pricing kernel allows the fund manager to request a compensation that is higher than the active return he is expected to generate.

5 Measuring the Fund's Risk-Adjusted Performance

The fund's expected excess return over the passive strategy, as derived in equation (8), is not a valid measure of abnormal performance because it does not adjust for the fund's risk. Ideally, the risk-adjusted performance of a fund would be measured by the difference between the fund's realized excess return and the risk premium required given the covariance between the fund's return and the pricing kernel. An econometrician, however, is unlikely to observe the true pricing kernel m and use it to measure fund performance. Instead, he proxies for m using $\widehat{m} \equiv E[m|I]$, where I is the information available to him when trying to measure fund performance. This information set I is based on a coarser partition of the state space than the information set of the mutual fund manager and investors. By construction, the specification error ϵ ($\equiv m - \widehat{m}$) satisfies $E[\epsilon|\widehat{m}] = 0$ for all values of $\widehat{m}$. In other words, ϵ is mean independent of the pricing kernel proxy $\widehat{m}$.[8] An example of a possible specification error ϵ would be an orthogonal factor that is omitted by the pricing kernel proxy. If the performance measure the econometrician uses depends on a pricing kernel proxy with an occasional nonzero error term (i.e., $var(\epsilon) > 0$), I characterize this performance measure as being *misspecified*. I assume (unsurprisingly) that the performance measure based on $\widehat{m}$ assigns no abnormal performance to the passive investment strategy producing r^e. This condition is satisfied, for example, when the econometrician proxies for the pricing kernel using a linear combination of passive returns, including r^e, as in Jensen (1968), Fama and French (1993), Gruber (1996), and Carhart (1997), among others.

The following proposition derives the expected risk-adjusted performance an econometrician using the pricing kernel proxy $\widehat{m}$ will measure in my model.

Proposition 2. *The expected risk-adjusted performance of the fund, as measured by the econometrician, is:*

$$E[\alpha] = -r_0 cov(\epsilon, a^*), \tag{9}$$

where ϵ denotes the specification error associated with $\widehat{m}$, i.e., $m = \widehat{m} + \epsilon$.

Proof. To measure $E[\alpha]$, I subtract from the fund's expected excess return the risk premium required given how the fund's return covaries with the pricing kernel proxy:

$$\begin{aligned} E[\alpha] &= E\left[r^e + a^* - f^* + \upsilon\right] + r_0 cov(\widehat{m}, r^e + a^* - f^* + \upsilon) \\ &= E\left[r^e\right] + r_0 cov(\widehat{m}, r^e) - r_0 cov(m, a^*) + r_0 cov(\widehat{m}, a^*) \\ &= E\left[r^e\right] + r_0 cov(\widehat{m}, r^e) - r_0 cov(\epsilon, a^*). \end{aligned} \tag{10}$$

[8] In the Appendix, I relax the assumption of mean independence of ϵ to $\widehat{m}$ and replace it by the weaker assumption that ϵ is uncorrelated with $\widehat{m}$.

By assumption, the passive investment strategy producing r^e is priced correctly by $\widehat{m}$, thus $E\left[r^e\right] = -r_0 cov(\widehat{m}, r^e)$. The first two terms in equation (10) cancel each other and the expected risk-adjusted performance of the fund is given by:

$$E[\alpha] \quad = \quad -r_0 cov(\epsilon, a^*). \tag{11}$$

□

The result in Proposition 2 is not specific to mutual funds. When an asset is correctly priced by the true pricing kernel, but the performance measure the econometrician uses is misspecified, the expected measured performance of this asset will equal the risk premium that would be required if the specification error ϵ were a pricing kernel. Since the performance measure does not adjust for $cov(\epsilon, a^*)$, which is priced by the market in equilibrium, $-r_0 cov(\epsilon, a^*)$ is wrongly considered as an abnormal return.

The covariance between ϵ and a^* can be decomposed into:

$$cov(\epsilon, a^*) = E[cov(\epsilon, a^*|\widehat{m})] + cov(E[\epsilon|\widehat{m}], E[a^*|\widehat{m}]). \tag{12}$$

Following Lemma 1, $cov(\epsilon, a^*|\widehat{m})$ is always positive in the model, making the first term on the right-hand side of equation (12) positive as well. The second term equals zero because the econometrician proxies for m using $\widehat{m} \equiv E[m|I]$, which implies that $E[\epsilon|\widehat{m}] = 0$ for any possible level of $\widehat{m}$. Hence, if $var(\epsilon) > 0$, the covariance between ϵ and a^* is strictly positive and $E[\alpha]$ is negative.

Note that this result is independent of the results derived in Section 4. One could propose a different explanation for the better performance of funds in bad states than in good states and still use Proposition 2 to reproduce the funds' negative unconditional performance. As long as performance is better in bad states of the economy than in good states, whatever the reason, a misspecification in the pricing kernel proxy should lead to the measurement of negative unconditional performance.

Together, results in Sections 4 and 5 imply that a fund manager who owns the skill to insure investors against bad states will appear to perform poorly unconditionally. This result is completely opposite to what most financial economists have assumed in the past. It has been argued that fund managers, if they are skilled, should provide strictly positive risk-adjusted performance to investors. Recently, Berk and Green (2004) have argued that fund managers own the bargaining power in their relationship with investors and should collect all the rewards from their active management skills, resulting in $E[\alpha]$ being equal to zero for each fund. My model extends their analysis by allowing for state-dependent active management policies. The result is a simple rational explanation for the negative performance of mutual funds. In my model, a fund manager faces higher incentives to generate active returns when the pricing kernel is high. It is therefore optimal for him to provide investors with an insurance against pricing kernel variations, including those captured by $\widehat{m}$ and those associated with ϵ. The performance measure the econometrician uses will, however, only value the insurance against variations captured by $\widehat{m}$. For this reason, a misspecified performance measure will be negatively biased and the skilled fund manager will wrongly appear to destroy value. Notice that if a fund manager were to promise active returns that did not covary with the true pricing kernel, my model's prediction in terms of measured unconditional performance would be identical to that of Berk and Green (2004), i.e., $E[\alpha] = 0$. Negative expected performance can be a rational equilibrium outcome in my model only because active returns covary with the component of the pricing kernel that the performance measure omits.

6 A Parameterization

In the previous section, I rationalize the negative risk-adjusted performance of actively managed mutual funds by imposing only a few restrictions on the fund manager's disutility of effort and the econometrician's performance measure. In this section, I parameterize the model and calibrate it to the U.S. economy to test whether the model's predictions are quantitatively sensible.

I assume the disutility of effort when generating an active return takes the quadratic form $D(a) = \frac{\theta}{2}a^2$, for $a \geq 0$, where $\theta > 0$. Therefore $D'(a) = \theta a$ and θ represents the slope of the marginal disutility function. As the parameter θ increases, the disutility of producing an active return increases as well. The first-order condition from equation (5) becomes $a_s^* = \frac{U'(f^*)}{\theta} r_0 m_s$. The manager's utility function $U(\cdot)$ does not need to be parameterized. The only way it appears in the model's predictions is in the expression $\frac{U'(f^*)}{\theta}$, which is constant across states. Parameterizing and calibrating $U'(\cdot)$ will have no quantitative implications without a choice of θ. I therefore only need to calibrate the expression $\frac{U'(f^*)}{\theta}$ without deeper consideration for the fund manager's utility of consumption per se.

I assume the econometrician uses the linear projection of m on r^e and a constant as his pricing kernel proxy ($\widehat{m} = \gamma_0 + \gamma_1 r^e$). This assumption yields a performance measure that is linear in r^e, as in Jensen (1968).[9] In the projection $m = \gamma_0 + \gamma_1 r^e + \epsilon$, the slope coefficient γ_1 satisfies:

$$\begin{aligned} E\left[r^e\right] &= -r_0 cov(r^e, m) = -r_0 cov(r^e, \gamma_0 + \gamma_1 r^e + \epsilon) \\ &= -\gamma_1 r_0 var(r^e). \end{aligned} \tag{13}$$

Therefore, $\gamma_1 = -\frac{E[r^e]}{r_0 var(r^e)}$ and $\gamma_0 = \frac{1}{r_0}[1 + SR^2]$, where SR denotes the Sharpe ratio of the passive investment strategy ($SR = \frac{E[r^e]}{\sqrt{var(r^e)}}$). As Roll (1977) shows, realizations of ϵ will equal zero in all states only when r^e is on the mean-variance frontier. Otherwise, $var(\epsilon)$ will be strictly positive, regardless of whether markets are complete.

[9]The theoretical derivations in this section also hold if the econometrician uses a multi-factorial estimate of the pricing kernel.

6.1 Parameterized Implications

The following proposition derives the fee a fund manager with a quadratic disutility-of-effort function will charge and the performance an econometrician using a linear function of r^e as his pricing kernel proxy will measure.

Proposition 3. *Assuming a quadratic disutility-of-effort function and a pricing kernel proxy that is linear in the passive return, the fund's equilibrium fee satisfies:*

$$f^* = \frac{U'(f^*)}{\theta} \left[1 + r_0^2 var(m)\right], \tag{14}$$

and the fund's expected risk-adjusted performance is:

$$E[\alpha] = -\frac{U'(f^*)}{\theta} r_0^2 var(\epsilon). \tag{15}$$

Unless $var(\epsilon) = 0$, $E[\alpha]$ is negative.

Proof. Inserting $a_s^* = \frac{U'(f^*)}{\theta} r_0 m_s$ and using the properties of the projection $m = \gamma_0 + \gamma_1 r^e + \epsilon$ in equations (7) and (9) yields the results. □

The model predicts that expected alpha will be negative unless $var(\epsilon) = 0$; any error in the pricing kernel proxy will lead to the expected measurement of a negative risk-adjusted performance. The unobservable statistic $var(\epsilon)$ represents the degree of misspecification in the econometrician's pricing kernel proxy (see Hansen and Jagannathan, 1997; Hodrick and Zhang, 2001). To have $var(\epsilon) = 0$, the passive return r^e has to be on the mean-variance frontier. But as Roll (1977), Berk (1995), and Fama (1998) argue, we should not expect this situation to occur in empirical practice. For example, Bekaert and Hodrick's (1992) empirical findings suggest that $var(\epsilon)$ is strictly positive when one uses domestic portfolios to measure performance. They compute the maximal Sharpe ratio (SR) attainable with conditional trading strategies in international markets and find that international investing sharpens the Hansen and Jagannathan (1991) lower bound on $\sqrt{var(m)}$. Hence, $\sqrt{var(m)}$

should be higher than the lower bound domestic investing predicts. When investors have access to financial instruments that allow for a better diversification than what the portfolio used in the pricing kernel proxy provides, then $var(\epsilon)$ is strictly positive.

Applying the implicit function theorem to equation (14) shows that, if the fund manager is risk-averse or risk-neutral around f^*, an increase in pricing kernel volatility will lead to active management providing a more valuable insurance and consequently to the fund manager charging a higher fee. The model also rationalizes why poorly performing funds charge high fees compared to other funds. All else being equal, fund managers with a lower disutility-of-effort parameter will provide a better insurance against pricing kernel variations. These fund managers will thus be able to collect a higher fee from investors. They will, however, also appear to perform more poorly, if the performance measure the econometrician uses is misspecified. Hence, my model predicts that f^* and $E[\alpha]$ will move in opposite directions in the cross-section of funds, consistent with the empirical results in Table 4 concerning funds with negative alphas (see highlighted deciles). In Section 7, I test empirically whether the insurance that funds provide can explain the negative relationship between fees and alphas observed in the cross-section of funds.

The last implication I derive is that the fund's expected risk-adjusted performance, gross of fee, is:

$$E[\alpha] + f^* = \frac{U'(f^*)}{\theta} \left[1 + SR^2\right], \tag{16}$$

which is strictly positive on average, consistent with the empirical findings of Gruber (1996), Carhart (1997), and Kacperczyk, Sialm, and Zheng (2005), among others.

6.2 A Calibration

Here, I verify that my model, when calibrated to the U.S. economy, is able to reproduce quantitatively the measured underperformance of U.S. funds. I assume a representative fund manager who behaves as my model would predict.

Expressions $\frac{U'(f^*)}{\theta}$ and $var(\epsilon)$ are not observable in reality. Before calibrating these unobservables, I tie down the moments that can be inferred directly from economic data. To simplify the calibration, I use the excess return on the S&P 500 index as my passive return r^e instead of a multi-factorial model of risk-adjusted return. I calibrate the first two moments of r^e and the mean risk-free rate r_0 using data for the 1980–2005 period from Kenneth French's website. Over this period, I observe a mean annual expense ratio of 1.29 percent. The expense ratio is the fraction of total investment that shareholders pay annually for the fund's operating expenses, including 12b-1 fees. To account for the amortized loads, which are not included in the reported expense ratio, I calibrate the fee f^* by adding 1/7 of the average front-load fee to the average expense ratio. Table 5 summarizes the calibration of the model's observable moments.

With the observable moments calibrated, I investigate the values for $\frac{U'(f^*)}{\theta}$ and $var(\epsilon)$ that allow the model's predictions to match selected empirical estimates. I solve for the relationship between $\frac{U'(f^*)}{\theta}$ and $var(\epsilon)$ that allows my model to match the average mutual fund fee I observe in the sample. Then I compare the range of $var(\epsilon)$ that produces reasonable predictions for $E[\alpha]$ to empirical estimates of $var(\epsilon)$.

To satisfy equation (14), $\frac{U'(f^*)}{\theta}$ needs to satisfy:

$$\frac{U'(f^*)}{\theta} = \frac{f^*}{1 + SR^2 + r_0^2 var(\epsilon)}. \tag{17}$$

If it does, the expected risk-adjusted performance of mutual funds, for a given fee f^*, is:

$$E[\alpha] = -\frac{r_0^2 f^*}{1 + SR^2 + r_0^2 var(\epsilon)} var(\epsilon). \tag{18}$$

Figure 1 plots the relationship between $E[\alpha]$ and $var(\epsilon)$ under the calibration of Table 5. Figure 1 also identifies the predicted $E[\alpha]$ for each level of $var(\epsilon)$ that several empirical estimates of $var(m)$ would imply (see Bekaert and Hodrick, 1992; Chapman, 1997; Melino and Yang, 2003; Bansal and Yaron, 2004; Kan and Zhou, 2006).[10] For my sample of mutual funds, the annualized one-factor alpha is -0.40 percent (see Table 2). This estimate is significantly better than the -1.10 percent Jensen (1968) reports but is still economically significant. In order to generate simultaneously $f^* = 1.53\%$ and $E[\alpha] = -0.40\%$ as in my sample, I need to set $var(\epsilon) = 0.39$. The standard deviation of m that allows to produce $E[\alpha] = -0.40\%$ is therefore 0.78. This level of pricing kernel volatility is close to the empirical estimates Bekaert and Hodrick (1992) and Bansal and Yaron (2004) report. In the current calibration, a two-standard-deviation shock in m_s implies a change of 1.50 percent in the a_s^* of the representative fund. The higher estimates of $var(m)$ Chapman (1997) and Kan and Zhou (2006) report allow my model to generate an alpha close to Jensen's (1968) estimate whereas Melino and Yang's (2003) lower volatility estimate still generates an economically significant level of underperformance.

In light of this calibration, one should not be puzzled to observe significantly negative alphas for actively managed U.S. equity mutual funds, given the insurance they provide against bad states of the economy.

7 Empirical Tests Linked to Auxiliary Implications

The main goal of this paper is to rationalize three empirical facts: the unconditional risk-adjusted performance of actively managed U.S. equity funds is negative, the funds' performance is systematically better in bad states of the economy than in good states, and poorly performing funds charge high fees compared to other funds. The model also provides auxiliary implications researchers have not yet tested empirically. In this section, I empirically examine two implications using the same sample as in Section 2. First, the model implies that fund managers should be more active, i.e., exert a higher effort, in bad states than in good states. Second, if the performance measure is misspecified, but mutual fund returns

[10] I use $var(m) = \gamma_1^2 var(r^e) + var(\epsilon) = \frac{SR^2}{r_0^2} + var(\epsilon)$, where SR denotes the Sharpe ratio of the passive investment strategy, to derive the $var(\epsilon)$ each empirical estimate of $var(m)$ implies.

are priced in equilibrium by investors, then funds with poor alphas should tend to provide investors with a good insurance against bad states. As in Section 2, I use NBER recession periods as well as periods in which per-capita consumption exhibited a negative growth as two alternative proxies for bad states. The indicator function $I(BadState)_t$ is used in the next tables to identify interchangeably both proxies.

A fundamental idea behind my model is that a fund manager has a higher incentive to be active in bad states than in good states because investors are willing to pay more for returns generated when realizations of the pricing kernel are high. Hence, in bad states the fund manager should exert a higher active management effort, for example, by collecting more information about investment opportunities. In this paper, I use the term *managerial activity* to describe in general the level of effort a fund manager exerts in a specific period. Wermers (2000), Kacperczyk, Sialm, and Zheng (2005), Kacperczyk and Seru (2007), and Cremers and Petajisto (2007) all provide empirical evidence suggesting that more "active" fund managers outperform less "active" managers. These findings suggest that a fund manager wishing to generate active returns higher in bad states than in good states might be able to do so by becoming more active in bad states. I test whether and how this implication holds in the data using different measures of managerial activity.

A fund manager wishing to be more active during a specific period should gather more information about investment opportunities during that period, whereas a fund manager wishing to be as inactive as possible during that period could simply track a benchmark portfolio. Portfolio risk is a potential indicator of managerial activity. Specifically, a fund manager who updates frequently the risk of his portfolio and who picks portfolios that are far away from the average portfolio of other fund managers, along the lines of Chevalier and Ellison (1997), can be considered as active. Hence, according to my model I expect to observe in bad states larger adjustments in the market risk of mutual fund portfolios and more cross-sectional dispersion in both their market risk and realized risk-adjusted returns.

I measure market risk using β_{it}, the exposure to the market factor in Carhart's (1997) four-factor model. I estimate β_{it} from a three-year rolling regression with monthly returns.

Then I use the fund-specific quarterly adjustments in systematic risk (i.e., $|\beta_{it} - \beta_{it-1}|$) and the absolute deviation of β_{it} from its cross-sectional mean (i.e., $|\beta_{it} - \overline{\beta_t}|$) as measures of how active fund manager i is in period t. I also identify the part of a fund's realized return that systematic risk cannot explain. To do so, I use $(\alpha_{it} + e_{it})$, where α_{it} is the intercept and e_{it} is the residual from the three-year rolling regression of Carhart's (1997) four-factor model. Together, these two terms represent fund i's realized excess return over the rate of return required in period t given fund i's exposure to the four factors. The absolute deviation of this return from its cross-sectional mean (i.e., $|(\alpha_{it} + e_{it}) - \overline{(\alpha_t + e_t)}|$) is similar to a measure of managerial activity Cremers and Petajisto (2007) use. It is the third and last measure I use to proxy for managerial activity.[11]

Table 6 reports summary statistics for these measures. Since these measures require 36 months of past data, only funds with more than three years of data can be used in the managerial activity tests presented below. Table 7 presents results from panel regressions of the three measures of managerial activity on lagged fund characteristics, an indicator function of bad state, and three indicator functions identifying quarters. To ensure that contemporaneous fund flows or market returns do not entirely explain changes in managerial activeness, I also control for these variables. I use quarterly data.

Using both proxies of bad states, all estimated coefficients associated to $I(BadState)_t$ are positive and significant, economically and statistically. Results in columns (1) and (2) suggest that fund managers update the market risk of their portfolios significantly more in bad states than in good states. Quarterly adjustments in market risk go up by 0.014 in NBER recession quarters and by 0.006 in quarters of negative consumption growth. Columns (3) to (6) show that the cross-sectional dispersion in market risk and realized risk-adjusted returns increase in bad states of the economy as well. The average dispersion in market risk increases by 0.015 in NBER recession quarters and by 0.020 in quarters of negative consumption growth, whereas the average dispersion in realized risk-adjusted returns increases by 0.414 in NBER

[11] In unreported tests, I verify whether portfolio turnover is larger in bad states than in good states. Using regressions similar to those in Table 7, I find that turnover is significantly larger in NBER recessions than in non-recessions. This finding, however, does not hold when periods of negative consumption growth proxy for bad states of the economy.

recession quarters and by 0.551 in quarters of negative consumption growth. These results suggest that fund managers pick portfolios that diverge more from the average mutual fund portfolio in bad states than in good states. This increase in divergence is unlikely to be due to the leverage effect that Black (1976) documents, because the regressions control for the concurrent level of market returns. Altogether, results in Table 7 suggest that fund managers are more active, in terms of portfolio risks, in bad states than in good states.

The second auxiliary implication I test here is a corollary of Proposition 2. In equilibrium, positive covariance between funds' active returns and the pricing kernel should result in the measurement of negative alphas, when the performance measure is misspecified. Hence, the model rationalizes the existence of mutual funds with negative expected alphas when these funds provide insurance against pricing kernel variations. Obviously, unlike the fund manager in my model, some fund managers in reality might not be skilled and might waste investors' money. Nonetheless, it seems important to verify whether, despite the "noise" introduced by unskilled fund managers, poorly performing funds tend to provide, on average, a good insurance against bad states. For each fund, I run a regression similar to the panel regressions from Table 3: I regress the fund's returns on the NBER recession indicator, the risk factors and the cross-products of the NBER recession indicator and the factors. A fund's OLS coefficient associated to $I(BadState)_t$ becomes my proxy for the sensitivity of the fund's return to the level of the pricing kernel.

In Table 8, I construct 10 decile portfolios based on unconditional alpha just as in Table 4, but I only consider the 2,124 funds that went through at least one NBER recession during the 1980–2005 period. For each decile portfolio, I present the mean unconditional alpha, expense ratio, total fee, and insurance provided by the funds. Panels A, B, and C show results when alpha is computed by the one-factor model of Jensen (1968), the three-factor model of Fama and French (1993), and the four-factor model of Carhart (1997), respectively.

Results for the three performance measures show differences between the average insurance provided by the funds in decile 1 and those in decile 10. These differences (at least 0.18%) are all economically significant given their monthly frequency. The difference for

Fama and French's (1993) three-factor model is statistically significant at the one-percent level. But as in Table 4, the empirical relationship studied is not strictly monotone as my model would predict. Still, these empirical results suggest that, as my model would predict, the countercyclicality of mutual fund performance is concentrated in funds with poor unconditional risk-adjusted performance and high fees. In unreported tests, I find that such patterns do not hold when using an indicator of negative consumption growth (a quarterly series) and quarterly data instead of monthly data (as in Table 4). The quarterly estimates of regression coefficients are more volatile than monthly estimates, which is not surprising since the median fund has only 32 quarterly return observations, and my performance measures require the estimation of up to 10 coefficients. For this reason, I believe results based on NBER recessions are more accurate and I focus on them.

Results in Table 8 might possibly depend on non-surviving funds. If it were the case, it would mean that, even though funds with poor unconditional performance can provide a good insurance against NBER recessions, mutual fund investors do not value this insurance as much as my model predicts. In the following test, I show this is not the case. I compare the state dependence in performance between "surviving" funds with negative past performance and "surviving" funds with positive past performance. Table 9 shows results from panel regressions similar to those in Table 3. But instead of aggregating the results over the whole sample, Panel A presents results only for funds with a negative realized risk-adjusted return in quarter $t-1$ (i.e., $\alpha_{it-1}+e_{it-1}$) that survive in quarter t, whereas Panel B presents results only for funds with a positive realized risk-adjusted return in quarter $t-1$ that survive in quarter t. Results presented in Table 9 are thus unlikely to be driven by non-surviving funds.

According to Table 9, funds that perform negatively in a given quarter and that survive until the next quarter tend to provide a significant insurance against NBER recessions in the following quarter, whereas funds that perform positively in a given quarter and that survive until the next quarter tend to provide the opposite of an insurance in the following quarter. This finding suggests that the sub-sample of surviving funds with negative unconditional performance may generate most of the insurance associated with actively managed U.S. equity funds. Consequently, my model provides a rationale for their survivorship.[12]

This finding also gives credit to the theory I develop in this paper. When an econometrician uses a misspecified performance measure, the unconditional risk-adjusted performance of an asset priced in equilibrium should be negatively related to the level of insurance against pricing kernel variations this asset provides. Consequently, observing simultaneously negative unconditional performance and positive conditional performance in bad states of the economy, for any important asset class, can be caused by a misspecification in the performance measure rather than by an irrational mispricing for the whole asset class. Hence, the sensitivity of measured performance to proxies of bad states could be used as a measure of misspecification in a given asset pricing model, a role similar to that played by firm size in Berk (1995).

Overall, I draw the following conclusions from the empirical work this section reports. First, results suggest that fund managers are more active in bad states than in good states—the market risk of their portfolios is updated more and their portfolios diverge more from the average mutual fund portfolio, in terms of risk, in bad states than in good states. Second, funds with poor unconditional risk-adjusted performance tend to provide a good insurance against NBER recessions, which might explain the survival of these funds and might suggest the existence of a recession-related misspecification in popular performance measures. To the best of my knowledge, these findings are novel in the literature.

[12]In unreported regressions, I investigate whether findings about the insurance against bad states can be driven by small mutual funds only or the opposite. I find that funds that are larger than the median in a given quarter and funds that are smaller than the median in a given quarter all provide, on average, a similar insurance against bad states in the following quarter.

8 Conclusion

In this paper, I derive a rational model that reproduces the following empirical facts: the unconditional risk-adjusted performance of actively managed U.S. equity funds is negative, the funds' performance is systematically better in bad states of the economy than in good states, and poorly performing funds charge high fees compared to other funds. The model focuses on the optimal active management policies of a fund manager able to generate active returns specific to the state of the economy. Facing rational investors who competitively supply him with money, the fund manager will find optimal to partially insure investors against bad states of the economy (i.e., states in which the pricing kernel is high). My model shows that a performance measure that does not allow for a perfect specification of the true pricing kernel will underestimate the value created by active management when active returns are positively correlated with the pricing kernel. Consequently, the skilled fund manager in my model will wrongly appear to be underperforming passive investment strategies, yet mutual fund investing will be rational.

In addition to deriving the model, I document empirically its implications. First, I use data on 3,260 funds over the 1980–2005 period to illustrate the empirical facts my model rationalizes. Second, I calibrate the model to the U.S. economy and reproduce quantitatively the measured underperformance of U.S. funds. Third, I document novel empirical evidence consistent with the model's auxiliary predictions. Fund managers seem to be more active in bad states of the economy than in good states (in terms of portfolio risks). Also, mutual funds with poor unconditional performance also tend to provide a good insurance against NBER recessions, which might explain the survival of these funds and might suggest the existence of a recession-related misspecification in popular performance measures.

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A Appendix

A.1 Sample Selection

I use the CRSP Survivorship-Bias-Free Mutual Fund database. The sample covers the time period from 1980 to 2005. The CRSP mutual fund database includes information on fund's returns, fees, investment objectives, and other fund characteristics, such as assets under management and turnover.

I use a similar sample to that of Kacperczyk, Sialm, and Zheng (2007) and focus the analysis on actively managed open-end domestic diversified equity mutual funds and eliminate balanced, bond, money market, international, sector, and index funds. I exclude funds that hold less than 10 stocks and those that invest less than 80 percent of their assets in equity.[13] For funds with multiple share classes, I compute fund-level variables by aggregating across the different share classes and eliminate duplicate share classes.

Elton, Gruber, and Blake (2001) and Evans (2006) document a bias in the CRSP mutual fund database. Fund families occasionally incubate several private funds—the track records of the surviving funds are made public, but the track records of terminated funds are kept private. To address this bias, I try to exclude all observations of funds that are in their incubation period. I exclude observations for which the observation year precedes the reported fund starting year and observations with missing fund name. Since incubated funds tend to be small, I also exclude funds that had less than $5 million in assets under management at the beginning of the quarter.

The current sample includes 3,260 distinct funds and 82,081 fund-quarter observations. The number of funds in each quarter ranges from 158 (1980, Q2) to 1,636 (2001, Q4). Table 1 reports summary statistics for the main fund attributes.

[13] I thank Marcin Kacperczyk and Amit Seru for giving me access to part of their data.

A.2 Relaxing the Mean Independence Assumption

Here, I relax the assumption that ϵ is mean independent from the level of $\widehat{m}$ (i.e., $E[\epsilon|\widehat{m}] = 0$ for all levels of $\widehat{m}$). I replace this assumption with the less restrictive assumption that ϵ is uncorrelated with the proxy $\widehat{m}$ (i.e., $E[\epsilon] = E[\widehat{m}\epsilon] = 0$). I find that

Proposition 4. *Using a second-order Taylor expansion for the disutility-of-effort function $D(\cdot)$ around a given value $\overline{a}$, the measured fund performance can be approximated by:*

$$E[\alpha] \approx -\frac{U'(f^*)}{D''(\overline{a})} r_0^2 var(\epsilon), \tag{19}$$

which is negative if $var(\epsilon) > 0$ and equal to zero otherwise.

Proof. Since $D(\cdot)$ is twice-differentiable, $D(a_s^*)$ can be approximated around a given $\overline{a}$ by:

$$D(a_s^*) \approx D(\overline{a}) + D'(\overline{a})(a_s^* - \overline{a}) + \frac{1}{2} D''(\overline{a})(a_s^* - \overline{a})^2. \tag{20}$$

The first-order condition (5) becomes $U'(f^*) r_0 m_s \approx D'(\overline{a}) + D''(\overline{a})(a_s^* - \overline{a})$, or equivalently $a_s^* \approx \overline{a} - \frac{D'(\overline{a})}{D''(\overline{a})} + \frac{U'(f^*)}{D''(\overline{a})} r_0 m_s$.

Inserting this approximation into equation (9) gives:

$$E[\alpha] \approx -\frac{U'(f^*)}{D''(\overline{a})} r_0^2 var(\epsilon). \tag{21}$$

Since $D(\cdot)$ is strictly convex and twice-differentiable, $D''(\overline{a})$ is strictly positive. Hence, the approximated $E[\alpha]$ is strictly negative if $var(\epsilon) > 0$ and equals zero otherwise. □

Under the less restrictive assumption that ϵ is uncorrelated with $\widehat{m}$, expected risk-adjusted performance can be approximated by a number that can be no greater than zero. This approximation is exact when $D(\cdot)$ is quadratic. Hence, the derivations using a quadratic disutility function in Section 6 hold even if I relax the assumption that ϵ is mean independent from $\widehat{m}$ and replace it with the less restrictive assumption that ϵ is uncorrelated with $\widehat{m}$.

Table 1: Summary Statistics

This table presents summary statistics for the sample of 3,260 actively managed U.S. equity mutual funds over the 1980–2005 period from the CRSP Survivorship-Bias-Free Mutual Fund database.

	Mean	S.D.	Median	25%	75%
Asset Size ($M)	939.94	3697.02	159.08	46.98	558.73
Age (years)	13.02	14.23	8.00	4.00	16.00
Turnover (%, per year)	91.90	122.02	67.00	35.20	114.51
Expense Ratio (%, per year)	1.29	0.51	1.23	0.97	1.54
Front-Load Fee (%)	1.70	2.38	0.00	0.00	3.44
Back-Load Fee (%)	0.52	0.96	0.00	0.00	0.80
Raw Return (%, per quarter)	2.62	10.47	3.13	-2.26	8.68

Table 2: Unconditional Mutual Fund Performance

This table presents results from panel regressions measuring the unconditional performance of actively managed U.S. equity mutual funds over the 1980–2005 period. I measure the risk-adjusted performance of funds using Jensen's (1968) one-factor model, Fama and French's (1993) three-factor model, and Carhart's (1997) four-factor model. MKT_t, SMB_t, HML_t, and MOM_t are the returns at time t on four zero-cost portfolios: U.S. stock market (minus risk-free rate), size, value, and momentum. Quarterly data are used. Returns are in % terms. All regressions include fund fixed effects. Standard errors reported between brackets are corrected for heteroskedasticity and within-fund correlation. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively.

Dependent Variable: Fund Excess Return$_t$ (%, per quarter)			
	(1)	(2)	(3)
Intercept	-0.101	-0.229	-0.334
	[0.010]***	[0.016]***	[0.019]***
MKT_t	1.026	0.985	0.996
	[0.006]***	[0.003]***	[0.004]***
SMB_t		0.203	0.212
		[0.008]***	[0.009]***
HML_t		0.032	0.043
		[0.010]***	[0.009]***
MOM_t			0.026
			[0.004]***
Observations	82081	82081	82081
Number of Funds	3260	3260	3260
R^2	0.73	0.74	0.74
Fund Fixed Effects	Yes	Yes	Yes

Table 3: Mutual Fund Performance Conditional on States of the Economy
This table presents results from panel regressions measuring the performance of actively managed U.S. equity mutual funds over the 1980–2005 period, allowing regression coefficients to take values that differ between bad states (denoted by the indicator function $I(BadState)_t$) and good states. Panels A and B show results when the proxy for bad states is NBER recessions and periods of negative (per-capita) consumption growth respectively. I measure the risk-adjusted performance of funds using Jensen's (1968) one-factor model, Fama and French's (1993) three-factor model, and Carhart's (1997) four-factor model. MKT_t, SMB_t, HML_t, and MOM_t are the returns at time t on four zero-cost portfolios: U.S. stock market (minus risk-free rate), size, value, and momentum. Quarterly data are used. Returns are in % terms. All regressions include fund fixed effects. Standard errors reported between brackets are corrected for heteroskedasticity and within-fund correlation. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively.

	Dependent Variable: Fund Excess Return$_t$ (%, per quarter)					
	Panel A. NBER Recession			Panel B. Consumption Growth < 0		
	(1)	(2)	(3)	(4)	(5)	(6)
$Intercept$	-0.097	-0.218	-0.367	-0.101	-0.220	-0.309
	[0.012]***	[0.019]***	[0.019]***	[0.013]***	[0.019]***	[0.023]***
$I(BadState)_t$	0.289	0.121	0.414	0.268	0.323	0.513
	[0.055]***	[0.072]*	[0.078]***	[0.085]***	[0.088]***	[0.127]***
MKT_t	1.005	0.982	0.994	1.022	0.975	0.985
	[0.006]***	[0.003]***	[0.004]***	[0.007]***	[0.003]***	[0.004]***
$MKT_t * I(BadState)_t$	0.106	0.037	0.028	0.034	0.042	0.032
	[0.007]***	[0.021]*	[0.020]	[0.006]***	[0.007]***	[0.006]***
SMB_t		0.204	0.207		0.228	0.233
		[0.009]***	[0.009]***		[0.009]***	[0.009]***
$SMB_t * I(BadState)_t$		-0.073	-0.114		-0.119	-0.144
		[0.016]***	[0.017]***		[0.018]***	[0.023]***
HML_t		0.033	0.050		0.049	0.058
		[0.010]***	[0.009]***		[0.010]***	[0.010]***
$HML_t * I(BadState)_t$		-0.053	-0.034		-0.103	-0.114
		[0.031]*	[0.032]		[0.013]***	[0.013]***
MOM_t			0.037			0.022
			[0.005]***			[0.005]***
$MOM_t * I(BadState)_t$			-0.076			-0.038
			[0.016]***			[0.012]***
Observations	82081	82081	82081	82081	82081	82081
Number of Funds	3260	3260	3260	3260	3260	3260
R^2	0.73	0.74	0.74	0.73	0.74	0.74
Fund Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Table 4: Unconditional Performance and Fees

This table presents the mean unconditional alpha, expense ratio and total fee of ten decile portfolios sorted on unconditional alpha. Panels A, B and C show results when alpha is computed using Jensen's (1968) one-factor model, Fama and French's (1993) three-factor model, and Carhart's (1997) four-factor model, respectively. I use monthly data during the 1980–2005 period to compute the alpha over the entire life span of each actively managed U.S. equity mutual fund. Deciles with negative unconditional alpha are highlighted. Total fee is measured as expense ratio + (1/7)*front-load fee. Numbers are in % terms. The differences between the averages of decile 1 and 10 are reported with their standard errors. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively.

Decile (Alpha)	Alpha (%, per month)	Expenses (%)	Total Fee (%)
	Panel A. One-Factor Model		
1	-1.35	1.67	1.89
2	-0.51	1.52	1.77
3	-0.31	1.38	1.63
4	-0.19	1.35	1.60
5	-0.09	1.27	1.51
6	-0.01	1.23	1.44
7	0.09	1.23	1.46
8	0.22	1.34	1.58
9	0.42	1.35	1.50
10	1.21	1.45	1.65
1-10	-2.56	0.21	0.24
	[0.09]***	[0.04]***	[0.05]***
	Panel B. Three-Factor Model		
1	-1.84	1.70	1.93
2	-0.47	1.45	1.67
3	-0.29	1.37	1.61
4	-0.19	1.30	1.54
5	-0.12	1.29	1.51
6	-0.05	1.27	1.49
7	0.02	1.25	1.47
8	0.11	1.26	1.48
9	0.27	1.41	1.63
10	1.82	1.48	1.69
1-10	-3.65	0.22	0.23
	[0.98]***	[0.04]***	[0.05]***
	Panel C. Four-Factor Model		
1	-1.47	1.68	1.89
2	-0.46	1.46	1.70
3	-0.29	1.42	1.67
4	-0.19	1.37	1.60
5	-0.12	1.29	1.51
6	-0.06	1.20	1.41
7	0.01	1.27	1.49
8	0.11	1.26	1.49
9	0.25	1.37	1.60
10	1.36	1.47	1.68
1-10	-2.83	0.21	0.21
	[0.25]***	[0.04]***	[0.05]***

Table 5: Moment Values for the Calibration

This table presents moment values used in the calibration of the model to the U.S. economy over the 1980–2005 period.

	Symbol	Value
Mutual Fund Fee	f^*	1.53%
Net Risk-Free Rate	$r_0 - 1$	5.97%
Mean Passive Excess Return	$E\left[r^e\right]$	7.99%
Std. Dev. of r^e	$\sqrt{var(r^e)}$	16.17%

Table 6: Summary Statistics for Mutual Fund Risk Regressions

This table presents summary statistics for the measures of managerial activity for the sample of 3,260 actively managed U.S. equity mutual funds over the 1980–2005 period from the CRSP Survivorship-Bias-Free Mutual Fund database.

	Mean	S.D.	Median	25%	75%
β_{it}	0.993	0.183	0.983	0.896	1.080
$\lvert\beta_{it} - \overline{\beta_t}\rvert$	0.128	0.125	0.093	0.042	0.174
$\lvert\beta_{it} - \beta_{it-1}\rvert$ (per quarter)	0.031	0.035	0.020	0.009	0.040
$(\alpha_{it} + e_{it})$ (%, per quarter)	-0.300	3.586	-0.285	-1.979	1.391
$\lvert(\alpha_{it} + e_{it}) - \overline{(\alpha_t + e_t)}\rvert$ (%, per quarter)	2.363	2.525	1.648	0.738	3.136

Table 7: Mutual Fund Risks

This table presents results from panel regressions of the quarterly adjustment in market risk $|\beta_{it} - \beta_{it-1}|$, the cross-sectional dispersion in market risk $|\beta_{it} - \overline{\beta_t}|$, and the cross-sectional dispersion in realized risk-adjusted returns $|(\alpha_{it} + e_{it}) - \overline{(\alpha_t + e_t)}|$ on lagged fund characteristics, an indicator function $I(BadState)_t$ of bad state, contemporaneous fund flows, market returns, and three indicator functions identifying quarters. Regressions with odd numbers use NBER recessions to proxy for bad states, whereas regressions with even numbers use periods of negative (per-capita) consumption growth. I use quarterly data for actively managed U.S. equity mutual funds over the 1980–2005 period. Expenses, returns (including $\alpha_{it} + e_{it}$), and flows are in % terms. All regressions include fund fixed effects. Standard errors reported between brackets are corrected for heteroskedasticity and within-fund correlation. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively.

Dependent Variable:	$\lvert\beta_{it} - \beta_{it-1}\rvert$		$\lvert\beta_{it} - \overline{\beta_t}\rvert$		$\lvert(\alpha_{it} + e_{it}) - \overline{(\alpha_t + e_t)}\rvert$	
	NBER	$\Delta c_t < 0$	NBER	$\Delta c_t < 0$	NBER	$\Delta c_t < 0$
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.027	0.028	0.143	0.140	2.278	2.176
	[0.002]***	[0.002]***	[0.012]***	[0.012]***	[0.150]***	[0.153]***
$I(BadState)_t$	0.014	0.006	0.015	0.020	0.414	0.551
	[0.001]***	[0.001]***	[0.002]***	[0.002]***	[0.039]***	[0.042]***
$Log(Assets_{t-1})$	-0.001	-0.001	-0.006	-0.006	0.069	0.076
	[0.000]***	[0.000]***	[0.002]***	[0.002]***	[0.024]***	[0.024]***
Age_{t-1}	0.000	0.000	0.002	0.002	-0.015	-0.014
	[0.000]***	[0.000]***	[0.000]***	[0.000]***	[0.004]***	[0.004]***
$Expenses_{t-1}$	0.001	0.000	-0.005	-0.006	-0.078	-0.088
	[0.001]	[0.001]	[0.007]	[0.007]	[0.082]	[0.083]
$Flow_t$	0.000	0.000	0.000	0.000	0.002	0.002
	[0.000]	[0.000]	[0.000]**	[0.000]***	[0.001]**	[0.001]**
MKT_t	0.000	0.000	0.000	0.000	-0.029	-0.025
	[0.000]***	[0.000]***	[0.000]***	[0.000]***	[0.001]***	[0.001]***
$I(Quarter2)_t$	-0.005	-0.003	-0.001	0.003	-0.117	-0.018
	[0.000]***	[0.000]***	[0.000]**	[0.000]***	[0.022]***	[0.022]
$I(Quarter3)_t$	-0.004	-0.003	-0.005	-0.002	-0.037	0.032
	[0.000]***	[0.000]***	[0.001]***	[0.000]***	[0.022]*	[0.022]
$I(Quarter4)_t$	0.003	0.005	0.000	0.002	0.276	0.344
	[0.000]***	[0.000]***	[0.000]	[0.000]***	[0.027]***	[0.027]***
Observations	62010	62010	63561	63561	63561	63561
Number of Funds	2620	2620	2688	2688	2688	2688
R^2	0.21	0.20	0.53	0.53	0.23	0.23
Fund Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Table 8: Unconditional Performance and Insurance Against NBER Recessions This table presents the mean unconditional alpha and insurance against NBER recessions provided by 10 decile portfolios sorted on unconditional alpha. The insurance provided by a given fund is defined as the difference in conditional alpha measured over the fund's entire life span between NBER recessions and non-recessions. Panels A, B and C show results when alpha is computed using Jensen's (1968) one-factor model, Fama and French's (1993) three-factor model, and Carhart's (1997) four-factor model, respectively. I use monthly data for the 2,124 actively managed U.S. equity mutual funds that went through at least one recession over the 1980–2005 period to compute alpha and the level of insurance provided over the entire life span of each fund. Deciles with negative unconditional alpha are highlighted. Total fee is measured as expense ratio + (1/7)*front-load fee. Numbers are in % terms. The differences between the averages of decile 1 and 10 are reported with their standard errors. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively.

Decile (Alpha)	Alpha (%, per month)	Expenses (%)	Total Fee (%)	Insurance (%, per month)
	Panel A. One-Factor Model			
1	-0.89	1.73	1.99	0.12
2	-0.37	1.40	1.70	-0.10
3	-0.23	1.38	1.65	0.10
4	-0.13	1.31	1.58	-0.23
5	-0.05	1.20	1.43	0.12
6	0.03	1.19	1.45	-0.06
7	0.12	1.26	1.52	-0.09
8	0.26	1.29	1.51	-0.08
9	0.45	1.35	1.52	-0.01
10	1.16	1.46	1.64	-0.06
1-10	-2.04	0.28	0.35	0.18
	[0.08]***	[0.05]***	[0.06]***	[0.23]
	Panel B. Three-Factor Model			
1	-0.87	1.70	1.96	0.15
2	-0.36	1.43	1.69	0.18
3	-0.24	1.30	1.53	0.13
4	-0.17	1.34	1.58	-0.05
5	-0.10	1.25	1.48	-0.02
6	-0.04	1.26	1.51	0.00
7	0.03	1.23	1.48	-0.18
8	0.11	1.25	1.51	-0.65
9	0.25	1.33	1.57	-0.36
10	0.85	1.47	1.68	-0.64
1-10	-1.72	0.23	0.28	0.80
	[0.09]***	[0.05]***	[0.06]***	[0.30]***
	Panel C. Four-Factor Model			
1	-0.94	1.69	1.93	0.57
2	-0.37	1.48	1.75	-0.10
3	-0.24	1.34	1.59	0.10
4	-0.16	1.34	1.59	-0.23
5	-0.10	1.32	1.56	0.12
6	-0.05	1.18	1.40	-0.06
7	0.01	1.28	1.52	-0.09
8	0.10	1.20	1.44	-0.08
9	0.22	1.28	1.53	-0.01
10	0.81	1.47	1.69	-0.06
1-10	-1.75	0.23	0.24	0.63
	[0.11]***	[0.05]***	[0.06]***	[0.47]

Table 9: Lagged Performance and Insurance against NBER Recessions

This table presents results from panel regressions measuring the performance of actively managed U.S. equity mutual funds over the 1980–2005 period, allowing regression coefficients to take values that differ between NBER recessions (denoted by the indicator function $I(BadState)_t$) and non-recessions. I measure the risk-adjusted performance of funds using Jensen's (1968) one-factor model, Fama and French's (1993) three-factor model, and Carhart's (1997) four-factor model. MKT_t, SMB_t, HML_t, and MOM_t are the returns at time t on four zero-cost portfolios: U.S. stock market (minus risk-free rate), size, value, and momentum. Panel A presents results only for funds with a negative realized risk-adjusted return in the previous quarter, whereas Panel B presents results only for funds with a positive realized risk-adjusted return in the previous quarter. Realized risk-adjusted return is defined as fund i's realized excess return over the required rate of return suggested by the "associated" factor model in period $t-1$ (i.e., $\alpha_{it-1} + e_{it-1}$); a column presenting results from a K-factor model uses only funds with a lower realized return in the previous quarter than the return the K-factor model requires. Quarterly data are used. Returns are in % terms. All regressions include fund fixed effects. Standard errors reported between brackets are corrected for heteroskedasticity and within-fund correlation. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively.

	Dependent Variable: Fund Excess Return$_t$ (%, per quarter)					
	Panel A. Only if $\alpha_{it-1} + e_{it-1} < 0$			Panel B. Only if $\alpha_{it-1} + e_{it-1} > 0$		
	(1)	(2)	(3)	(4)	(5)	(6)
$Intercept$	-0.949	-0.508	-0.510	0.726	0.125	-0.266
	[0.023]***	[0.024]***	[0.028]***	[0.012]***	[0.033]***	[0.034]***
$I(BadState)_t$	1.768	0.680	1.015	-1.160	-0.433	-0.125
	[0.133]***	[0.124]***	[0.142]***	[0.122]***	[0.140]***	[0.143]
MKT_t	1.040	0.997	1.014	0.982	0.974	0.972
	[0.007]***	[0.005]***	[0.005]***	[0.008]***	[0.005]***	[0.005]***
$MKT_t * I(BadState)_t$	0.047	0.038	0.030	0.160	0.158	0.154
	[0.009]***	[0.031]	[0.031]	[0.010]***	[0.028]***	[0.029]***
SMB_t		0.151	0.156		0.211	0.220
		[0.011]***	[0.011]***		[0.012]***	[0.013]***
$SMB_t * I(BadState)_t$		-0.036	-0.102		-0.138	-0.159
		[0.026]	[0.029]***		[0.025]***	[0.031]***
HML_t		0.163	0.021		-0.084	0.081
		[0.012]***	[0.010]**		[0.013]***	[0.013]***
$HML_t * I(BadState)_t$		-0.172	0.098		0.223	0.010
		[0.049]***	[0.051]*		[0.051]***	[0.052]
MOM_t			-0.006			0.092
			[0.006]			[0.008]***
$MOM_t * I(BadState)_t$			-0.071			-0.091
			[0.024]***			[0.023]***
Observations	32779	34518	34648	30031	28292	28162
Number of Funds	2532	2551	2553	2501	2493	2495
R^2	0.79	0.77	0.78	0.74	0.77	0.74
Fund Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

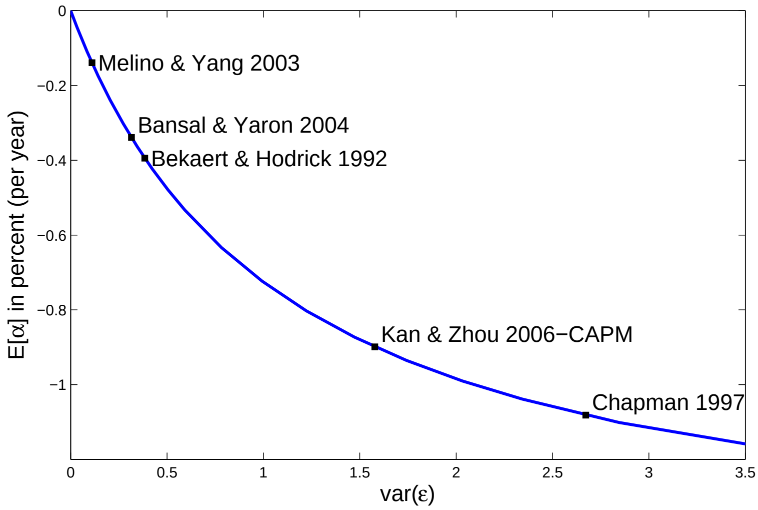

Figure 1: Misspecification and Mutual Fund Performance

This figure plots the relationship between expected risk-adjusted performance $E[\alpha]$ and the degree of misspecification in the performance measure $var(\epsilon)$ when the model is calibrated to the U.S. economy over the 1980–2005 period (see Table 5). The figure also identifies the $E[\alpha]$ associated to each level of $var(\epsilon)$ implied by the empirical estimates of $var(m)$ reported by Bekaert and Hodrick (1992), Chapman (1997), Melino and Yang (2003), Bansal and Yaron (2004), and Kan and Zhou (2006) (based on the CAPM).