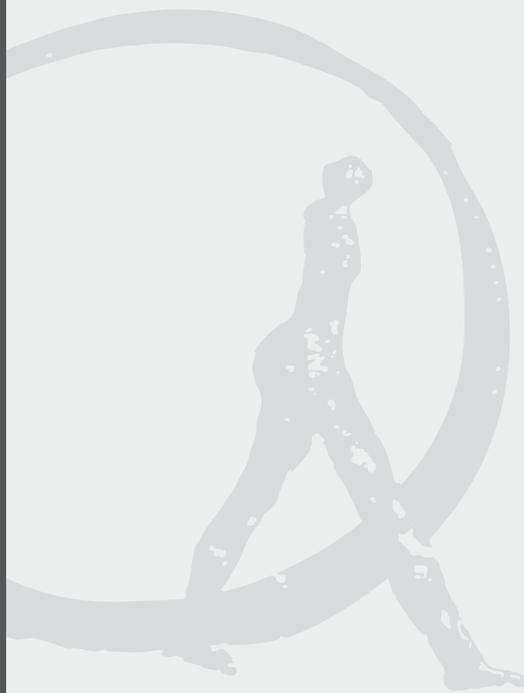


# Fees at Risk

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**Bernhard Scherer**

Professor of Finance, EDHEC Business School

## Abstract

Hull (2007) writes: "For an asset manager the greatest risk is operational risk". In 2008, however, asset management companies came under severe pressure not from operational risk, but from market risk. What had been seen as an annuity stream that was thought to expose firms to little or no earnings risk turned out to be directional stock market exposure combined with high operational leverage. Asset management companies, however, should hedge the risks of large swings in their P&L due to changes in asset-based fees in accordance with well established risk management principles. While alpha risks are regarded as core risks (it is the business of an asset management company to exploit these risks in return for fees), beta risks arising from client benchmark exposure are incidental. We suggest both the hedging of production risk (fees at risk) and capital market related business risk (redemptions by clients either to shed risk or to raise cash).

A revisited version of this working paper is forthcoming in the *Journal of Applied Corporate Finance*.

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## 1. Introduction

"For an asset manager the greatest risk is operational risk" (Hull, 2007, p. 372). In 2008, however, asset management companies came under severe pressure not from operational risk, but from market risk. What had been seen as an annuity stream that was thought to expose firms to little or no earnings risk turned out to be directional stock market exposure combined with high operational leverage (a high ratio of fixed to variable costs). While operational leverage led to what has been praised as scalable business (low costs of taking on additional business), it was always clear that this would lead to massive losses in bad times. In short, asset managers partially share clients' benchmark risks. As client benchmarks went down, so did asset-based fees (a percentage fee applied to average assets under management over a year), the most common type of fee agreement in the asset management industry.

At the same time, operational leverage increased the downturn in profits. A small example should make the mechanics clear. Suppose an asset manager with €100 billion assets under management, fees of 50bps, total costs of 35bps, and operational leverage of 90% (31.5bps in fixed costs). At the outset the expected profits for the year are €150 million. For a benchmark volatility of  $\sigma = 30\%$  asset-based fees will be exposed to 17% variability (see the next section for the plausibility and calculation of these numbers). In other words, asset management revenue will be down by about 35% in a two-sigma event. Should average assets under management fall by 35% all profits will be wiped out and the company will be left with a loss of €12.75 million.<sup>1</sup> A 35% reduction in revenues led to a fall in profits of more than 100%. Operational leverage leads to a reduction in profits that is many times greater than the reduction in revenue (fees). This number assumes no redemptions and no shifts from high-fee equity products to low-fee fixed-income funds.

Given the size of this result, it is surprising that asset managers made no effort to reduce a source of risk that is outside their control. In fact, year after year, careful business plans are drafted with detailed planning of new flows and revenues coming from existing and new clients, distribution channels, etc., while markets continue to make a complete mockery of these exercises. Even a plus or minus one sigma event on market returns leads to windfall gains or losses that are beyond the control of an asset management firm. While one could make the point that asset managers have a competitive advantage in assessing and taking stock market risks,<sup>2</sup> this point would also have required them to manage these risks actively over time. They did not.

The paper is organized as follows. Section 2 introduces some closed-form solutions to approximate the volatility of asset management fees and provides examples of the closeness of these approximations. Section 3 tests our conjecture that asset management is not an annuity business for T. Rowe Price. Section 4 tries to explain the current failure of actively hedging fees at risk as a combination of misapplication of financial theory and corporate governance problems. Section 5 reviews the case for hedging and Sections 6 and 7 attempt to describe what and how to hedge.<sup>3</sup> Two appendices contain technical material.

## 2. Fees at Risk

To assess the potential impact of market exposure on an asset manager's P&L, we must find an expression for the volatility of asset management fees. Since asset-based fees are a percentage of the average assets under management over a time period, the calculations are slightly more complicated than usual value-at-risk calculations. Asset-based fees contain both benchmark (beta) as well as non-benchmark (alpha) exposure. Unless stated otherwise, we focus exclusively on the client-imposed benchmark component. We assume that the alpha component of asset-based fees is negligible, which will be true for most mandates. Using standard results from derivatives pricing, we can approximate the volatility of annual asset management revenues by<sup>4</sup>

1 - At a lower operational leverage of 50% (with the same total costs at the beginning of the year) profits would have still been up to €36.25 million.

2 - That few managers engage in market timing suggests that beta timing is not regarded by asset management firms as a core competency from which they can earn profits.

3 - Writing a paper on this subject might seem pro-cyclical or the work of someone confusing hindsight with risk management. However, all the building blocks used in this paper have long been readily available; for people to listen, it simply takes a crisis.

4 - See appendix A for a derivation of (1) and its underlying assumptions together with an expression for "Fees at Risk". Appendix B provides a brief simulation study on its approximating properties.

$$(1) \sigma(\tilde{f}_{t+n}) \approx \theta \cdot A_t \sqrt{\left( \frac{2e^{\sigma^2} - 2(1 + \sigma^2)}{\sigma^4} \right) \left( \frac{2e^{\sigma^2} - 2(1 + \sigma^2)}{\sigma^4} - 1 \right)}$$

where  $A_t$  is assets under management at time  $t$ ,  $\theta$  percentage fees and  $\sigma$  the volatility of asset returns underlying the calculation of average assets under management. For those who prefer simpler formulas, it is also possible to use:

$$(2) \sigma(\tilde{f}_{t+n}) \approx \theta \cdot A_t \frac{\sigma}{\sqrt{3}}$$

This formula will provide very similar results. Instead of using the arithmetic average, it is based on the geometric average.<sup>5</sup> An example will illustrate both the quality of the approximations and the extent of "fees at risk" in asset management companies. Exhibit 1 calculates the volatility of average asset prices under approximations in (1) and (2) as well as the "true" bootstrapped volatility.

Exhibit 1: Volatility of average stock prices

$\sigma$	Approx.: (1)	Approx.: (2)	Bootstrapping
50%	31.1%	28.9%	30.5%
40%	24.2%	23.1%	24.1%
30%	17.8%	17.3%	17.9%
20%	11.7%	11.5%	11.9%
10%	5.8%	5.8%	5.9%

Both approximations work remarkably well compared to the "true" value from bootstrapping. The simpler approximation in (2), however, seems to persistently underestimate the volatility of asset management fees. For lower volatility figures, the approximations become increasingly better. Fee volatility for a European equity mandate with 30% volatility (not unusual in 2008) is around 18%. Too large to be left unmanaged. The corresponding P&L volatility can lead to staff defections and organizational instability. Clients prefer stable and profitable asset management firms whose ability to maintain key staff and to invest in the required infrastructure and IT enables long-term investment strategies. Large swings in asset management profitability are often accompanied by asset outflows, poor client perception, consultant downgrades, questions about independence, and short-term cost cutting that often comes at client expense. The costs incurred in 2008 were a perfect example of the frictional costs of P&L volatility. We will provide a deeper understanding of these forces in the next sections.

### 3. Current Orthodoxy—Why Did Asset Managers Fail to Hedge Their P&L?

Asset management firms failed to protect their revenues against a downturn in markets. Rather than being an annuity business, these firms shared their clients' benchmark risks, and while their clients actively managed that exposure, asset managers did not. What *Zeitgeist* caused this risk management failure?

The first argument against hedging runs as follows. Holding financial assets requires an *ex ante* positive risk premium (in general, markets rise). Hedging asset-based fees (which would rise in tandem with the markets) will mean a long-term opportunity loss for shareholders. Why forgo the long-term windfall that upwards drifting markets would provide? How do we answer this concern? Let us review the basics of corporate finance. What projects should firms undertake? It is generally accepted in corporate finance that companies need not worry about their shareholders. Companies (their management) need worry only about engaging in positive NPV (net present value) projects. Is the positive expected fee growth from AUM growth driven by market returns a positive NPV project? The clear answer is no. This applies no matter how great the expected growth rate of assets. The reason for this apparently unintuitive proposition is that asset-based fees are the simplest form of a derivative contract (with assets under management as underlying).

5 - See Nelken (1996).

We know that the value of a derivative contract is independent of the real world growth rate of the underlying. As such, the growth rate does not matter. This is just rephrasing the fact that capital market investments provide zero NPV, or, as Ross (2005, p. 71) puts it: "since the fee is contingent on asset value as a contingent claim its current value is independent of expected rates of returns."

The second argument is slightly more sophisticated, as it relates to another cornerstone of financial economics: the famous Modigliani/Miller (MM) argument for hedging irrelevance. In frictionless markets, that is, in the absence of (frictional) bankruptcy costs or taxes, hedging would be irrelevant. So why should asset managers hedge asset management fees (by the same token, why should airlines hedge fuel price risk, or German sports car manufacturers dollar risk)? Couldn't shareholders of an asset management firm simply unwind the implicit beta exposure that comes with asset-based fees in their private portfolios? The trouble with the MM argument is that it rests on unrealistic assumptions. In reality, markets are not without friction. Hedging, for example, preserves costly liquidity or reduces frictional bankruptcy costs, which are particularly high in the banking industry. The great number of bank runs in 2008 has attested to these costs. In other words, the MM argument is irrelevant to the banking industry.<sup>6</sup> Reducing volatility in asset management earnings reduces not only frictional bankruptcy costs but also the need to tap capital markets when they are least willing to provide external financing.

The final argument that the author has been confronted with is what has been called intellectual risk. In other words, a hedging policy might be intellectually sound, but as soon as the hedge itself makes losses corporate memories seem to fade and nobody sees the offsetting gains of the hedged position. As such, the hedging policy might hedge corporate financial risk but not individual career risk. Just ask those airline treasurers who hedged their fuel costs at an oil price of \$140 a barrel. This argument is particularly relevant at the time of writing, when markets are believed to have hit rock bottom. While the author sympathizes with the risk manager in an asset management organization with intellectual risks, this seems rooted more in positive (why things are done) than in normative (how should things be done) theory. Intellectual risk is not so much a serious argument against hedging "fees at risk" as a problem of corporate governance.

Finally, it must be said that it is tempting for a CIO to be paid a large bonus on the basis of beta exposure and that shareholders, but not the CIO, may have incentives to reduce this exposure.<sup>7</sup> Managers paid with options (non-linear exposure to earnings variability) on the underlying business will see an increase in the value of their executive options if they fail to hedge the P&L against market risks. Hence, senior management often has good reason not to hedge fees at risk, even if (as we will argue in the next section) this will, on average, reduce shareholder value. Again, this is a corporate governance issue. The opposite is true for private partnerships (manager and owner coincide), where managers have a linear exposure to earnings variability. Hedging here would reduce income volatility and hence increase manager (and owner) utility.

#### **4. New Orthodoxy—Why Should Asset Managers Hedge Their P&L?**

It is well known that hedging is shareholder positive if it creates a positive NPV project.<sup>8</sup> Building on the previous section, we argue that while asset-based fees are zero NPV projects (not hedging them will create no negative NPV *per se*) they still create P&L risks that in a world with capital market frictions and taxes are costly. First, because it is necessary to hold cash against these risks to maintain a target rating, not hedging asset-based fees means that positive NPV projects (investing in new products, people, IT platforms, and so on) will not be undertaken. Real projects such as the opening of an office in Madrid, the new product development team, or the marketing

6 - Most asset management firms are still owned by banks. However, a similar argument applies to stand-alone firms. Asset management firms that record large losses are likely to be subject to heavier redemptions on client concerns about their ability to keep and recruit key staff, etc.

7 - Recall, for example, what happened to CIOs of real estate asset management firms in 2006 and 2007. During the property bubble their management was highly paid for running a long beta business and often earned internal promotions. When the bubble burst they left the firm exposed. The same, of course, applies to fixed-income managers who invested in credit versus a government bond benchmark up to 2007.

8 - All arguments used here have been available for many years in the corporate finance literature. A nice summary can be found in Doherty (2000). One contribution of this paper is to apply these thoughts to the business of managing client money.

campaign for a successful product get crowded out. If no cash is held as risk capital, not hedging P&L risk will increase the expected frictional bankruptcy costs and simultaneously limit the ability to leverage (and hence the ability to reap a tax shield or to use operational leverage). Unhedged swings in fee income will also increase the value of the tax option the government holds against the asset management firm. Taxes must be paid if profits are made, but with limited carry forward and backward no equal amount is received if losses are made. The larger these swings, the greater the value of this option. This argument obviously depends on whether the tax option is at the money.

Hedging P&L risk from capital market movements should also allow improved observability of effort in the principal agency relationship between firm management and shareholder. In other words, a CEO might have worked very hard and made all the right decisions, but because of falling equity markets end-of-year P&L is still negative. How can he convince the board that he should be paid incentive compensation when the board tells him that he is lucky to get another year to prove his leadership? Not only might management compensation driven by windfall gains and losses attract the less skilled (who would take risks he cannot control if he can avoid it?) but it might also discourage effort, as it is unlikely to be reliably observed by shareholders.

While we could think of many other channels through which risk management will increase value, 2008 taught the industry an unforgettable lesson. Losses on asset-based fees are greatest in severe downturns in which almost all asset classes fall in value and clients redeem assets *en masse* to shed risk or raise cash. And it is precisely in these states of the world that bank funding dries up. In other words, high correlation of revenue risks and funding risks clearly calls for hedging fees at risk. After all, hedging protects costly liquidity as losses exhaust internal capital that is much needed (preferred) to finance new projects (pecking order theory).

## 5. Case Study—Revenue Sensitivities of T. Rowe Price

If asset management companies fail to hedge their risks, they will show a considerable beta exposure to risky assets, *i.e.*, asset management will cease to be an annuity business. This conjecture has not been backed by empirical evidence. In this section, we therefore want to estimate the relationship between asset management revenues and stock market returns. We decide to use quintile regressions (QR) as well as ordinary least squares (OLS) to obtain a summary for this relationship across quintiles. We take this approach because we are interested in whether data in the tails of the conditional distribution exhibit a different sensitivity to changes in market returns than data around the central location. This would be very useful to know when calculating “fees at risk”.<sup>9</sup>

We select T. Rowe Price as the only publicly listed pure asset management company with a long enough history. For example, Schroders is publicly listed but it became an asset management company only in 2001, State Street and Northern Trust also run banking and custody businesses, and Janus has only a few years of data available. Our data stretch from 2007 to 1988. As a proxy for fee income, we take annual revenue growth from COMPUSTAT/FACTSET.<sup>10</sup> As a measure of market returns,  $r$ , we use both annual returns (for the MSCI World in USD), *i.e.*,  $r = \frac{S_{t+250}}{S_t} - 1$  as well as annual percentage changes in average price relative to prices at the start of a year:

$$r = \frac{\frac{1}{250} \sum_{i=1}^{250} S_{t+i}}{S_t} - 1.$$

9 - In general, QR provides an estimate of the quintile,  $q$ , of revenues,  $rev$ , as a linear function of our measure for market returns,  $\widehat{rev}_q | r = F_q^{-1}(q | r) = \alpha_q + \beta_q r$ , while an OLS regression takes the form  $\widehat{rev} = \alpha + \beta r$  is the inverse of the cumulative density function, conditional on our measure of market returns,  $r$ . In other words,  $F_q^{-1}(q | r)$  is the value at risk (conditional on  $r$ ) at the  $1-q$  confidence level as a linear function of  $r$ , where the regression sensitivities change with  $q$ . We can think of  $\beta_q$  as the solution to  $\beta_q = \underset{\beta}{\operatorname{argmin}} \sum_{i=1}^I d_i q |\varepsilon_i| + (1-d_i) |(1-q) \varepsilon_i|$ , where  $\varepsilon_i = rev_i - \alpha - \beta x_i$  and  $d_i = 1$  for  $\varepsilon_i \geq 0$  and otherwise. This compares to OLS as the solution to  $\beta_{OLS} = \underset{\beta}{\operatorname{argmin}} \sum_{i=1}^I \varepsilon_i^2$ .

10 - This will also contain changes in the asset mix over time as well as distributional strength and weakness.

We conjecture that the latter better represent the nature of asset-based fees. Table 1 shows our results.

Table 1: OLS and QR for annual revenue growth versus two measures of annual market performance. Regression of annual revenue growth versus two definitions of market returns for 2007-1988. Source: FACTSET/DATASTREAM.

Market return	$r = \frac{1}{250} \sum_{i=1}^{250} \frac{S_{t+i}}{S_t} - 1$					$r = \frac{S_{t+250}}{S_t} - 1$				
Sensitivities	$\beta_{OLS}$	$\beta_{0.3}$	$\beta_{0.5}$	$\beta_{0.7}$	$\beta_q = \beta$	$\beta_{OLS}$	$\beta_{0.3}$	$\beta_{0.5}$	$\beta_{0.7}$	$\beta_q = \beta$
T. Rowe	0.94	1.37	0.71	0.45	3.03	0.42	0.45	0.37	0.25	0.3
Price	(3.81)	(3.28)	(1.65)	(2.13)	0.06	(2.79)	(1.48)	(1.68)	(1.7)	0.74

The revenue sensitivity in an OLS regression<sup>11</sup> for our standard definition of market returns is 0.42 with a significant t-value of 2.79. This is a clear indication that asset management is not an "annuity business" but rather comes with substantial cyclical equity market exposure in its revenues. This is not to be confused with the stock market beta of T. Rowe Price. For example, the average annual beta of T. Rowe Price over the last twenty years has been about 1.58. Hardly an annuity business but also driven by leverage. The above measure aims at the impact of markets on revenues directly.

The skeptical reader, however, might reply that 0.42 looks low. Let us investigate this claim. We can prove under fairly standard assumptions (see appendix C) that fee sensitivities  $\beta_{fee}$  in an OLS regression will converge against half the asset class beta,  $\beta$ , as averaging becomes continuous ( $n \rightarrow \infty$ ), i.e.:

$$(3) \quad \beta_{rev} = \frac{(1 + \frac{n-1}{2})\beta\sigma_m^2 n}{\sigma_m^2 n^2} = \frac{\beta(1 + \frac{n-1}{2})}{n} \underset{n \rightarrow \infty}{=} \frac{\beta}{2}$$

In other words, the averaging process for fee income hides some market exposure. If we use returns on the average price as a market return, the sensitivity roughly doubles (to 0.94) and t-values increase. The low beta is a result of the averaging, not an indication of low market exposure. We also find that beta in the more extreme quintiles ( $q = 0.3, 0.5$ ) provides more significant t-values. The zero hypothesis that all quintile betas are equal can be rejected in this case, with a *p-value* of 6%.<sup>12</sup>

Ideally, we would prefer a zero equity beta in our revenue stream. Beta exposure, of course, carries no implicit reward (zero NPV), but it comes at deadweight volatility costs (described in the previous section), i.e., eventually a negative NPV.

Some readers might wonder: Don't all businesses have some beta sensitivity in their revenue streams? Demand will rise if the economy is doing well and vice-versa. True, but first some of that beta is part of the firm's core risk-taking business. Extend your sports car production in a boom, reduce your lorry production before demand for cars (recession) falters. Second, this relation is fuzzy and indirect for most businesses, while the way asset management fees are calculated creates a direct one-to-one relationship between market risk and revenue risk that is not desirable from a shareholder's perspective.

## 6. What to Hedge?

We have talked about why hedging P&L risk is NPV positive for an asset manager, but we have been very narrow (we focused on the beta part of asset-based fees, assuming no redemptions or client-specific risks) about exactly what we should hedge. This section tries to provide

11 - See Lewent and Kearney (1993) for a similar approach applied to currency risks.  
12 - We use ANOVA to test, using the variance of residuals for different conditional means.

more context. Let us divide risks into production risks and business risks to get some further insight.

Production risks are a by-product of managing client money. Both asset- and performance-based fees fall into this category. Production risks come both as alpha (outperformance of a risk-adjusted benchmark) and beta (economic factor exposure) risks. Taking (owning) alpha risks is one of the core competencies of an asset management firm. The firm is rewarded for its scarce and industry-specific skills. Acquiring these risks is essentially a positive NPV project, as risks are more than offset by the expected profits. Creating alpha is equivalent to creating positive NPV, both for the firm and its clients. Beta risks, on the contrary, are incidental risks that asset managers do not, in general, deliberately take on, perhaps because they think they lack the skills. Even if asset managers had market-timing skills, the risk/return ratio is likely to be so low that it seems wiser to hedge these risks to free up risk capacity for more core, higher NPV-generating risks.

While we argued very strongly in favor of hedging the beta part of asset-based fees, it should be clear that we should not hedge performance-based fees. We would simply destroy the option value provided by the client. Here, we want volatility.

Also note that, by definition, we can hedge only systematic beta risks and that idiosyncratic risks are an asset manager's core product, *i.e.*, the core production risk to take. It also would be (legally) difficult to hedge performance-based fees, as the asset manager would have to hold positions (for his own P&L in a separate brokerage account) offsetting those he takes in his fiduciary role. Option pricing technology becomes a dangerous tool here, as replication is impossible.

Although it is rare for banks to hedge business risks (risks that are common to a business model but not directly related to production), it is clear that some of these business risks are correlated with capital market risks. Business risks in the asset management industry are mainly related to systematic outflows affecting entire product lines. In a severe equity downturn, retail investors will shift out of fee-intensive equity funds and into money market funds or government-guaranteed deposits, while institutional clients such as insurance companies might, as a result of their own (now binding) regulatory constraints, reduce their risk exposures. We could think of various ways to hedge client redemption risk. Redemptions in the retail sector are usually correlated with asset performance and we might want to hedge against the extremely bad market scenarios likely to trigger mass redemptions. For institutional clients redemptions might also be motivated by the client's financial distress: the client might need to raise cash or shed risk. All instruments related to financial distress could be used. For example, an asset management company that is exposed to a weakly rated insurance company might want to buy puts or credit default swaps on the insurer to hedge parts of its fee income. A fund of hedge fund provider might want to buy puts on hedge fund replicating clones for partial protection from client redemptions or fees at risk.

## 7. How to Hedge?

The easiest way to hedge asset-based fees is not to offer them. This follows the idea of duality in risk management. We can either root out the cause (variability in markets) or the effect (offer fixed fees). Fixed fees have long been discussed in institutional asset management, but they are perceived to suffer from the obvious to renegotiate in a world with positive inflation (although they could of course be indexed). However, the author expects that these fee arrangements will become more common.

How do we implement a hedge program aimed at insulating an asset manager's P&L from market-induced variations of average assets under management for a given time period? The naive proposition would be to sell futures with one-year maturity on the underlying assets with a

notional  $\theta \cdot A_t$ . If assets increase in value the hedge (ignoring carry) creates a loss of  $-\theta \cdot \Delta A$ , while asset management fees rise by an offsetting  $+\theta \cdot \Delta A$ . But because of the path dependency of fees based on average assets under management, this hedge will not generally work. We can easily think of a situation where equity markets fall gradually over eleven months in a year but recover sharply near the end and more than compensate for previous losses. Here, we would lose money on the hedge (equity markets are up for the year) and in revenues (average assets under management are down, too). What we need is a hedging instrument that moves with average prices rather than with year-end prices. Fortunately, all we need is to trade (or replicate) a forward contract on the average stock price, *i.e.*, a contract that pays the average stock price at the end of the period (Asian forward,  $F_{t,t+n}^{Asian}$ ). The price of such a contract to sell the average stock price (yet random) at a known price  $\bar{S}$  is given by<sup>13</sup>

$$(4) \quad F_{t,t+n}^{Asian} = e^{-r} \left( S_t \sum_{i=1}^n \frac{e^{\frac{r \cdot 250}{n}}}{n} - \bar{S} \right)$$

Note that (4) is independent of the distribution that the average price process might follow. We assume  $n = 250$ . Another way to think of (4) and to create a position a position in an Asian forward is to buy a long position in an Asian call with strike  $\bar{S}$  and one-year maturity and a short position in an Asian put with the same strike and maturity. A long call and short put provides a synthetic forward that comes at zero cost if the strike is at the money forward.<sup>14</sup>

How would this work? We assume current assets under management of \$100 billion with fees of 50bps.<sup>15</sup> The current P&L to defend is €500 million or €507.56 million at current forward prices ( $0.5\% \cdot 100 \text{ billion} \cdot \sum_{i=1}^n \frac{e^{\frac{r \cdot 250}{n}}}{n} = 507.56 \text{ million}$ ). Suppose the asset manager wants to isolate the P&L at current rates of 3% per annum against market exposure. Suppose the benchmark asset trades at an index level of 4500, where each index point is valued at €2500. Here  $S_t = €4500 \cdot €2500 = 1125000 = €1.125 \text{ million}$ . A forward contract to sell the average index level at  $\bar{S} = €1.142 \text{ million}$  is valued at zero at time  $t$ . We need to sell

$$\# \text{ Asian Forwards} = \frac{A_t \theta}{F_{t,t+n}^{Asian}} = 444.444$$

Now suppose the average index level drops at the end of the year to  $\frac{1}{n} \sum_{i=1}^n S_{t+i} = 3800$ . The payoff from our short forward position is

$$444.444 \cdot \left( \bar{S} - \frac{1}{n} \sum_{i=1}^n S_{t+i} \right) = €85.3533 \text{ million}$$

Together with asset management fees of  $\theta \cdot \frac{3800}{4500} \cdot €100 \text{ billion} = €422.22 \text{ million}$ , this amounts to total fees of €507.76 million, which is exactly what we sold the fee income for the coming year for. We have insulated the P&L.

Let us finally address some all too predictable objections. *Fixing your revenues when your input costs are variable (inflation, competitive pressure to hire talent, etc.) does not sound like a good idea.* There are two answers to this. First, inflation expectations are incorporated in the forward curve for pricing  $F_{t,t+n}^{Asian}$  (although we assumed for simplicity a flat curve above). Second, if input costs change, any business needs to increase prices or increase efficiency. There is nothing special about asset management. *The hedging horizon is limited to one year.* True, but while not only is this of considerable help a long-term decline in assets under management is part of business model risk, which is the essence of markets and would be difficult to hedge. *Isn't there large counterparty risk?* No, because the hedge can be replicated via futures, but even if it were implemented with OTC instruments and the hedges were not paid out when markets have fallen, this would at worst leave the asset manager in the position he would have been in without hedges. *Isn't there peer group risk; that is, what happens if my firm implements the strategy while other firms don't and*

13 - A replicating strategy would sell  $\frac{1}{n} e^{-r}$  forward contracts for each of the  $n$  averaging points.

14 - In other words, if  $\bar{S} = S_t \sum_{i=1}^n \frac{e^{\frac{r \cdot 250}{n}}}{n}$ .

15 - This example should be used for illustrative purposes only. As (all) asset managers manage various products with different benchmarks we need to hedge each product separately. As this is a straight-forward extension of what is presented in this paper, we continue to present the "single product" case.

*the market goes up?* This is the risk manager's nightmare, but it really should be the corporate communication department's nightmare. Properly communicated, the relative performance will be understood and highly valued by the market. Earnings quality is the Holy Grail. In addition, the relative underperformance would take place when markets are up, business conditions are good, and outperformance is less valuable.

## 8. Summary

Unlike the existing risk management literature, which focuses narrowly on measuring market risks that asset managers take on behalf on their clients, this paper looks at the impact of capital markets on asset management profitability. We argue that traditional benchmarked long-only asset management firms take too much non-rewarded beta risk in their primarily asset-based fee structures. Hedging these risks should create value for shareholders and insulate asset managers from swings in their fortunes that are unrelated to their core skills, that is, providing outperformance and suitable products to their clients.

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## Appendix A—Approximate Distribution of Asset-Based Management Fees

An asset-based fee at time  $t + n$ ,  $\tilde{f}_{t+n}$ , is a random variable (characterized by  $\sim$ ) that depends on the random realization of the path of future assets under management  $\tilde{A}_{t+i}$  for  $i = 1, \dots, n$ . Fees are calculated as a percentage  $\theta$  (usually measured in basis points) on the average assets under management over a given time period. We assume assets under management are calculated daily (which is the case for all retail funds with daily liquidity) and we will usually assume that  $n = 250$ , i.e., we look at the distribution of annual fees with daily (almost continuous) averaging.

$$(1) \quad \tilde{f}_{t+n} = \theta \cdot \left( n^{-1} \sum_{i=1}^n \tilde{A}_{t+i} \right)$$

Ignoring future in- and outflows as well as active management returns, assets under management are tied to the evolution of benchmark returns,  $\tilde{A}_{t+i} = A_t \frac{\tilde{S}_{t+i}}{S_t}$ , where  $\frac{\tilde{S}_{t+i}}{S_t}$  is the benchmark return for the period from  $t$  to  $t + n$ . In other words, asset management companies share client's benchmark risks:

$$(2) \quad \tilde{f}_{t+n} = \theta \cdot A_t \cdot \left( \frac{1}{n} \sum_{i=1}^n \frac{\tilde{S}_{t+i}}{S_t} \right)$$

The trouble with (2) is that even though  $\frac{\tilde{S}_{t+i}}{S_t}$  is lognormal (with mean  $\mu$  and variance  $\sigma^2$ ) the sum of lognormal variables is not. However, Haug (2006) provides an approximate formula for a process with zero drift<sup>16</sup>

16 - We use (3) for illustration given the community's obsession with closed-form solutions. The interested reader might explore various approximations for the distribution of  $\ln\left(n^{-1} \sum_{i=1}^n \frac{\tilde{S}_{t+i}}{S_t}\right)$  usually provided in the options pricing literature (Nelken, 1996). However, given that log returns themselves are neither normal nor uncorrelated nor yet independent, all these expressions can only be seen as back-of-the-envelope shortcuts. Given the low (computational) costs of bootstrapping the small sample distribution, a simulation approach should always be the preferred route.

$$(3) \quad \ln\left(n^{-1} \sum_{i=1}^n \frac{\tilde{S}_{t+i}}{S_t}\right) \sim N\left(0, \sqrt{\ln\left(\frac{2e^{\sigma^2} - 2(1+\sigma^2)}{\sigma^4}\right)}\right)$$

where  $\sigma^2$  denotes the variance of benchmark asset returns. He argues that  $\ln\left(n^{-1} \sum_{i=1}^n \frac{\tilde{S}_{t+i}}{S_t}\right)$  might very well be approximated by a normal distribution. The cumulative distribution for a lognormal variable is given by

$$(4) \quad P\left(n^{-1} \sum_{i=1}^n \frac{\tilde{S}_{t+i}}{S_t} \leq S\right) = \Phi\left(\frac{\ln(S)}{\sqrt{\ln\left(\frac{2e^{\sigma^2} - 2(1+\sigma^2)}{\sigma^4}\right)}}\right)$$

where  $S$  is the average of rescaled (to 1) benchmark values and  $\Phi$  the cumulative density function of a standard normal. We can now easily calculate "Fees at Risk" (FaR) for alternative benchmark assets (*i.e.*, volatilities  $\sigma$ ) and confidence level  $1-\alpha$  from (4) by solving for the required percentile. For  $\Phi(z_\alpha) = 0.05$  we know that  $z_\alpha = -1.64$ . Given that expected returns are notoriously difficult to forecast, we assume that benchmark assets exhibit zero drift.

$$(5) \quad FaR_{\alpha,t} = \theta \cdot A_t \cdot e^{-z_\alpha \sqrt{\ln\left(\frac{2e^{\sigma^2} - 2(1+\sigma^2)}{\sigma^4}\right)}}$$

Also note that we can use (2) and (3) to calculate the variance of asset management fees. Applying again properties of the lognormal distribution we get

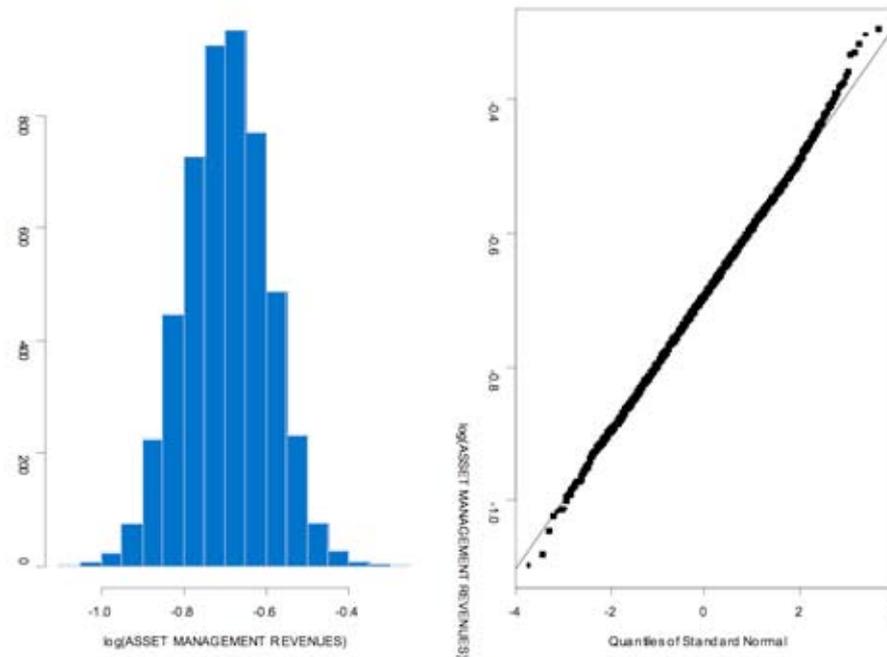
$$(6) \quad \begin{aligned} \text{Var}(\tilde{f}_{t+n}) &= (\theta \cdot A_t)^2 \text{Var}\left(n^{-1} \sum_{i=1}^n \frac{\tilde{S}_{t+i}}{S_t}\right) \\ &= (\theta \cdot A_t)^2 \left(\frac{2e^{\sigma^2} - 2(1+\sigma^2)}{\sigma^4}\right) \left(\frac{2e^{\sigma^2} - 2(1+\sigma^2)}{\sigma^4} - 1\right) \end{aligned}$$

which is what we used in (1). To derive (6) we simply used that for a lognormal random variable  $X$  with variance  $\sigma^2$  we know that  $\text{Var}(X) = e^{\sigma^2}(e^{\sigma^2} - 1)$ .

## Appendix B—Simulation Study

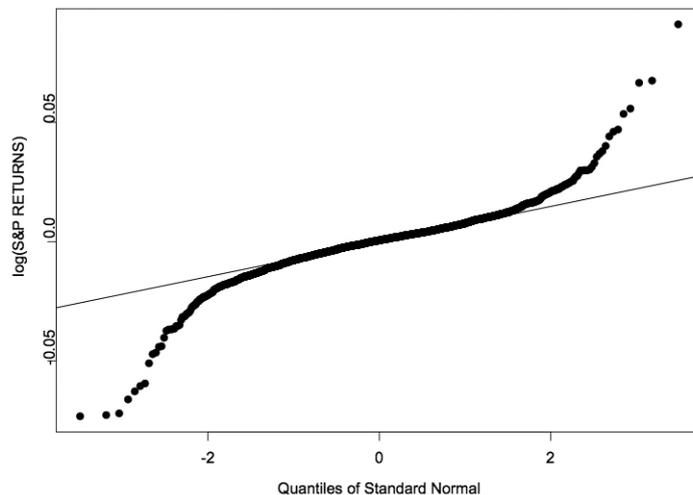
We want to test whether  $\ln(\tilde{f}_{t+n})$  is approximately normally distributed, that is, whether asset management fees can be approximated as a lognormal random variable. If we could a whole battery of approximations that could provide us with closed-form solutions for "Fees at Risk" or fee volatility would be available. To do this task, we bootstrap 5,000 annual time series for stock returns. To make the example realistic we use real world stock returns—daily returns on the S&P500 from January 2000 to November 2008—to bootstrap from. It is well known that classic bootstrapping destroys dependence structures in a time series, as each draw is assumed independent. Instead, we try to maintain some of the dependence structure with a straightforward modification. After each return draw we draw a second random variable from a uniform distribution between 0 and 1. If the draw falls below  $q = \frac{1}{2}$  we take the neighboring entry from the original data series; otherwise, we continue drawing randomly from the original time series.

Figure 1. Histogram and quantile plot for bootstrapped log asset management fees



The likelihood of drawing two consecutive entries is 0.5, the likelihood of three consecutive entries is 0.25, and so on, *i.e.*, the expected block length is 2. If  $q$  becomes larger, the expected block length increases. Figure 1 shows both a histogram and quantile plot for  $\ln(\tilde{f}_{t+n})$ . Both figures confirm our assumption that asset management fees can be approximated by a lognormal random variable. The QQ plot shows a remarkably good fit, given that the underlying daily return series for the S&P500 is far from normal, as Figure 2 shows. Daily returns obviously exhibit great kurtosis.

Figure 2. Quantile plot for bootstrapped log S&P 500 returns



This is a remarkable result (that also holds for larger  $q$ ). Figure 1 may suggest that it is a perfect fit, but it is not. The term approximately lognormal still applies. Formal tests, such as the Wilkison/ Shapiro test for normality of  $\ln(\tilde{f}_{t+n})$ , reject normality with a p-value of around zero. Even though skewness (0.0142) and kurtosis (0.143) are small, they are still significant given the large number of observations. While this result is encouraging, we are unable to generalize for other time series, time periods or data frequencies; in other words, when in doubt, bootstrap.

## Appendix C—Market Beta for Asset-Based Fees

Asset-based fees are based on average prices over a year, while market sensitivities are calculated using year-end prices, ignoring the "middle part" of the stock price path over a year. How will this affect estimated stock market sensitivities? How do the returns for the market portfolio and returns on average fund prices move together? We start from our definition of market sensitivity

$$(1) \quad \beta_{\text{fee}} = \frac{\text{Cov}\left(\frac{n^{-1}\sum_{i=1}^n S_i^p, S_n^m}{S_0^p, S_0^m}\right)}{\text{Var}\left(\frac{S_n^m}{S_0^m}\right)}$$

where  $S_i^m$  ( $S_i^p$ ) is the market (portfolio) level at time  $i$ . Without loss of generality we set  $S_0^m = S_0^p = 1$ . Assume that portfolio and market prices follow  $S_n^p = S_0^p + \sum_{i=1}^n \Delta S_i^p$ ,  $S_n^m = S_0^m + \sum_{i=1}^n \Delta S_i^m$ , where  $\text{Var}(\Delta S^m) = \sigma_m^2 n$  such that

$$(2) \quad \text{Var}(S_n^m) = \text{Var}\left(\sum_{i=1}^n \Delta S_i^m\right) = n \text{Var}(\Delta S) = \sigma_m^2 n^2$$

We can now work out the covariance of average portfolio prices over  $n$  days and the final market price at day  $n$ .

$$(3) \quad \text{Cov}\left(n^{-1}\sum_{i=1}^n S_i^p, S_n^m\right) = \text{Cov}\left(n^{-1}\left(\underbrace{S_0^p + \Delta S_1^p}_{S_1^p} + \underbrace{S_0^p + \Delta S_1^p + \Delta S_2^p}_{S_2^p} + \dots\right), S_0^m + \sum_{i=1}^n \Delta S_i^m\right)$$

Let us also assume that  $\Delta S_i^p = \beta \Delta S_i^m + \varepsilon_i$ .

$$(4) \quad \begin{aligned} \text{Cov}\left(n^{-1}\sum_{i=1}^n S_i^p, S_n^m\right) &= \\ &= \text{Var}(\beta \Delta S_1^m) + \frac{(n-1)}{n} \text{Var}(\beta \Delta S_2^m) + \dots + \frac{(n-(n-1))}{n} \text{Var}(\beta \Delta S_n^m) \\ &= \left(1 + \frac{n-1}{2}\right) \beta \sigma_m^2 n \end{aligned}$$

Substitute (4) and (2) into (1) and we arrive at

$$(5) \quad \beta_{\text{rev}} = \frac{\left(1 + \frac{n-1}{2}\right) \beta \sigma_m^2 n}{\sigma_m^2 n^2} = \frac{\beta \left(1 + \frac{n-1}{2}\right)}{n} \underset{n \rightarrow \infty}{=} \frac{\beta}{2}$$

Even though asset-based fees in the above example are determined by market returns, regression beta will equal half the market beta as a result of the averaging process.