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### From Delivering to Packaging of Alpha

#### Illustration from Active Bond Portfolio Management: Using Fixed Income Derivatives to Design Hedge Fund Type Offerings that Better Fit Investors' Need

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**Abstract:** In this paper, we emphasize the need for the hedge fund industry to adopt a consumer (investor)-driven approach, as opposed to the current producer (manager) perspective, and we call for the emergence of new types of offering with characteristics better suited to the needs of institutional investors. Using active bond portfolio management as an example, we present evidence that derivatives can be used by managers not only for generating and delivering abnormal performance, but also for packaging such performance in a form that is consistent with the modern core-satellite approach to institutional portfolio management, for which we explore both a standard static version and also a dynamic extension allowing for dissymmetric control of active management risk.

# 1. Introduction

With currently almost one trillion US dollars in assets under management, hedge funds have seen impressive growth over the past decade and providers of such investment vehicles do not lack arguments why investors should try to gain exposure to hedge funds.<sup>1</sup> From an initial phase, where some high net worth individuals invested in hedge funds, the industry made it into the mainstream as more and more institutional investors have started allocating to, or at least looking at, hedge funds as a distinct asset class.

The interest from institutional investors comes at a time when they try and find solutions to recover after having been dramatically affected by downturns in the equity market. This is especially true for institutions where declining interest rates have increased liabilities at the same time as assets were reduced. These market events, in addition to questioning the current investment practices of institutional investors in general, and pension funds in particular, have put the emphasis on alternatives to stocks and bonds, such as hedge funds.

From a conceptual standpoint, hedge funds are nothing but vehicles that allow investors to gain an access to the benefits of very active investment strategies which previously were only accessible to investment banks through proprietary trading activities. Hedge funds can be seen as the ultimate organisational form for such strategies since they have a flexible legal structure, are only lightly regulated, and give strong incentives for manager performance. This organisation allows for liberty in investment decisions such as using derivatives, short selling and leverage, and investing in illiquid securities. The most important characteristic of a hedge fund is probably that the manager typically does not have to tie his performance to that of a reference benchmark, such as a market index or a peer group of managers. This is a notable difference to most mutual funds.<sup>2</sup>

Although the existing literature seems to concur on the interest of hedge funds as valuable investment alternatives, because of the opacity and lack of transparency of hedge fund strategies, there still remain a large number of institutional investors who wonder whether they should invest in hedge funds, and more importantly, how they should do it. The classic argument of hedge fund providers for investing in such structures, which is the claim that they provide investors with access to skilled managers, does not necessarily shed much light on how these products actually fit investors' needs with respect to their preferences and liability constraints.

<sup>1</sup> According to the 2004 Alternative Fund Service Review Survey, as reported in the weekly publication *International Fund Investment*, issue 116, May 17th, 2004.

<sup>2</sup> It should however be noted that absolute return benchmarks (such as risk-free rate plus x basis points) are typically used. Furthermore, benchmarking of hedge fund returns through peer grouping is becoming more and more common practice.

Generally speaking, institutional investors have a particularly strong preference for non-linear payoffs because of the non-linear nature of the liability constraints they face (see for example Draper and Shimko (1993)). This is the case in particular for institutional investors whose portfolio value must at all cost exceed a given value, but thereafter can accept reasonable risks. From a pragmatic standpoint, taking for example the case of pension funds, it is clear that a small change in the probability of extreme contribution rates is typically considered much more important than an equal change in the probability of an extremely high refund.

In this paper, we emphasize the need for the hedge fund industry to adopt a consumer (investor)-driven approach, as opposed to the current producer (manager) perspective, and we call for the emergence of a new types of offerings with characteristics better suited to the needs of institutional investors. Using active bond portfolio management as an example, we present evidence that derivatives can be used by hedge fund managers not only for generating and delivering abnormal performance (alpha benefits), but also for packaging such performance in a way that is consistent with the modern core-satellite approach to institutional portfolio management. We also introduce a dynamic extension of this approach, which leads to a non-linear, dissymmetric control of tracking error risk, which is in essence a convenient way to allow investors to benefit from an option based on hedge fund managers' skills.

The rest of the paper is organized as follows. In section 2, we examine the performance of bond timing strategies, first in a long-only context and then in an absolute return, duration-neutral framework. In section 3, we consider the inclusion of such bond timing strategies within the context of a core-portfolio approach. Finally, we present our concluding remarks in section 4.

## 2. Examining the Performance of Bond Timing Rotation Strategies

A significant part of the expertise of active bond portfolio managers is the ability to implement active strategies based on active views on interest rate changes. If they think that interest rates will decrease in level, they will lengthen the duration of their portfolio so as to optimize capital gains. On the other hand, if they think that interest rates will increase in level, they will shorten the duration of their portfolio so as to minimize the exposure of the portfolio to interest rate risk.

There is actually now a consensus in empirical finance that expected asset returns, and also variances and covariances, are, to some extent, predictable. Pioneering work on the predictability of asset class returns in the U.S. market was carried out by Keim and Stambaugh (1986), Campbell (1987), Campbell and Shiller (1988), Fama and French (1989), and Ferson and Harvey (1991).

While the performance of tactical style allocation models is well documented in equity markets, a sizable body of research suggests that similar levels of predictability can be found in bond markets. The literature on predictability in bond returns has first focused on timing bonds versus stocks or bonds versus cash, with no emphasis on the timing of bonds with different maturities. Examples of papers on tactical asset allocation decisions involving bond markets include Shiller (1979), Shiller, Campbell, and Schoenholtz (1983), Fama (1981), Fama and Bliss (1987), Campbell (1987), Campbell and Shiller (1991), Bekaert, Hodrick, and Marshall (1997), Ilmanen (1995, 1997), Lekkos and Milas (2001), Baker et al. (2002), Ilmanen and Sayood (2002), among others.

In these papers, the focus is on exploiting predictability in a global bond portfolio and hence in the *level* of interest rates, but do not attempt at exploiting predictability on other dimensions of the shape of the yield curve such as *slope* and *curvature*. More recently, researchers have recognized the benefits of exploiting predictability in the shape of the yield curve. In a first attempt, Dolan (1999) argues that the curvature parameter of the yield curve, estimated using the Nelson-Siegel model, can be predicted with simple parsimonious models, and shows that these forecasts have investment significance in the selection of bullet over barbell portfolios. In a related effort, Diebold and Li (2002) estimate autoregressive models for predicting Nelson-Siegel (1987) level, slope and curvature factors, while Fabozzi, Martellini and Priaulet (2004) test for the statistical significance in the predictive power of a series of economically meaningful variables and find strong evidence of predictability in changes in the slope of the yield curve based on such predictive variables.

The use of predetermined variables to predict asset returns has produced new insights into asset pricing models, and the literature on optimal portfolio selection has recognized that these insights can be exploited to improve on existing policies based upon unconditional estimates. For example, Kandel and Stambaugh (1996) argue that even a low level of statistical predictability can generate economic significance and abnormal returns may be attained even if the market is successfully timed only 1 out of 100 times. The aim of the present research project is an attempt to outline the benefits of bond maturity rotation strategies for European fixed income investors. More specifically, we use in this paper monthly data on the period 1993–2003 for two European broad-based bond futures, the Euro-Bund and Euro-Schatz Futures, and we show how significant outperformance can be generated from systematic maturity rotation strategies. We focus on futures based on short-term (Euro-Schatz) and long-term (Euro-Bund) notional contracts, as opposed to a medium-term notional contract (Euro-Bobl), because it is well known that bond portfolios with relatively similar duration are typically very highly correlated (see for example Martellini, Priaulet and Priaulet (2003)) and predictive models work better when applied to contrasted asset classes.

Bond indices and futures with different maturities perform somewhat differently in different times and economic conditions, and there is evidence of predictability in these patterns. Using multi-factor models for the returns on bond indices, where the factors are chosen to measure the many dimensions of financial risks (market, volatility, credit and liquidity risks), one may be able to implement a strategy that generates abnormal return from timing between different maturity sub-indices (see for example Fabozzi, Martellini and Priaulet (2004)).

### **2.1. Base Case Experiment**

In an attempt to assess the performance of maturity style timer with various levels of forecast ability, we calculate the profit generated by investing 100% at the beginning of each month in the futures contracts (Euro-Bund or Euro-Schatz Futures) with the highest return in the following month. More specifically, we show in exhibit 1 the performance of a tactical style timer on the sample period ranging from January 1999 to August 2004. In this experiment, 100% of the portfolio are invested in the best performing contract with various degrees of predictive ability depicted by hit ratios ranging from 50% (no predictive ability) to 100% (perfect timer). In case of a hit ratio lower than 100%, the winning months are drawn randomly in the sample period. The benchmark is invested at 50% in each futures contract and theoretically available cash is invested in the risk-free rate (EONIA), with rebalancement taking place at the beginning of each month to bring the allocation back to neutrality.

As can be seen from the results in exhibit 1, we find that the performance of a style timer with perfect forecast ability who has invested 100% of a portfolio at the beginning of the year in the best performing style for the year generates an impressive information ratio equal to 4.97.

**Exhibit 1:** Performance of a tactical style timing portfolio on the period ranging from January 1999 to August 2004. In this experiment, 100% of the portfolio is invested in the best performing futures contract (Euro-Bund or Euro-Schatz Futures) with various degrees of predictive ability depicted by hit ratios ranging from 50% (no predictive ability) to 100% (perfect timer). The available cash is invested in the risk-free rate, the EONIA in this case. The benchmark is invested at 50% in each futures contract, with rebalancement taking place at the beginning of each month to bring the allocation back to neutrality. Like the portfolio, the available cash is also invested in the risk-free rate.

	Portfolio Risk & Return Analysis				Benchmark
Hit Ratio	100.00%	75.00%	70.00%	50.00%	
Annualized Return	9.09%	6.42%	5.84%	3.54%	3.58%
Cumulative Return	66.56%	43.35%	38.61%	21.76%	22.11%
Cumulative Excess Return	44.45%	21.24%	16.50%	-0.36%	
Annualized Excess Return	5.50%	2.84%	2.26%	-0.04%	
Annualized Volatility	3.15%	3.21%	3.53%	3.54%	3.21%
Annualized Tracking Error	1.11%	1.76%	1.83%	1.95%	
Information Ratio	4.97%	1.61%	1.23%	-0.02%	

Obviously, the assumption of perfect timing ability is not realistic. It can be argued that a realistic performance for a successful style timer is consistent with a hit ratio around 70%.<sup>3</sup> Such a level of hit ratio allows for a 2.26% excess return and a 1.83% annual tracking error with respect to the equally-weighted benchmark, which results in a good information ratio equal to 1.23 (see Grinold and Kahn (2000) for an empirical distribution of information ratios among active managers).

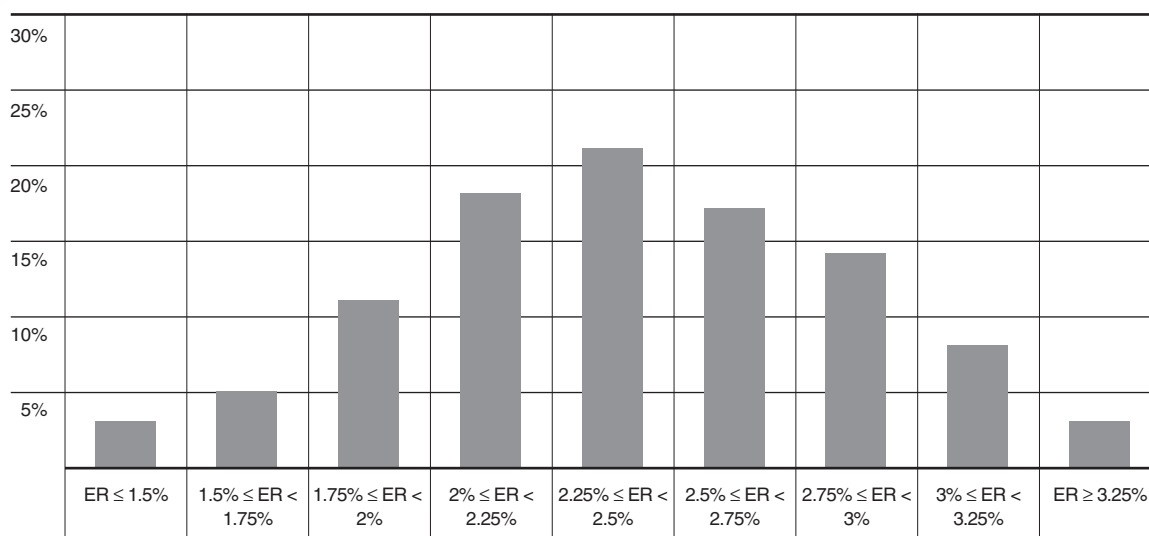
<sup>3</sup> For example, in the case of 68 observations (i.e., monthly observations between January 1999 and August 2004), a hit ratio of at least 70% is significantly greater than 1/2 at the 0.5% level.

## 2.2. Robustness Analysis

To test the robustness of the results above, we have repeated 100 times the experiment by drawing randomly the successful months, while maintaining a 70% hit ratio level.

Exhibit 2 below shows the distribution of overperformance obtained by a style timer, as we let successful 70% of the months vary across the 68 months of the sample.

**Exhibit 2:** this figure shows the distribution of overperformance obtained by a style timer exhibiting a 70% hit ratio. The successful months have been drawn randomly while maintaining the above-mentioned 70% hit ratio.



As can be seen from exhibit 2, the performance of the style timer is not a mere artifact of a particular choice of the winning months in the sample. This shows the robustness of abnormal performance that can be generated by a realistic timing strategy.

## 2.3. Absolute Return Approach

Not only can maturity rotation strategies be implemented in a long-only context, but they can also be used to generate absolute return benefits.

### 2.3.1. The Base Case

From this perspective, exhibit 3a on page 8 shows the performance of a strategy that simultaneously implements long-short positions generated by a style timer producing a 70% hit ratio. Therefore, a long position in the futures contract that is perceived as likely to outperform is combined with a short position in the futures contract that is perceived as likely to underperform while maintaining a zero-duration.

Four levels of leverage have been tested, from 1 to 4. In the case of a leverage fixed at 1 (respectively, 2, 3 and 4), about 100% of initial capital is invested in cash-equivalent (EONIA), and long-short positions together represent a 100% (respectively, 200%, 300% and 400%) exposure in absolute value.<sup>4</sup>

**Exhibit 3a: Absolute Return Approach.** In this experiment, we focus on a 70% hit ratio, with long and short positions simultaneously implemented from January 1999 to August 2004 while maintaining a zero-duration + 100% of initial cash in the risk-free rate (EONIA).

Portfolio Leverage	1	2	3	4	EONIA
Annualized Return	4.10%	4.78%	5.44%	6.19%	3.37%
Cumulative Return	26.11%	30.98%	35.83%	41.61%	21.00%
Annualized Volatility	0.74%	1.41%	2.03%	2.76%	0.29%

Exhibit 3a suggests that the benefits of maturity rotation strategies can be implemented in an absolute return approach, with a substantial potential for outperformance, as can be seen from an excess return with respect to the EONIA rate. While the outperformance naturally increases with leverage, the benefits of maturity rotation strategies are already obvious even in the context of modest leverage levels. It should be noted that such out-performance is generated with very little volatility.

### 2.3.2. Introducing an Option Overlay Strategy

While active bond portfolio managers can use futures contracts to implement active bets on changes in the shape of the yield curve, options based on these futures contracts can be used to implement truncated return strategies that aim at enhancing the performance and/or at reducing the risk of a maturity rotation program by eliminating the few worst returns of a fund track record. In what follows, we show that using an option overlay portfolio can also serve a return enhancement purpose in trendless periods of the market cycle, which are typically difficult market environments for timing strategies (see Arnott and Miller (1996)).

More specifically, we focus on a suitably designed type of option strategies that can be used to enhance the performance of the absolute return strategy that implements long/short bets with Euro-Schatz and Euro-Bund Futures contracts described in the previous sub-section. The objective is to design a program that would consistently add value during periods of calm markets, while not significantly impacting the market timing strategy ability to generate positive returns during turbulent market environments. This means that the enhancement program must not lose much during the market turbulence that typically leads to good timing profits. In what follows we examine the suitability of embedding option positions based on Euro-Bund Futures in a portfolio whose characteristics should achieve these desired objectives.

<sup>4</sup> Net exposure varies over time in order to always keep a zero-duration. Positions are rebalanced monthly.

Among the range of option strategies that are appropriate when the underlying price is expected to change very little over the life of the options, one of the simplest is a long call butterfly spread, the “wingspread”. This option strategy consists of three legs with a total of four options: long one call with a lower strike (in-the-money), short two calls with a middle strike (at-the-money) and long one call of a higher strike (out-of-the-money). All the calls have the same expiration date, and the middle strike is halfway between the lower and the higher strikes. When a butterfly spread is implemented properly, the potential gains and losses are usually limited. In our example, we sell the middle strike (the “body” of the butterfly) at the end of each month (last business day) in such a way that it is equal (or the closest to) the current price of the underlying.<sup>5</sup> Simultaneously, we buy the outer strikes (the “wings” of the butterfly) as follows:

- Lower strike price = Middle strike price – 50 bps;
- Higher strike price = Middle strike price + 50 bps.

All call options have the same 3-month expiry date. Positions implemented at the end of month M are systematically closed out at the end of month M+1, using the settlement prices as the assumed transaction prices. The quantity of options (purchased and sold) is computed so that the additional leverage is equal to 1, knowing that the absolute return strategy has an initial leverage of 2 (see table 3a), cash included (initial monies fixed at EUR 10 million). Table 3b report the results.

**Exhibit 3b:** Absolute Return Approach with Option Overlay. The case without options is identical to the results in table 3a for the case of a leverage equal to 2 (70% hit ratio, with long and short positions simultaneously implemented from January 1999 to August 2004 while maintaining a zero-duration +100% of initial cash in the risk-free rate). In the case with options, we add a butterfly spread option overlay strategy (see body of the text for details).

	EONIA	Without Options	With Options
Portfolio Leverage	0	2	3
Cumulative Return	21.00%	30.98%	39.31%
Annualized Return	3.37%	4.78%	5.88%
Annualized Volatility	0.29%	1.41%	1.51%
Sharpe Ratio		1.00	1.66
Annualized Downside Risk 3%		0.79%	0.83%
Sortino Ratio 3%		1.78	3.02
Monthly Drawdown		-0.73%	-0.72%

The benefits of adding an option overlay strategy can perhaps be best seen from the fact that the return of the strategy with the option overlay is greater than the one without the option overlay in 90% of the months such that the Bund-Schatz spread is lower than 1% in absolute value. This strongly suggests that the option overlay can indeed enhance the performance of the underlying maturity rotation strategy when the latter fails to perform well because of narrowing spreads.

<sup>5</sup> First position initiated at the beginning of January 1999.

### 2.3.3. Introducing a Portable Alpha Strategy

Before the alpha benefits of the absolute return strategy (with or without options) can be transported to a portfolio reflecting an investor's strategic asset allocation (see next section), further adjustments need to take place so as to align its exposure to that of the investor's benchmark. For the sake of illustration, we consider the case of an investor with a core position invested in medium-term maturity bonds, which for example can be achieved by trading the Euro-Bobl Futures contract.<sup>6</sup>

In exhibit 3c, we repeat the same experiment as in exhibit 3a, except that we add an additional investment in the Euro-Bobl Futures contract equivalent to 100% of initial capital, fully collateralized with EONIA. As a result, the net exposure of the portfolio with respect to the bond market is identical to that of the Euro-Bobl Futures contract, which is assumed to represent the investor's strategic bond allocation.

Three levels of leverage have been tested, from 2 to 5. For example, with a leverage fixed at 2, about 100% of initial capital is invested in cash-equivalent (EONIA), exposure to Euro-Bobl notional contract comes to 100%, and long-short positions together represent a 100% exposure in absolute value. Net exposure varies over time in order to always keep a zero-duration. Positions are rebalanced monthly.

**Exhibit 3c: Absolute Return Approach.** In this experiment, we focus on a 70% hit ratio, with long and short positions simultaneously implemented from January 1999 to August 2004 while maintaining a zero-duration + 100% of initial cash in the risk-free rate (EONIA) + 100% invested in the Euro-Bobl Futures contract.

Portfolio Leverage	2	3	4	EONIA	Euro-Bobl + EONIA
Annualized Return	4.72%	5.40%	6.06%	3.37%	3.99%
Cumulative Return	30.22%	35.28%	40.33%	21.00%	24.91%
Annualized Volatility	3.38%	3.43%	3.59%	0.29%	3.47%

The abnormal performance generated from maturity rotation strategies can be transported to a core portfolio invested in a broad-based index (possibly through a derivatives position) such as a medium-term bond index. This is what we turn to next.

<sup>6</sup> The same approach can be adopted to transport the alpha benefits of the bond maturity rotation strategy to any benchmark portfolio, consisting of either stock and/or bond allocation.

### 3. Enjoying the Benefits of Bond Maturity Rotation within the Context of a Core-Satellite Approach

In this section, we show how fixed income derivatives can be used in the context of core-satellite portfolio management.

#### 3.1 Introducing the Core-Satellite Approach to Portfolio Management

Most active managers still have dominant passive exposure to their benchmark. Instead of paying high fees on the passively managed part of their portfolio, the core-satellite approach suggests to passively invest in a low-fee index fund (or an enhanced index product) as a core portfolio and in a variety of satellite active managers with higher tracking error. In its purest form, this approach leads to an investment in market-neutral managers who provide only portable alpha benefits without passive exposure to the index, so that they only compensate active managers for their abnormal returns, not for their passive exposure to rewarded sources of risk.

Let us consider a core-satellite approach with a single satellite portfolio. The mathematics of a core-satellite approach is then straightforward. The overall portfolio corresponds to:  $P = wS + (1 - w) C$ , where  $w$  is the proportion invested in the satellite (S), and  $1 - w$  is the fraction invested in the core (C). We now calculate the tracking error with respect to a benchmark B. We have:  $P - B = wS + (1 - w) C - B = w(S - B) + (1 - w)(C - B)$ . If we now assume that the core portfolio is perfectly replicating the benchmark, we have  $C = B$ , then we have:  $P - B = w(S - B)$ .

As a result,  $TE(P) = \sqrt{\text{var}(P - B)} = w\sqrt{\text{var}(S - B)} = wTE(S)$ .

Let us consider the following example. We assume an investor has a target level of risk relative to a given benchmark, such as a 2.5% tracking error budget. Two options are possible. Either the investor hires one manager with a tracking error equal to 2.5% for the entire portfolio, or the investor forms a passive core portfolio and leaves 20% in an aggressively managed satellite with a  $12.5\% = \frac{TE(P)}{w} = \frac{2.5\%}{20\%}$  tracking error. The latter solution is more cost-efficient as 80% of the portfolio will be passively managed in the framework of a low-cost indexing strategy. The next step consists of deriving the optimal proportion  $w^*$  to invest in the satellite versus core portfolio. We solve the problem in the context of a simple mean-variance analysis.

The optimization program reads:

$$U = E(P - B) - \lambda\sigma^2(P - B) = IR(P) \times TE(P) - \lambda TE^2(P)$$

Here  $U$  denotes the investor's utility function, which is assumed to be increasing with the portfolio expected excess return  $E(P - B)$  and decreasing with tracking error  $TE(P) = \sigma(P - B)$ . The coefficient  $\lambda$  denotes the investor's risk-aversion with respect to tracking error risk.  $IR(P)$  is the information ratio of the portfolio  $P$  with respect to the benchmark, i.e.

$$IR(P) = \frac{E(P - B)}{\sigma(P - B)} = \frac{E(P - B)}{TE(P)}$$

We may rewrite the optimization program as:  $U(w) = IR \times w \times TE(S) - \lambda w^2 TE^2(S)$ , and the first-order condition reads:

$$\frac{\partial U}{\partial w}(w^*) = 0 \rightarrow w^* = \frac{IR}{2\lambda TE(S)}$$

For example, let us assume that the tracking error of the active fund is 5%, that the information ratio ( $IR$ ) is 0.5, and that the coefficient of risk-aversion with respect to relative risk is  $\lambda = 0.2$ . Then, the optimal proportion invested in the active portfolio is:

$$w^* = \frac{IR}{2\lambda TE(S)} = \frac{0.5}{2 \times 0.2 \times 5\%} = 25\%$$

The resulting tracking error is  $TE(P) = 25\% \times 5\% = 1.25\%$ .

This analysis can easily be extended to the case of a satellite  $S = \sum_{i=1}^n w_i S_i$  invested in a number  $n$  of active portfolio managers  $S_i$  according to the proportions  $w_i$ . The excess return on the satellite portfolio is then  $S - B = \sum_{i=1}^n w_i (S_i - B)$ , and the tracking error of the satellite portfolio reads

$$TE(S) = \left( \sum_{i,j=1}^N w_i w_j \sigma_{ij} - 2 \sum_{i=1}^N w_i \sigma_{iB} + \sigma_B^2 \right)^{1/2},$$

where  $\sigma_{ij}$  is the covariance between portfolio managers  $S_i$  and  $S_j$ , and  $\sigma_B$  is the volatility of the benchmark.

One can then find the optimal proportion invested in each active manager within the satellite portfolio so as to achieve the highest possible information ratio. One can show (see for example Scherer (2002)) that the optimal condition is that the ratio of return to risk contribution is the same for all managers, which reads:

$$\frac{w_k \alpha_k}{\left( w_k^2 \sigma_{\alpha k}^2 + \sum_j w_k w_j \sigma_{kj} \right) / TE(S)} = \frac{w_l \alpha_l}{\left( w_l^2 \sigma_{\alpha l}^2 + \sum_j w_l w_j \sigma_{lj} \right) / TE(S)}$$

### 3.2 Using Bond Maturity Rotation Strategies as Portable Alpha Investment Vehicles

An absolute return version of the bond maturity timing strategy is perfectly suited for investors who attempt to use hedge funds to add portable alpha benefits to their long-only portfolio without modifying their passive exposure to a reference index, as it allows for a separate control on the tracking error of the satellite and core portfolios, so as to ensure that the overall portfolio is consistent with a target level of deviation with respect to the chosen benchmark.

In exhibit 4 below, we show the performance of a core-satellite portfolio approach, where the core portfolio is passively invested in medium-term notional contracts (Euro-Bobl Future) fully collateralized with EONIA, and the satellite portfolio is based upon a timing strategy on the short versus long-term futures contracts (leverage fixed at 4, i.e. about 300% (in absolute value) in long and short positions in order to keep a zero-duration at any time +100% invested in cash-equivalent (EONIA) +100% invested in Euro-Bobl Futures contract). With regard to the satellite portfolio, we focus on the realistic case of a 70% hit ratio.

Several experiments have been performed with an allocation to the satellite portfolio ranging from 10% to 30%. Results obtained through these experiments demonstrate that the alpha benefits can be successfully transported to a core portfolio reflecting the strategic asset allocation of the investor.

**Exhibit 4: Core-Satellite Portfolio Management.** This table shows the performance of a global core +satellite portfolio, where the core is passively invested in the Euro-Bobl Futures + EONIA, while the satellite is an active portfolio implementing a maturity rotation strategy (absolute return version with a 70% hit ratio).

Satellite		Portfolio Risk & Return Analysis
	Annualized Return	4.20%
	Cumulative Return	26.39%
	Cumulative Excess Return	1.48%
10%	Annualized Excess Return	0.21%
	Annualized Volatility	3.43%
	Annualized Tracking Error	0.20%
	Information Ratio	1.04
	Annualized Return	4.40%
	Cumulative Return	27.88%
	Cumulative Excess Return	2.97%
20%	Annualized Excess Return	0.41%
	Annualized Volatility	3.40%
	Annualized Tracking Error	0.40%
	Information Ratio	1.04
	Annualized Return	4.61%
	Cumulative Return	29.38%
	Cumulative Excess Return	4.47%
30%	Annualized Excess Return	0.62%
	Annualized Volatility	3.39%
	Annualized Tracking Error	0.60%
	Information Ratio	1.04

This analysis strongly suggests that bond derivatives can be used to implement a very broad and thorough set of bond portfolio strategies: not only they can be used by investors to create diversified core positions around which they can add value, but also, as argued in the previous section, they can be used by investors to implement their (satellite) active portfolio strategy.

In what follows, we extend the core-satellite approach to a dynamic context, where we let the proportion invested in the active portfolio vary as a function of the current outperformance of the global portfolio with respect to the benchmark.

### 3.3 Using Bond Maturity Rotation Strategies in the Context of Dynamic Core-Portfolio Management

Tracking error is not necessarily bad. Just like with good and bad cholesterol, there is a “good” tracking error, which refers to overperformance of the portfolio with respect to the benchmark, and a “bad” tracking error, which refers to underperformance with respect to the benchmark. By severely restricting the amounts invested in active strategies as a result of tight tracking error constraints, investors obviously miss an opportunity for significant outperformance.

In this section, we use a new methodology introduced by Amenc, Malaise and Martellini (2004) that allows investors to gain full access to good tracking error, while maintaining the level of bad tracking error at a reasonable threshold, based on an optimal dynamic adjustment of the proportions of total wealth invested in core versus satellite portfolios. This method can be regarded as a natural extension to a relative return context of constant proportion portfolio insurance techniques (CPPI), originally designed to ensure the respect of absolute performance.

In other words, the traditional CPPI technique, designed to ensure absolute risk management, still applies in a benchmarked portfolio management process, provided that the risky asset is re-interpreted as the satellite portfolio, which contains relative risk with respect to the benchmark, and the risk-free asset is re-interpreted as the core portfolio, which contains no relative risk with respect to the benchmark.

The method leads to an increase in the proportion allocated to the satellite when the satellite has outperformed the benchmark. Indeed such an accumulation of past outperformance has resulted in an increase in the cushion, and therefore in the potential for a more aggressive (and hence higher tracking error) strategy in the future. If on the other hand the satellite has underperformed with respect to the benchmark, the method leads to a tighter tracking error strategy (through a decrease of the proportion invested in the satellite portfolio) in an attempt to ensure the guarantee of the relative performance objective. Consistent with the spirit of the CPPI approach, the methodology recommends to take the investment in the satellite (risky asset in a relative risk context) to be a constant number,  $m$ , called the *multiplier*, multiplied by the *cushion*, defined by the difference between the portfolio value and a *floor* value, while the remaining part of the portfolio is invested in the benchmark (risk-free asset in a relative risk context). The floor is in turn defined as a percentage of the benchmark portfolio value (see Amenc, Malaise and Martellini (2004) for more details) that can be regarded as the relative protection level.

This approach allows for dissymmetric management of tracking error, ensuring that the underperformance of the portfolio with respect to the benchmark will be limited to a given level, while letting the investor gain fuller access to excess returns potentially generated by the active portfolio. This can be measured in terms of the difference of ratio of an *upside information ratio* (defined as the volatility of excess return of the portfolio conditional

on outperformance) and a *downside information ratio* (similar to downside risk: volatility of excess return of the portfolio over the benchmarks conditional on underperformance) – see exhibit 5.

Note that what follows cannot be achieved using traditional active managers. This is because an institutional investor cannot easily and economically terminate, increase or decrease the size of positions in a given manager. On the other hand, this can easily be done with futures. Another major benefit of futures in the context of dynamic asset allocation decisions is liquidity. Whenever the institutional investor needs to change the allocation to the core versus the satellite, it can do so very easily. That is much more difficult with traditional active asset management.

Exhibit 5 on page 17 contains the results of the experiment in the case of a guarantee equal to 95% of the benchmark's performance and an active portfolio invested in a maturity rotation strategy with a hit ratio equal to 70%. Assuming that EUR 100 million are initially invested in the strategy, we have tested 4 different values for the multiplier  $m$  ( $m = 2, 3, 4$  or  $5$ ). The higher the multiplier, the more the investor will participate in a sustained relative increase in satellite versus core portfolio value. On the other hand, the higher the multiplier the faster the portfolio value will approach the floor in case of a sustained relative decrease in satellite versus core portfolio value. As the cushion approaches zero, exposure to the satellite is also converging to zero, which in principle (i.e., in continuous-time) prevents the portfolio value from ever breaching the floor value. In practice, however, because of discrete trading, the portfolio value can fall below the floor value in case of a sharp decrease in relative value before the investor has a chance to trade. As a result of this analysis, it appears that the optimal multiplier value should be a decreasing function of the relative risk of the satellite versus the core (i.e. the propensity for the satellite to severely underperform the benchmark) and an increasing function of trading frequency.

**Exhibit 5:** Performance of relative return CPPI. This table shows the result of the experiment in the case of a guarantee equal to 95% of the benchmark's performance and an active portfolio invested in a maturity rotation strategy with a hit ratio reaching 70%. We assume that EUR 100 million are initially invested in the strategy. We have tested 4 different values for the multiplier  $m$  ( $m = 2, 3, 4$  or  $5$ ). We present in line 7 the annualized excess return with respect to the benchmark passively invested in the Euro-Bobl Futures contracts (+ available cash invested in the risk-free rate). In lines 12 and 13 we show the upside information ratio and the downside information ratio.

Guarantee = 95% of Benchmark Performance	Initial Cushion = 5 M				Benchmark
	$m = 2$	$m = 3$	$m = 4$	$m = 5$	
68-Mth Analysis Satellite Leverage = 4					EONIA + Euro-Bobl
Satellite Initial Weighting	10%	15%	20%	25%	
Cumulative Return	26.52%	27.45%	28.47%	29.58%	24.91%
Annualized Return	4.22%	4.35%	4.49%	4.64%	3.99%
Annualized Volatility	3.42%	3.40%	3.38%	3.37%	3.47%
Annualized Excess Return	0.23%	0.35%	0.49%	0.65%	-
Annualized Tracking Error	0.22%	0.36%	0.51%	0.67%	-
Information Ratio	1.01	0.99	0.98	0.97	-
Upside Information Ratio	2.40	2.42	2.43	2.43	-
Downside Information Ratio	-1.25	-1.24	-1.23	-1.22	-
Ratio of Information Ratios	1.93	1.95	1.98	1.99	-
Net Assets as from 08/31/2004	126 386 815	127 130 197	127 877 185	128 627 792	-
Guaranteed Value as of 08/31/2004	118 665 278	118 665 278	118 665 278	118 665 278	-
Difference	7 721 537	8 464 919	9 211 908	9 962 515	-
Monthly Drawdown	-1.85%	-1.79%	-1.73%	-1.65%	-1.95%

The performance of this method can perhaps be best understood by noting that the “ratio of information ratios” (upside IR divided by downside IR given in absolute value) is significantly higher than 1. This result suggests that good tracking error has been efficiently captured while the level of bad tracking error has been maintained at a reasonable threshold.

## 4. Conclusion

Although the existing literature seems to concur on the interest of hedge funds as valuable investment alternatives, because of the opacity and lack of transparency of hedge fund strategies, there still remain a large number of institutional investors who wonder whether they should invest in hedge funds, and more importantly, how they should do it.

In this paper, we emphasize the fact that more meaningful hedge fund solutions can be designed, based on the recognition that the marketing and packaging of alpha is as important to investors as the delivery of alpha. In particular, as the hedge fund industry is preparing to welcome the wave of institutional money management, it will have to develop different products designed to meet different investors' needs on the basis of a given alpha generation process.

More specifically, we present a series of illustrations in a fixed income environment suggesting that futures and options can be employed towards the design of products, allowing for the transformation of raw alpha into portable alpha, which can be used within the context of a modern core-satellite approach to portfolio management. Institutional investors may find a dynamic, non-linear version of this approach particularly appealing as it allows them to benefit from a dissymmetric control of tracking error risk and higher access to the potential benefits of abnormal returns generated by hedge funds without all the associated risks.

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