Fixed Income Derivatives:
Strategies for Portfolio Managers

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A recent study of a set of exchange-traded bond derivatives traded on Eurex has produced interesting results that are highly relevant for the fund management industry. Felix Goltz of the EDHEC Risk and Asset Management Centre assesses how these derivatives may be included in a state-of-the-art bond portfolio management process. While the original study examines the value of introducing derivatives both in a pure asset management context and in an asset liability management context, this article focuses on the former.

The field of fixed income derivative pricing and hedging has given birth to an impressive number of innovations over the past two decades. In particular, as debt instruments keep evolving from rather straightforward cash flow structures to securities with increasingly complex cash flows, new valuation techniques for these complex securities have been widely published. This article presents the results of a study (EDHEC, 2005, *Derivatives Strategies for Bond Portfolios*, research sponsored by Eurex) that takes a different angle by illustrating how various types of derivative securities can be used to shift the risk associated with investing in fixed income securities. More precisely, it looks at a set of exchange-traded bond derivatives traded on Eurex and assesses how these derivatives may be included in a state-of-the-art bond portfolio management process. In particular, it considers the following bond futures *(see Table 1, below)* and options on these futures in a fixed income portfolio.

The motivation for including options is that they have non-linear payoffs and allow investors to construct funds with skewed or dissymmetric return profiles. In comparison to simple bond index exposure, these may offer an efficient way of limiting the extreme values of a portfolio return distribution.

In order to assess the performance of different strategies using the instruments, we simulate interest rates and interest rate volatility by implementing the Longstaff-Schwartz interest rate model (see *Journal of Finance*, vol. 47, 4, pp. 1259–1282). We simulate 1,000 paths for the short rate and its volatility according to the model. The next step is the time-discretisation of these processes for simulating paths so that we can generate scenarios to represent the future uncertainty. Based on these scenarios, we calculate returns for different assets.

Table 1: Contract specifications

Futures Contract	Option	Remaining term defined in contract	Calculated duration used by us
Euro-Bund Futures (OGBL)	Put option on OGBL	8.5 to 10.5	7,8017
Euro-Buxl Futures (FGBX)	_	24 to 35	17,984

OPTION STRATEGIES IN FIXED INCOME PORTFOLIO MANAGEMENT

A favourite strategy with investors is a Protective Put Buying (PPB) strategy. This strategy consists of a long position in the underlying asset and a long position in a put option, which is rolled over as the option expires. We introduce the protective put buying strategy on the Bund contract in our simulation analysis in order to assess the benefits that investors can expect from such a strategy by comparing the strategy to a position in the Bund futures index. Our aim is to compare the performance of this strategy to a strategy that simply invests in the Bund future and rolls over the position every three months.

Table 2 *(right)* shows the risk and return of the Bund futures strategy and protective put buying strategy at a one-year investment horizon. The left part of the table indicates the percentiles of the return distribution over the 1,000 scenarios that we generated. The right part of the table indicates some standard performance measures based on this distribution. The information ratio is calculated with respect to the Bund futures strategy. "Bond" denotes the Bund futures strategy. "PPB" denotes the protective put buying strategy.

The percentiles of the return distribution show that the PPB strategy clearly dominates the results of the simple Bund futures strategy. This can be seen from the fact that the returns for PPB are higher for each cumulative probability. The 5% percentile, for example, shows that the probability of having returns that are below or equal to -4.59% (-3.20%) is 5% for the Bund futures strategy (PPB strategy). This corresponds to the standard Value-at-Risk measure at 95% confidence, i.e. the most extreme loss with 95% confidence is -4.59% and -3.20% respectively.

Table 2: Performance of the Bund futures strategy ("Bond") versus the put buying strategy ("PPB")

Percentiles of end of horizon return			Performance statistics		
	Bond	PPB		Bond	PPB
0%	-13.36%	-12.37%	Mean	4.96%	5.98%
5%	-4.59%	-3.20%	Sharpe-Ratio (2%)	0.52	0.70
25%	1.22%	1.88%	VaR (95%)	4.59%	3.20%
50%	5.21%	5.69%	Skewness	-0.28	0.14
75%	9.02%	9.93%	Info-Ratio	0.00	0.41
95%	13.88%	15.20%			
100%	19.69%	27.67%			

Examining the performance statistics also leads to the conclusion that the PPB strategy is largely favourable. In particular, the mean return also increases. This stems from the fact that the put option is exercised in scenarios with strongly negative returns. Consequently, the left tail of the return distribution is cut off, which increases the mean return. This effect is equally apparent from the higher skewness of the PPB strategy.

The previous simulations considered standalone investments in either the options strategy or the bond futures strategy. It appears that the PPB strategy clearly dominates the bond futures strategy. More precisely, the PPB strategy has lower downside risk, while achieving returns that are considerably above those for the bond futures strategy. Investors looking for capital preservation would naturally favour such an investment. The assessment of the standalone benefits would ultimately suggest that an investor should replace his stock and bond portfolio with a portfolio of hedge funds.

OPTIMAL ALLOCATION TO OPTION STRATEGIES

Instead of looking at choices between single assets, a more pertinent question is to ask what benefits arise from investing in the option strategy in a portfolio context, as an addition to the bond futures strategy. This subsection turns to this issue.

Our portfolio choice problem is between the bond futures strategy and the PPB strategy described above. We test two optimisation objectives. Our first risk measure is the Value at Risk (at 95% confidence) and the second is the variance of portfolio returns. The time horizon is one year, as in the section above.

Table 3 (*below*) shows the risk and return characteristics of the minimum risk portfolios. In addition, the last two lines of the table show the improvement over the case where the portfolio consists of 100% invested in the bond futures strategy. It can be seen that the reduction of the volatility (standard deviation of returns across simulated portfolio wealth at a horizon of one year on our 1,000 paths) is present, but not very significant in economic terms. However, the reduction in Value at Risk is very pronounced, and this even in the case of the minimum variance portfolio, which reduces the Value at Risk by 15%. The Minimum Value at Risk Portfolio even reduces the Value at Risk by 32%.

Table 3: Risk and return characteristics of minimum risk portfolios

	Min VaR	Min Variance
Mean	5.92%	5.44%
Std Dev	5.64%	5.52%
VaR (95%)	3.20%	3.90%
Sharpe-Ratio (2%)	0.69	0.62
Skewness	0.11	-0.10
Reduction in Volatility	0.04%	2.21%
Reduction in VaR	30.36%	15.13%

These results clearly show that assessing the value of the option strategy in terms of standard deviation is misleading, since the standard deviation does not fully describe the risk in the case of asymmetric return distributions. The main benefit of including the option strategy comes from the fact that it introduces positive asymmetry into the portfolio. This only becomes fully apparent when looking at the Value at Risk, which captures the asymmetry of the return distribution.

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