Creating a practical tool for financial valuation

Neil Henfrey says the time he spent on writing a zero-coupon pricing model proved to be a good investment. Here, he provides an outline of its many uses.

Many years ago, when large companies were just becoming actively involved in the interest rate swap market, my employer at that time decided we needed to be sure that banks were quoting fair prices when dealing interest rate swaps with us.

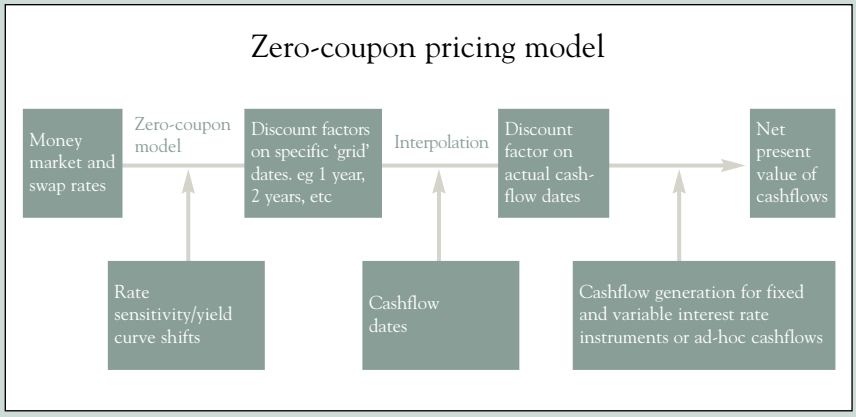
Then (back in the early 1990s), banks did not 'share' their models and you could not buy them 'off the shelf', so it was a case of writing a zero-coupon pricing model from scratch. It took several months to write, but this has proven to be one of the best investments of time I have ever made and the resulting model has found numerous uses over the years. This article covers a few of these uses.

Model

The standard methodology for interest rate valuation (excluding options) is the zero-coupon pricing model (covered in the Money Management module of the Association's syllabus). In creating a practical tool for financial evaluation, this pricing methodology needs combining with other input/output elements, which can be seen in *Figure 1*. The complete model enables:

- discount factors to be calculated for any future specified date based upon input market rates (swap and money market/futures) using standard zero coupon methodology;
- future cashflows to be generated for fixed or floating rate loans based upon their input parameters (and market rates for floating rate cashflows); and
- the resultant net present value of the future cashflows to be calculated.

FIGURE 1



With this discount factor and cashflow 'calculator' (which works in the same way as banks value interest rate products), most non-option-related interest rate financial calculations can be made.

Practical uses

The most obvious, and original, use is for seeking quotes for interest rate swaps. Unless the swap being dealt is completely 'plain vanilla' – that is, all its terms are identical to the quoted standard on the Reuters or Bloomberg screen, then it is important to ensure that bank(s) are quoting on exactly the terms required.

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Given that there can be more than 20 variables, even for a simple interest rate swap, this needs a detailed deal sheet, deal discipline and a price checker (that is, the interest rate valuation model). For example, a five year US$ interest rate swap quoted on a 30/360 day basis will have a fixed rate 10bp (basis points) different to that quoted on an A/360 basis, so it is important to be able to calculate and anticipate what the quote level should be before real quotes are obtained.

It is not unusual to find that the 'winning' bank has quoted on a different basis to that expected, unless this preparation work has been done.

Once there are a few swaps on the books, the uses of an interest rate valuation model multiply.

Valuation of swaps is required for accounting disclosure purposes under the FRS13 – only those companies with

modern, sophisticated treasury systems can do this automatically, so again a valuation model is needed. The same valuations might also be used for assessing counterparty credit risk, or more importantly for smaller companies, assessing how much of their precious 'credit limit' is being used up by existing swaps.

UK accounting disclosures also have to be made for the 'fair value' of fixed rate loans. If these loans are not publicly quoted then a reasonable estimate of the fair value has to be made.

Since the fair value of a loan is merely the NPV of its future cashflows, the interest rate valuation model can be used again. This time the discount factors used are calculated using market swap rates, but with the typical corporate lending margin added. So, for example, if the 'normal' lending rate for floating rate loans is Libor+50bp, then the fair value of a 7% fixed rate loan could be calculated using the market swap rates with a 50bp premium added to each rate.

Even the best laid hedging strategies sometimes require amendment, often as the result of a change of corporate strategy (and in particular M&A activity), such that existing swaps need to be cancelled.

Unlike dealing new swaps, when competitive quotes from banks ensure a reasonable price sharpness, cancelling swaps is more fraught with difficulty. While it is possible to set up a competitive process (by quoting for a new 'opposite' deal with competing banks or getting quotes for cash settling an assignment of the existing deal to a new bank), often it ends up as a negotiation exercise with the existing bank.

In theory, the incumbent bank should give a tight price as cancelling the swap reduces its credit risk.

However, unless there is a reliable pricing model available to the company, there will be only one winner. The monetary value of a 1bp difference in rate for a £10m swap with five years left is approximately £4,000, so it does pay to know what the market value should be before commencing negotiations.

In addition, it is easy to calculate the sensitivity of the value of a swap to interest rate movements by calculating the impact of a 1bp shift in the yield curve (present value of a basis point, PVBP) using a model of this type.

Analysing hedging scenarios and looking at interest rate sensitivities of existing exposures in a quantitative manner then becomes much more rigorous.

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However, over the years, I have found the most powerful use of a model of this type is not for swaps and hedging, but for more general financial questions. Three examples are given below.

Example 1: assessing a good deal

A bank offers a GBP fixed rate loan for two years at 6.5%. Is this a good deal compared with its normal offer for short-term funding of Libor+50bp? If competitive quotes are not available, then the best way of forming a judgement is to value a two-year 6.5% fixed rate loan against a two-year Libor+50bp loan on the interest rate valuation model.

Since the zero-coupon model calculates expected future variable interest rates, the expected future cashflows of both loans can be derived and the NPV calculated.

If, for example, the model calculates that a fixed rate loan of 6.5% is equivalent in NPV terms to a Libor+70bp floating rate, then the bank is clearly trying to charge an additional 20bp margin. Whether this is acceptable will depend on a number of factors, but at least by knowing the equivalent floating rate margin (based upon the same methodology as the bank will have used) an informed discussion can be had with the bank.

Example 2: payment terms

A key customer wants to make payments spread quarterly over two years instead of up-front. If the usual borrowing margin for short-term funds is 50bp, how much will the customer need to pay each quarter so that we are no worse off financially (ignoring liquidity issues) to an outright sale? This is, again, a classic NPV type problem.

In this case, the input rates used would be market rates with 50bp added, and quarterly payments chosen so that their NPV equalled the outright sales price.

Although this problem is often tackled using Microsoft Excel financial functions, the scope for error is usually significant, particularly on whether the interest rate to be used would be the quarterly or yearly rate.

Even without errors, the answer can be substantially different anyway between an Excel function, which uses only a single interest rate, and zero-coupon pricing based upon the true yield curve, which may be steeply sloping. I am always wary when using an Excel function for this type of calculation, as the value calculated is often misleading.

Example 3: evaluating leases

The problem, in converse, might be that a leasing company has quoted a payment stream (possibly complex) for some equipment and we want to calculate the inherent interest rate the leasing company is charging and compare with normal bank funding rates. A simple job for an interest rate valuation model even when payments are not evenly spread over time, which Excel financial functions cannot cope with.

Good news for treasurers

I hope this article has shown the usefulness, particularly in small and medium-sized firms that do not have access to sophisticated treasury systems or bank software, to go beyond using Excel NPV functions for their financial calculations.

Banks use zero-coupon pricing off the swap yield curve to price their products, so to have an informed pricing debate with them, treasurers need to do so, too.

There are many good systems available, but one I have found particularly useful is the CheckInt Interest Rate Valuation Model system, which can be found at www.finansystems.com. Systems like these are good news for treasurers. Now, treasurers do not need to invest many months writing such a model, they can be simply bought 'off the shelf'. ■

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