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Chinese 50 year bond: how does it perform against extrapolated values?

The issue of new ultra-long bonds beyond the previous longest maturity of a bond market provides a natural test of yield curve extrapolation methods. In this comment we look at how a recently-issued Chinese government 50-year issue traded relative to extrapolated values.

Methods for the extrapolation of yield curves in the absence of market prices have attracted considerable attention recently. This attention is a result of a realization among firms and regulators that decisions on extrapolation can have a major impact on the market-consistent value of certain classes of liability in countries where long-term bonds are unavailable or where liability maturity is long relative to available bonds. At the beginning of this March, a European regulatory 'Task Force' published a set of 11 principles for how these calculations should be performed¹. The proposed principles are broadly consistent with the methods proposed and adopted by Barrie & Hibbert in our own work in recent years. See for example, our note "Market-consistent valuation of ultra long-term cash flows" dated October 2008.

Extrapolation aims to set a value for an asset which either does not exist or where market prices are judged to be unreliable. This value should answer the question of where an asset would trade if it were exchanged between two market participants in an 'orderly transaction'. You might argue that new issues of ultra-long term bonds provide a natural test for extrapolation methods. We can compare actual market prices with the (previous) estimates based on some extrapolation method. For a good extrapolation method these differences should be small. Last year's issue of 50-year bonds by the Chinese government provides one such example. Of course, it is only one example, so we would be foolish to draw any strong conclusions but it is worthwhile reviewing the outcome all the same.

On November 27th 20 billion Yuan of bonds were issued at a yield of 4.30% (which was somewhat lower than the 4.50% predicted by market analysts). The maturity of the new bond (at 50 years) is just over 20 years longer than the next longest 30-year maturity. So how did the market yield compare with extrapolations?

The extrapolation method adopted by Barrie & Hibbert involves fitting and extrapolating forward interest rates towards a global unconditional assumption for government yields of 5.5% (end November 2009) with the rate of movement towards this level dictated by a view on the volatility decay of forward interest rates. The Barrie & Hibbert method produced an extrapolated

1. Task Force Report on the Liquidity Premium, CEIOPS-SEC-34/10, 1 March 2010

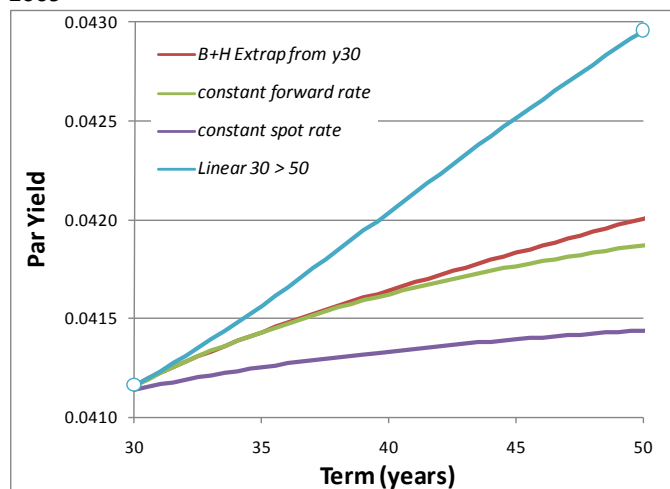
fair par yield for the 50-year bond of 4.20% - 10 basis points lower than the actual market yield. This appears to be a reasonable result bearing in mind the 20-year difference between the two longest maturities.

How does this compare with alternatives? Although extrapolation towards a limiting forward rate has recently gained wider acceptance, other simpler methods have been proposed (and used) for this purpose.

Firstly, consider the use of a constant forward interest rate. As we have observed, producing a reliable estimate for this rate for a long bond is difficult because the forward rate is very sensitive to changes in the long bond price. For China, there are a number of bonds close to the 30-year maturity and different techniques for estimation could produce markedly different estimates for the forward rate. Notwithstanding this, our estimate for the 30-year forward interest rate at end-November was 4.48% (continuously compounded). Assuming this is constant for years 30 to 50, produces a par yield for the 50-year bond of 4.19%, only marginally lower than that achieved using the Barrie & Hibbert method. An alternative is to use a constant *spot* (i.e. zero-coupon) interest rate. This produces an estimate for the 50-year yield of 4.14% - 16 basis points below the actual market yield.

It is worthwhile highlighting that the difference between the actual market 30-year and 50-year bond yields implies markedly *higher* forward interest rates over the 30 to 50-year horizon compared to levels generated by the Barrie & Hibbert methodology.

Chart: Extrapolated par yields for CNY government bonds at end-November 2009



Conclusion

New issues of ultra-long bonds provide a useful natural benchmark for extrapolation methodologies. In the case of the end-November issue of 50-year bonds by the Chinese government the **Barrie & Hibbert** methodology does a better job of estimating the trading level of the 50-year bond than assuming either flat forward or flat spot rates. The *actual* market rate implies a significant rise in forward rates beyond the 30-year maturity. The analysis will confirm what many readers already know – that yield curve extrapolation is subject to a considerable degree of (estimation) error. No technique can reveal the 'true' market price with the level of reliability that we might wish for. The Barrie & Hibbert method performs well relative to the simple alternatives of flat forward or flat spot rates.

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