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Capturing the interest rate risk in MBS investments

Mortgage-Backed Securities (MBS) issued by Freddie Mac, Fannie Mae and Ginnie Mae are common holdings in US insurers' fixed income portfolios. Over the past few years the annual issues of MBS securities by these three agencies has averaged close to a trillion dollars per year. During the credit boom annual issue of MBS directly by commercial banks became increasingly common, often as complex 'structured' Collateralised Mortgage Obligations (CMOs). While commercial CMO annual issues have effectively ground to a halt following the credit crisis, great efforts have been made to keep the agencies operating and providing liquidity within the US mortgage market.

The size of this asset class is such that it is relatively rare for a US insurer not to hold a significant proportion of their fixed income allocation in MBS. Investment in MBS is considered an attractive way of diversifying fixed income and credit portfolios holdings which would otherwise be largely concentrated in the government or commercial bond markets.

Although there are tens of thousands of different agency MBS 'issues' that an insurer might hold in their portfolio, simple 'pass-through' MBS differ principally due to the 'pool' of underlying mortgages backing the MBS. In differentiating between different MBS there are a relatively small number of characteristics of the mortgage pool that are particularly important:

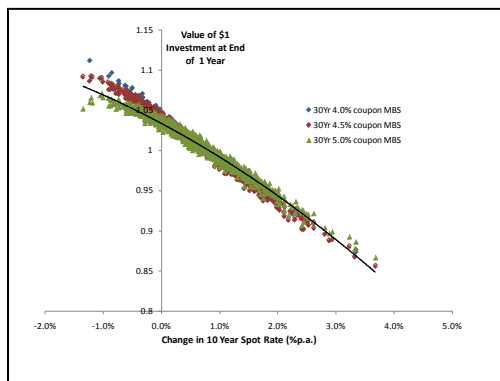
- + The mortgage term. Most typically the mortgage pools will consist entirely of thirty year fixed-rate mortgages.¹
- + The average mortgage rate – typically 4.5%, 5.0%, 5.5% or 6.0% in recent years.
- + The average age of the underlying mortgages –at present lower rate.
- + The 'pool factor'- the percentage of original mortgage principal that is still outstanding.

These characteristics largely determine the scheduled cash flows from a mortgage pool. In a pass-through MBS these cash flows are simply passed on to the MBS holder after guarantee and administration costs are subtracted. The MBS coupon payment on a simple agency pass through MBS is typically 50 basis points lower than the average mortgage interest payment.

However, modelling the characteristics and risks in an MBS is more challenging than simply modelling the scheduled cash flows. Significant uncertainty arises because mortgage holders have an option to pay back some or all of their mortgage debt at any time. What's more, they are expected to exercise this right opportunistically when better mortgage rates become available. When rates fall mortgage holders will refinance.

1. Less commonly they may be composed of 15, 10 or 20 year mortgages.

Comparison of 1 year returns for MBS with different coupons



In order to capture the realistic probability of prepayment cash flows in an MBS one needs to implement a model which captures the wide range of prepayment behaviour expected over a large heterogeneous set of mortgages, and the impact of changing refinancing opportunities on mortgage holder behaviour.

Barrie & Hibbert has recently implemented an MBS model and calibration which models the mortgage holder prepayment behaviour consistently with the underlying economic scenarios. In the chart below we show the expected value of a one dollar investment in three different MBS investments (versus change in 10 year interest rate over the year).

The investment return is strongly linked to changes in rates, with increasing gains. The effective duration of the investment return is lower for the higher rate MBS due to more refinancing from higher rate mortgages. The MBS also show negative effective convexity. Falling rates lead to significantly lower levels of refinancing within the mortgage pool, limiting the upside for the MBS holder. The solid line shows a positive-duration/negative-convexity approximation to the portfolio return which captures much of the interest rate risk.

At first glance this seems to indicate a simple approximation to modelling MBS returns consistently with interest rate scenarios. The Barrie & Hibbert ESG allows users to set up generic bond portfolios with positive duration and negative convexity. Would a short-duration/negative-convexity bond portfolio produce realistic returns distributions for MBS, without the need for the sophisticated prepayment model?

Unfortunately, there are some issues with this simplified modelling approach. The three MBS assets projected above have effective durations of between 3.5 and 5.5 years. However the investment returns are actually linked most strongly to the 10-year rates. The scheduled payments on a 30-year mortgage have a duration of close to 10-12 years which means the 10 year rate can be thought of as a proxy for the prevailing 30-year mortgage rate. Changes in this prevailing mortgage rate (not the 3 to 5 year yield) will drive refinancing behaviour.

Modelling MBS as short-duration/negative-convexity bond portfolios which are linked to the 3 to 5 year yield will produce asset returns that are instead highly correlated to changes in the short end of the yield curve. The chart below shows a comparison of the Barrie & Hibbert ESG MBS model and a short duration negative convexity proxy which is also available in the ESG.

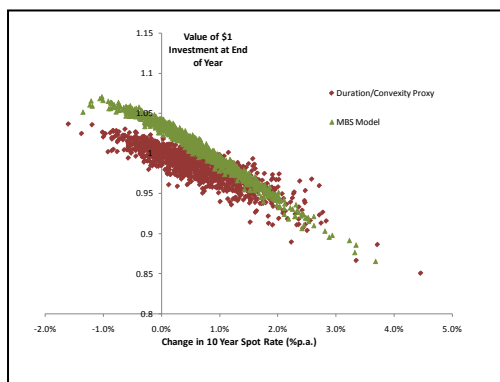
There are a number of features of the duration/convexity proxy which are less than satisfactory.

- + The proxy shows less dependency on the 10-year rate than the MBS model (despite the fact that the values for duration and convexity were estimated using the MBS model)
- + (Although not shown above) the proxy shows more dependency on changes at the short end of the yield curve than the MBS model
- + There is little evidence of convexity in the relationship between the proxy's return and changes in the 10-year rate (and too much convexity when you look at changes in the 4 year rate)
- + The average return is 3-4% lower for the proxy (because in this particular calibration the short end of the yield curve is predicted to rise rapidly).

With care, better approximations could be made using the yield curve scenarios produced by the ESG². However there are still likely to be some

² The key is to link the returns appropriately to changes in the long end of the curve

Comparison of prepayment MBS model versus negative convexity proxy



major shortcomings with a duration convexity proxy for more sophisticated users of economic scenarios. If modelling cash flows is important (due to projected liability payouts or derivative hedges held against the MBS) a short-duration portfolio approximation is unlikely to produce realistic cash flow scenarios (in fact it is not obvious how cash flows can be incorporated at all).

The MBS model is currently available to Barrie & Hibbert clients who subscribe to the P&C Scenario Service or who are using the P&C version of the ESG and will also be available in version 7.0 of the ESG. If you are interested in exploring how the model may be able to help you capture the interest rate risk in your MBS portfolios please contact us for more information.

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