

Topic of the Month: Rate and Yield Range in Duration: Why Size Matters

Excerpt from the December 2006 Month in Review

This is the first installment of a multi-part series exploring the various methods used in calculating duration within mortgage valuation and hedging community.

Duration measurement is an integral piece of any fixed income portfolio's risk assessment. Simply put, duration is a linear measure of a fixed income instrument's price sensitivity to interest rate movement, or a rate shock, at a given point in time. There are several approaches to calculating duration which have developed as the fixed income market has evolved. The first generation calculation was derived by Frederick Macauley, who was seeking a way to measure the price risk of a bond portfolio. In the universe of callable bonds such as mortgages, which have embedded call options (prepayments), a more sophisticated measurement of duration is required due to the uncertainty of future cash flows. This gave rise to Effective Duration, which is the duration method used by Compass. One might define Effective Duration as the change in price given a yield movement based on pricing models or market price/rate observation.

With respect to mortgages, one must consider different sources of Effective Duration, as well as the actual magnitude of the rate/yield change used in the duration calculation (the denominator – think negative convexity). For example, 100 bps is a standard rate range used in calculating duration, especially among Street firms. Compass employs a 6 bps rate range which results in higher durations than what one might observe on the Street. The horizon for price risk is abbreviated in a mortgage pipeline hedging environment versus the Street's horizon which may be based on a longer term investment objective. For instance, Compass is modeling durations for a rate range assuming a 30 day lock period, while Street firms assumptions may be based on a more expansive horizon.

The Price Movement model Compass applies is defined below.

Step 1. Using prepayment assumptions (Constant Prepayment Rates – CPR's) calibrated (averaged) across several dealer/broker research departments, a lognormal interest rate path generator and 100 stochastic rate paths, Compass derives agency, coupon and delivery month option adjusted spread (OAS) values.

Step 2. Using client/Compass-defined rate ranges (e.g. +/- 24 bps in yield by 3 bps increments), the yield curve is shifted for each point on the rate range and the OAS values derived from Step 1 are used in calculating the new MBS price at that point of the shock given projected cash flows from CPRs (considering rate range) and discounted by yield curve + OAS.

The calculation of Non-Agency durations must consider the higher probability of negative convexity. After surveying three competitive conduit rate sheet prices, Compass derives a note rate level price spread for each non-agency product relative to the same interest rate agency product. This note rate spread increases (i.e. has increased negative price impact) the further above par an interest



rate climbs. This reflects the reality that Non-Agency products are traded as WAC pools where traders prefer to buy product close to market rates, and at some point will refuse to pay additional price for excess yield. Increased negative convexity must be modeled when deriving non-agency durations and convexity. Compass accomplishes this by applying the note rate level price spreads against agencies then slides that scale as rates are shocked. For example, if a note rate 50 bps above par today is priced back 1.5% and a note rate 75 bps above par is priced 1.75% back, with a rate range showing a decrease in rates of 25 bps, the note rate 50 bps above par would “slide” to show that it will become 1.75% back from agencies.

As mentioned, Compass duration is expressed in terms of local duration, that is duration over a 6 bps range. Compass employs this range given that it is most consistent with what we observe as market move on a day over day basis. This tighter trading range results in more changes to durations than wider ranges (e.g. 1 point in yield). The tradeoff is more accurate local durations and increased duration volatility versus less accurate local durations and less duration volatility.

Consider the following example:

100 basis point range (+/- 50 bps in yield) for a coupon price at par today might yield a price move to 101.50 (down 50) and 97.0 (up 50 bps). If the duration was derived using a 100 bps rate range, the duration could be $(101.50 - 97.0) / 1.0$ or 4.5. If 4.5 was used, and the market did decrease in rate 50 bps, then actual duration would be 3 $(101.5 - 100) / .5$, not 4.5 and a hedge mismatch would occur. If smaller rate ranges are used, the hedger can calibrate durations and duration ratios more frequently and thereby mitigate the risk of such mismatches.

If Compass utilized larger rate range increments, we would in general expect lower durations given that more negative convexity would become a factor (convexity will be covered in future installments). The converse is also true – if the rate range is smaller, e.g. .01 bps or 1 bps, we would expect Compass’s durations to be higher. Street durations, which are often expressed over a 100 bps range, are often lower than Compass’s durations for this reason.

As the above example illustrates, the range of rate/yield change applied in calculating durations is a germane consideration in pipeline hedging. In the next article, we will introduce Compass functionality that allows the CompassPoint™ customer to choose rate/yield change values used in duration in order to tailor their durations to the life if their loan locks and market volatility. –*Virgil Caselli and Vimi Vasudeva*