

**Lakhbir Hayre**

(212) 816-8327

[lakhbir.s.hayre@ssmb.com](mailto:lakhbir.s.hayre@ssmb.com)

**Robert Young**

(212) 816-8332

[robert.young@ssmb.com](mailto:robert.young@ssmb.com)

---

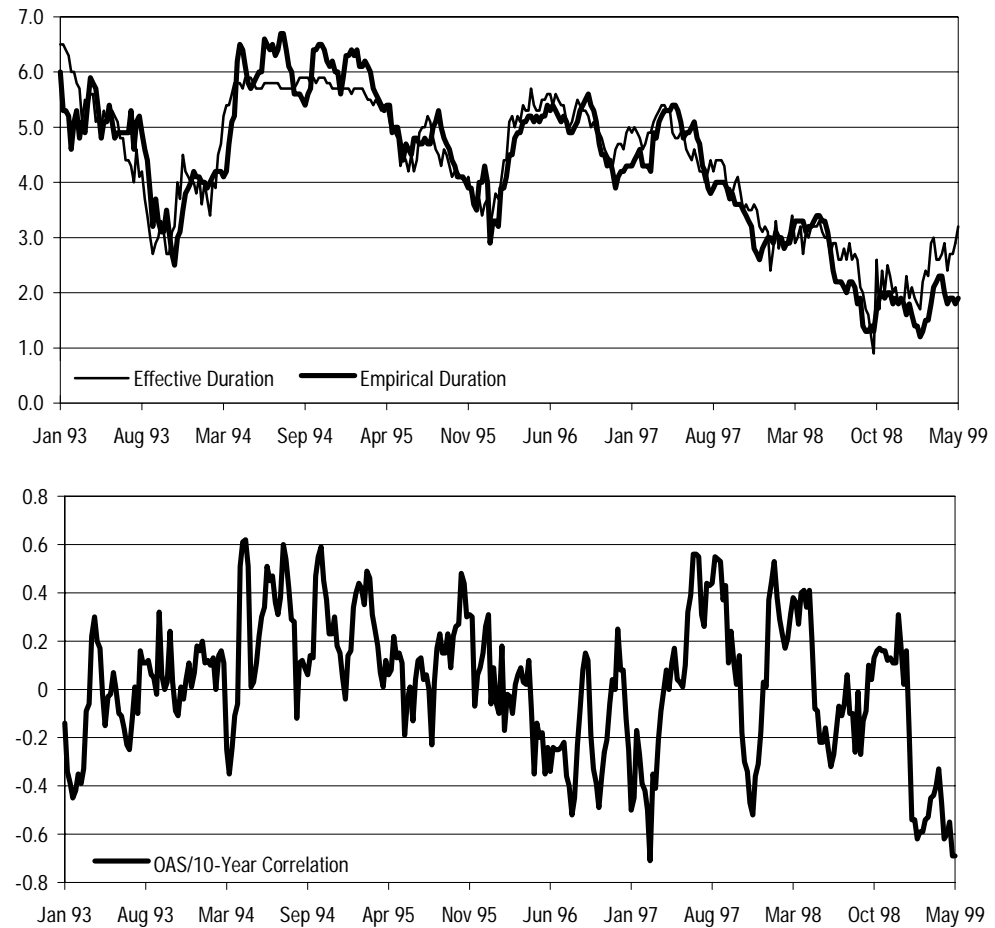
## Directionality and Mortgage Durations

Effective durations and empirical durations have diverged markedly in recent months. Of course, the two have diverged at times in previous years, but the current divergence seems particularly pronounced and persistent. The difference between the two is related to the directionality of OAS; that is, the correlation between OAS and yield changes.<sup>9</sup> OASs tend to become directional during periods of heightened prepayment fears (in other words, when the media effect is strong). They widen when rates drop and tighten when rates rise, leading to dampened price movements and lower empirical durations. The directionality, and hence, the gap between empirical and effective durations, should have diminished as the markets, for the most part, returned to normalcy after the financial panic of last fall. However, as Figure 22 indicates, this has not been the case.

---

<sup>9</sup> Roughly speaking, the empirical duration is equal to the effective duration less a multiple of the correlation mentioned in the text. See *Effective and Empirical Durations of Mortgage Securities*, Lakhbir Hayre and Hubert Chang, Salomon Smith Barney, September 1996.

Figure 22. Durations and Correlations Between OAS and Ten-Year Treasury Yields for Conventional 7s, 1 Jan 93–12 May 99



Source: Salomon Smith Barney.

This article is the first of several that will discuss MBS durations and hedging implications and strategies. This week, we analyze why effective and empirical durations have diverged.

#### Why Were Empirical Durations Lower Than Effectives?

We start by conducting a post-mortem on recent MBS price movements and, thus, identifying the specific factors causing the recent divergence between effective and empirical durations. Recall that the usual method of computing empirical duration is to regress mortgage price changes against changes in Treasury yields. For Salomon Smith Barney's *Effective/Empirical Duration Report* (manifold MB728), daily percentage changes in mortgage prices for the past month are regressed against corresponding changes in the ten-year yield.<sup>10</sup>

For example, as of the close of May 12, 1999, 30-year Fannie Mae 6.5s had an empirical duration of 2.8, meaning that the MBS had, on average, displayed a price

<sup>10</sup> For a comprehensive description of empirical durations, see *Effective and Empirical Durations of Mortgage Securities*.

elasticity of 2.8% in the prior month with respect to changes in the ten-year yield (in other words, extrapolating from the past 30 days, we would expect the price to change by 2.8% for a 100bp move in the ten-year Treasury yield).

Empirical durations are based on actual price and yield moves, and hence, can provide a necessary sanity check on model results, especially during uncertain times when basic model assumptions may not hold. However, investors should realize that **empirical durations are backward looking** — they embed actual market changes and relationships displayed over the period used for the estimation. This can be good (if we expect such relationships to persist to the hedging horizon), or bad (if not). Examining developments over the past month allows us to illustrate this point.

- **Nonparallel yield curve changes.** Yield curve changes are unlikely to be parallel over the estimation period. For example, for the month up to May 12, 1999, the ten-year yield rose by 53bp, while the two-year climbed 27bp, the five-year 42bp, and the long bond 38bp. Based on the partial durations of the Fannie Mae 6.5%, this is equivalent to a parallel shift of about 44bp. Hence, unless we expect the yield curve to change in the same manner going forward (which is unlikely, because the ten-year on-the-run yield was recently distorted by a new auction on May 13), the empirical duration should be adjusted, by a factor of 53/44 say, to 3.4, for hedging purposes.
- **Level of rates.** Interest rates overall increased from April 12 to May 12. Hence, the empirical duration is biased downward because the data over the past month tends to come from a lower-rate environment (in which durations should be shorter). The *Updated Empirical Duration* shown in our manifold MB728 attempts to correct for this by adding the average change in effective duration. In this case, the correction is 0.4, giving an updated empirical duration of 3.2. If we combine this with the nonparallel yield curve shift adjustment, we obtain an empirical duration of about 3.8 for hedging purposes.
- **Changes in other factors.** In the month prior to May 13, volatilities declined (for example, the 5x10 swaption was lower by 65bp), current-coupon spreads tightened by 22bp, and OASs on the Fannie Mae 6.5s narrowed by 12bp. The net effect of these changes is a lowering of duration by about 0.6. In other words, if these changes are not repeated over the hedging horizon, then other things being equal, we would expect the observed duration to be about 0.6 higher.

These factors explain why empirical durations were lower than effectives over the past month. While interest rate changes, yield curve reshaping, or changes in vols are difficult to predict (but can be hedged), the real question for traders and investors concerns OAS directionality. What is causing it, and will it persist?

Reasons for OAS Directionality

Possible explanations for OAS directionality include prepayment risk and a splitting of MBS trading from Treasuries.

**Prepayment Risk**

A perfect prepayment model would allow the prepayment risk in MBSs to be captured (at least in theory) through the OAS. Hence, OASs should not be directional with a perfect model. Therefore, the directionality may indicate that the market thinks current prepayment models understate the true risk. For example, market participants may believe that refinancing efficiency or the media effect may be greater in the future than is currently assumed, and the shorter durations may reflect this belief. Prior to the surprisingly strong early-1998 refinancing surge, the market remembered the surprisingly slow speeds from early 1996. Perhaps the market has now decided that bursts in the MBA Refi Index like that of early 1998 (and we should not leave out worries about mortgages obtained via the Internet) make the entire mortgage market more callable and, thus, shorter.

Although this theory is appealing, and to some extent valid, it has several problems:

- Current speeds have been pretty much in line with our model (see last week's issue).
- If we assume that actual speeds will diverge from projections over time, then implausible speeds have to be projected in the future to obtain effective durations close to recent empiricals. For example, for Fannie Mae 6.5s, to reduce the effective duration by about one year, one set of dials on the Yield Book led to a long-term projection of 22% CPR (for a current coupon!).
- If prepayment fears were very high, presumably this would show up through investors demanding higher risk premiums, leading to high OASs. In fact, OASs have declined sharply from the highs of last fall. Furthermore, all the liquid coupons have tightened in a similar manner, although a more severe refinancing function would be expected to have different effects on 6s versus 7s, for example.

**MBSs Trading to Spread Product, Rather Than to Treasuries**

Last year's crisis led to a severe liquidity crunch and flight to quality, with Treasuries (especially on-the-runs) rallying much more than other spread products. As a result, spread products became partly detached from Treasuries, and this may still be a factor in the minds of many investors. As a result, a given move in Treasury yields may not translate into a corresponding move in, for example, MBSs. Empirical evidence provides strong evidence for this belief. For example, for the month ending May 12, 1999, for Fannie Mae 6.5s, the OAS to on-the-run Treasuries tightened 12bp, while the OAS to swaps tightened only 2bp. We will examine MBS OASs and durations to swaps in more detail next week.<sup>11</sup>

---

<sup>11</sup> A forthcoming paper by Y.K. Chan will discuss the topic of MBS durations and swaps, and provide a general framework for modifying mortgage durations to reflect such relationships.