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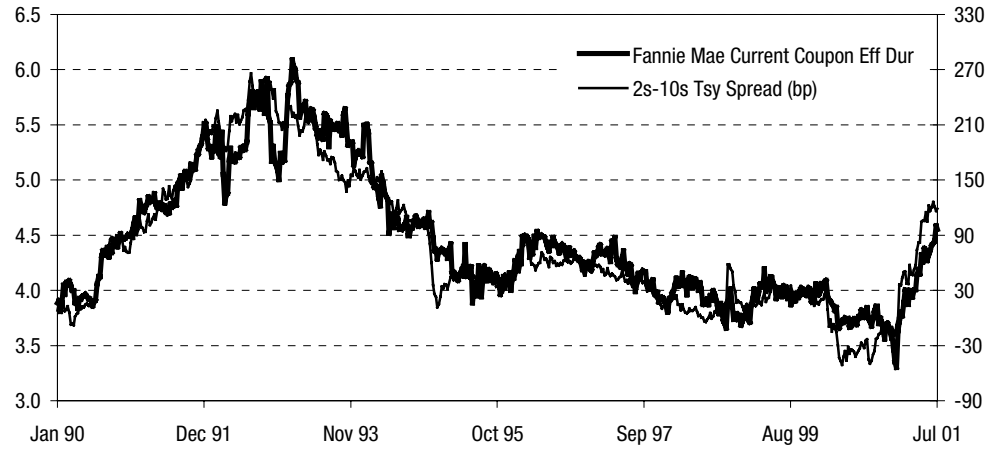
The current-coupon effective duration has reached a multi-year high of 4.6.

A Note on the Steepening Curve and Mortgage Durations

While effective durations are in general heavily dependent on the level of rates, for the current coupon, the slope of the yield curve is a major determinant of model effective durations. Figure 17 shows the effective duration of the Fannie Mae current coupon versus the 2s-10s Treasury yield spread since 1990. In the OAS model framework, the tendency of a steepening yield curve is to lengthen mortgage durations. A steeper yield curve means that interest rate paths have a greater tendency to increase as they follow implied forward rates.[5] This results in slower projected speeds along interest rate paths and, thus, longer durations. Recently, mostly owing to the steep yield curve, the current coupon effective duration has reached a multiyear high of 4.6.[6]

Figure 17. Fannie Mae 30-Year Current-Coupon Effective Duration Versus 2s-10s Treasury Yield Spread



Source: Salomon Smith Barney.

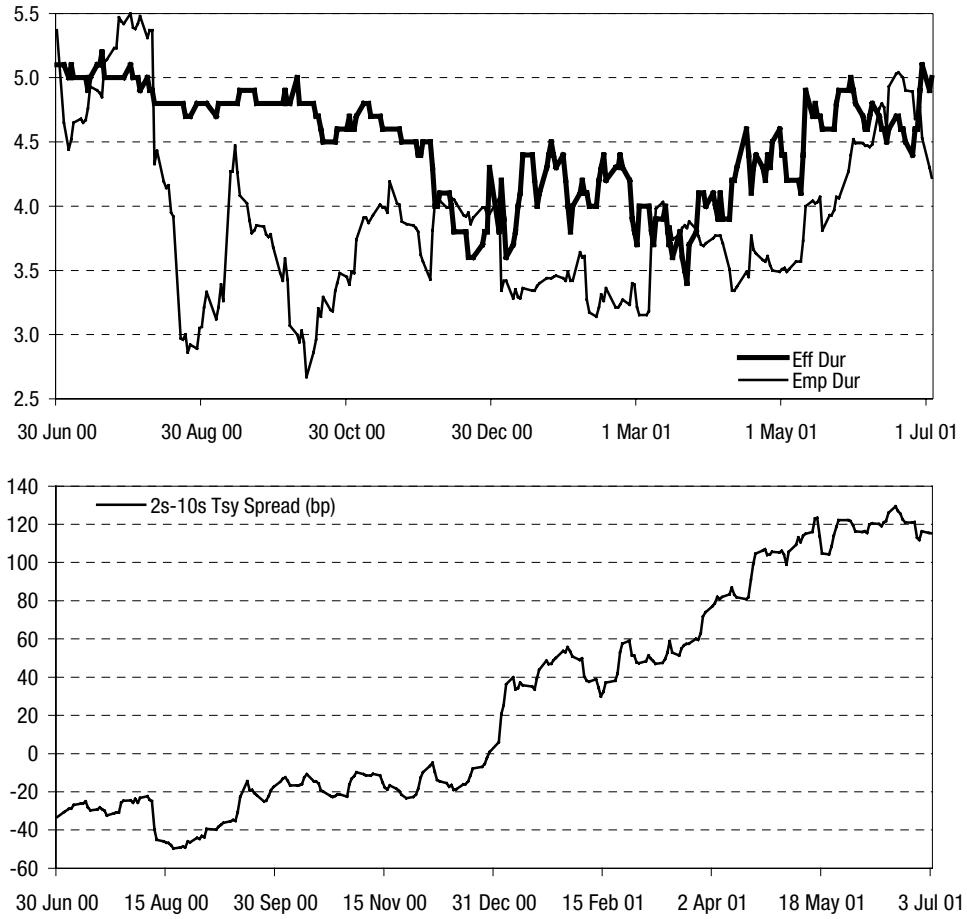
However, as seen from Figure 18, model effective durations and market empirical durations (versus the ten-year Treasury) can diverge substantially.[7] In particular, during the second half of 2000, effective and empirical durations (of Fannie Mae 6.5s) did not appear to track one another very closely. (Note that empirical durations will tend to lag the "true" duration as they are based on historical data over some past period, like a month in the case of Salomon Smith Barney's empirical durations.)

[5] The higher implied forward rates are **not** a prediction of higher rates in the future by the OAS model, but rather, are a consequence of risk-neutral, arbitrage-free pricing.

[6] As of the close of July 3, 2001. Figure 17 shows that the current coupon (Fannie Mae 30-year) effective duration can vary quite a bit, ranging from about 3.3 to 4.6 over the past five years, for example. This can be seen on the Historical Data page (1.6) of Yield Book™. See also *Bond Market Roundup: Strategy*, Salomon Smith Barney, October 9, 1998.

[7] See MB728, for example, for empirical durations (not to be confused with updated empirical durations, which attempt to account for rate level changes by adding to the empirical duration the average change in effective duration). Empirical durations are computed by regressing daily percentage mortgage price changes versus changes in a benchmark yield, such as the ten-year Treasury. See *Mortgage Durations and Price Moves*, Salomon Smith Barney, March 6, 2001 (this is an updated version of *Effective and Empirical Durations of Mortgage Securities*, Salomon Smith Barney, September 1996).

Figure 18. Fannie Mae 6.5s Effective and Empirical Durations Versus 2s-10s Treasury Yield Spread



Source: Salomon Smith Barney.

However, as the curve has steepened, market empirical durations appear to be moving roughly consistent with the move in effective durations, with both moving higher over the past five months or so (see Figure 19). Also, the implied volatility OAS to swaps has remained roughly stable during this period.[8]

[8] This is also one reason why empirical durations have tracked effective durations in recent months. OAS widening and tightening often show up in the form of deviations between empirical and effective durations. See *Mortgage Durations and Price Moves*, Salomon Smith Barney, March 6, 2001.

Figure 19. Fannie Mae 6.5s Effective and Empirical Durations Versus 2s-10s Treasury Spread, Implied Volatility OAS to Swaps, 2 Feb 01–3 Jul 01

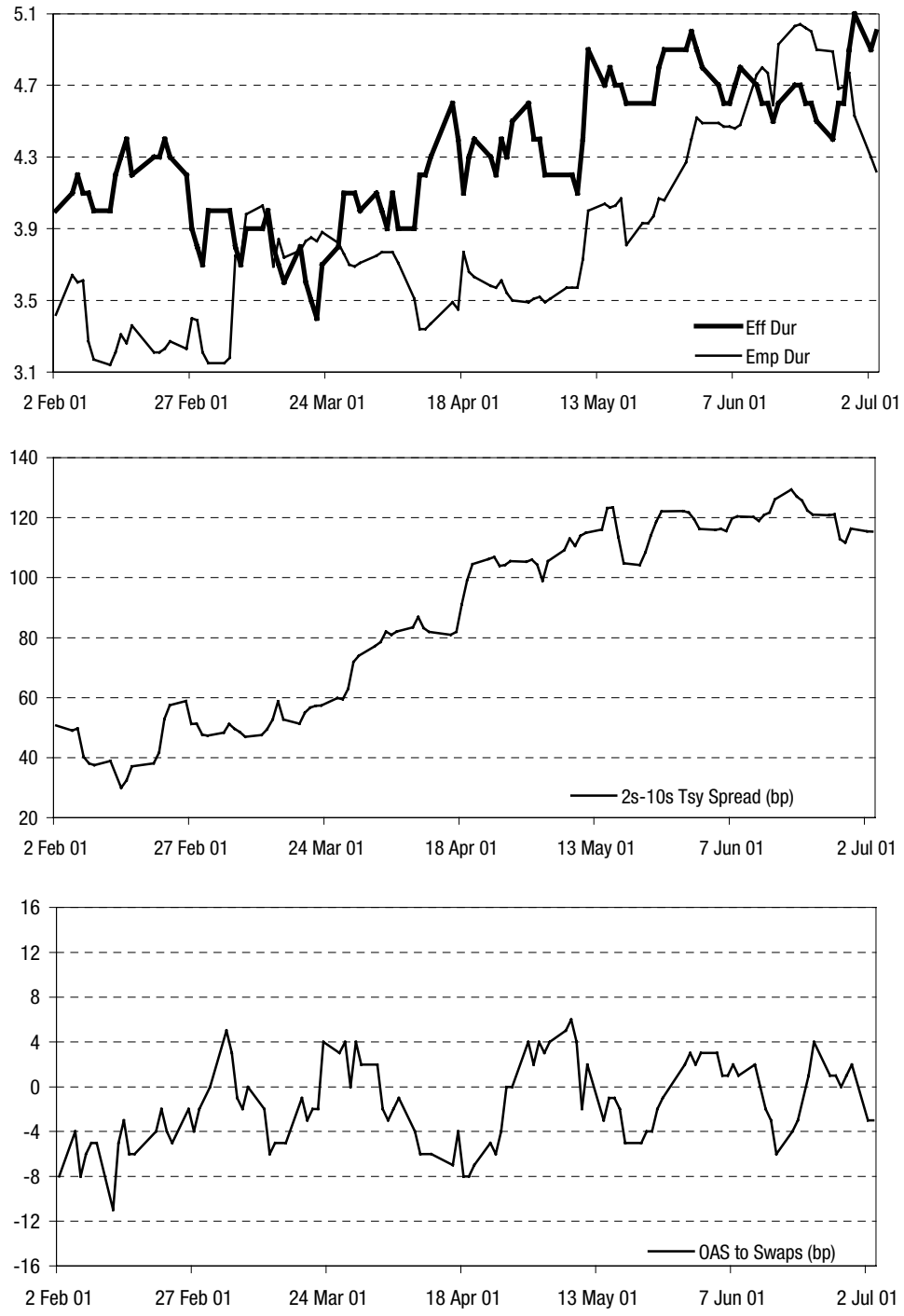
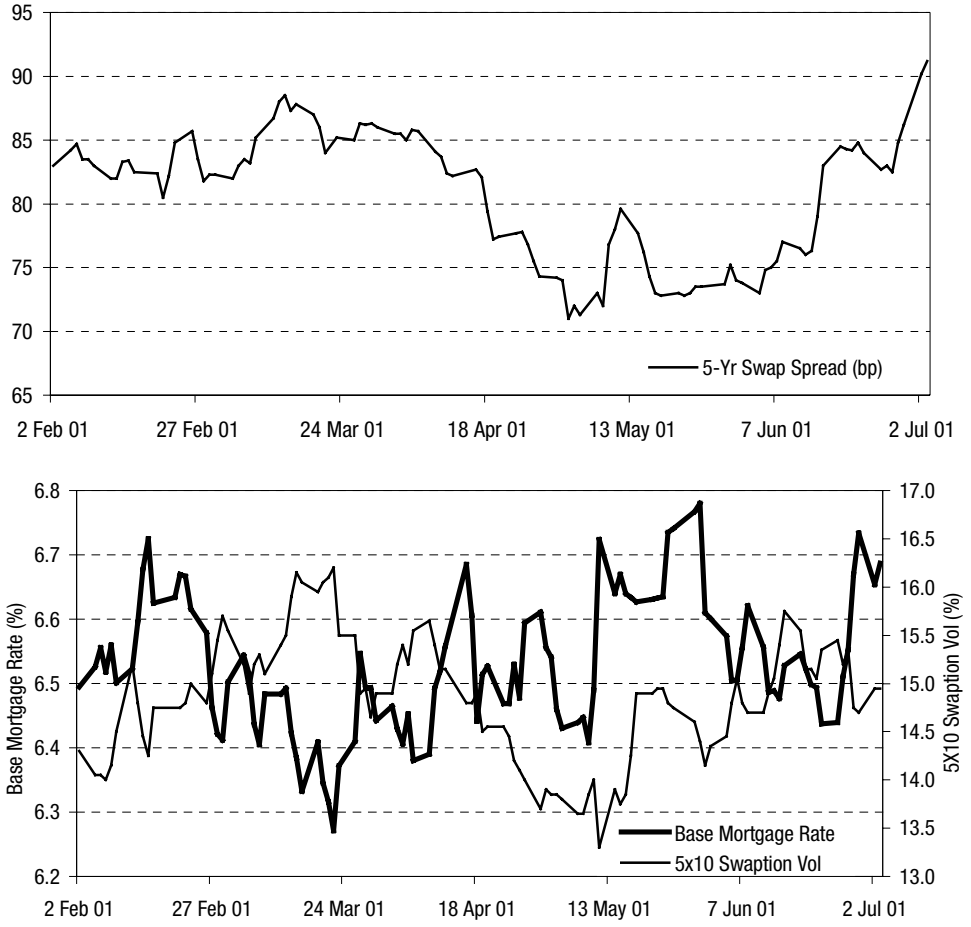


Figure 19. Fannie Mae 6.5s Effective and Empirical Durations Versus 2s-10s Treasury Spread, Implied Volatility OAS to Swaps, 2 Feb 01–3 Jul 01 (Continued)



Source: Salomon Smith Barney.

Comparing two specific dates when mortgage rates were around similar levels gives a similar picture, regardless of whether one is looking at durations to Treasuries or to swaps.[9] However, although empirical durations have moved sharply higher (see Figure 20), they are still shorter than effective durations.[10]

[9] The empirical duration versus swaps is obtained by regressing daily percentage mortgage price changes versus changes in the ten-year swap rate.

[10] The effective duration assumes parallel yield curve shifts. A colleague has suggested that the difference in effective and empirical durations may be due to the fact that in reality different parts of the curve are not perfectly correlated with the ten-year. See also *Mortgage Durations and Price Moves*, Salomon Smith Barney, March 6, 2001.

Figure 20. Fannie Mae 6.5s — OAS-Related Data, 21 Feb 01 Versus 3 Jul 01

	Base Mortgage	10-Year Rate (%)		2s-10s Treasury	Effective Duration to		Empirical Duration to		Imp-Vol OAS to Swaps	Option Cost	5x10 Swaption Vol
Date	Rate (%)	Treasury	Swap	Spread (bp)	Treasury	Swaps	Treasury	Swaps	(bp)	(bp)	(%)
21 Feb	7.18	5.14	6.07	42	4.4	4.3	3.2	2.5	-2	66	14.8
3 Jul	7.19	5.39	6.27	115	5.0	4.9	4.2	3.8	-3	55	15.0

Source: Salomon Smith Barney.

All of this suggests that over short periods, price movements can deviate substantially from those suggested by OAS models. However, over longer periods, there does appear to be some relationship between model-implied effective durations and market-implied empirical durations, at least in the case of a substantial curve steepening/flattening.

What if Rates Are Expected to be Range-Bound?

For an investor comparing the environments of February 21 and July 3 in Figure 20, it appears that a greater number of ten-years need to be shorted to hedge Fannie 6.5s now than back in February. And this means a more costly hedge (in the steep curve environment) if one expects rates to be range-bound.[11] The hedge is more costly partly because these relatively simple hedging schemes ignore the option characteristics of mortgages. As the yield curve steepens, the option that the mortgage investor is short the borrower decreases in value (in other words, the option cost decreases). Thus, although the hedge becomes more costly as the yield curve steepens, in a more complete hedging scheme that includes options, fewer options need to be purchased to hedge the prepayment option that the investor is short.[12]