# Dynamic Cross Hedging with Mortgage-Backed Securities

**Gregory Koutmos, Kenneth F. Kroner, and Andreas Pericli**
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The authors evaluate the efficacy of dynamic hedge ratios vis-à-vis the more traditional static approaches. Myriad tests suggest that time-varying hedge ratios are better than static ones for reducing risk, enhancing investor utility, and reflecting the effect of prepayment uncertainty on mortgage-backed security value.

Hedging the risk of mortgage-backed securities (MBS) has long been a concern of the many institutional owners of these bonds. Recent financial losses have hastened the need to understand how best to deal with the indeterminate timing of cash flows, notably the prepayment option that allows a home buyer to prepay a mortgage at any time. Prepayments affect the duration of MBS. Moreover, rate changes affect bond values differently because bond losses caused by rate increases tend to dwarf bond gains caused by rate drops.

Given the demise of some mortgage futures contracts, cross-hedging with 10-year Treasury futures has become extremely popular. Hedge ratios are based either on an empirical evaluation of spot price changes, relative to futures price changes, or on a matching of spot asset duration to futures duration. Neither method is problem free. Duration matching fails to deal with the high correlation between prepayment rates and coupon-refinancing rate differences. Regression or empirical hedging assumes that only the first two moments are important, which corrodes the assumption that hedge ratios are stable over time. An alternative strategy,

Gregory Koutmos is at Fairfield University. Kenneth F. Kroner is at BZW Barclays Global Investors. Andreas Pericli is at the Federal Home Loan Mortgage Corporation. The abstract was prepared by Susan M. Mangiero, CFA, Sacred Heart University.

known as roll-up, roll-down (RURD), which was proposed by Breeden (*Journal of Fixed Income*, 1991 and 1994), relies on market prices for MBS with differing coupons. Breeden has found that RURD hedge ratios, which are based on time-varying second moments, are better than static ratios for the 1982–86 period.

First, using daily data, the authors calculate hedge ratios using a "bivariate error correction model with a GARCH [generalized autoregressive conditional heteroscedasticity] error structure." The method directly incorporates the nonconstant covariance structure of the joint distribution of mortgage and Treasury futures price changes. Second, they compare these hedge ratios with alternative methods. Even with transaction costs, the dynamic model is the best model in terms of risk reduction and utility gain.

Logarithmic price data are differenced to induce stationarity of the time series. Further tests suggest that for four of the six cases considered, mortgage and futures prices are cointegrated, thus necessitating the inclusion of an error correction term. The authors generate numerical estimates of various model parameters by using numerical techniques designed for nonlinear functions. Their findings include the observation that volatility shocks persist for all but the 10 percent coupon MBS under study. They reject the notion of a constant correlation structure between MBS and futures prices.

Because of the frequent and costly revisions required when using a full error correction GARCH (EC-GARCH) model in the presence of transaction costs, the authors use simple models to make comparisons. Comparing the full model with restricted versions suggests that the full model exhibits the smallest variance, followed by the GARCH model, the error correction OLS (ordinary least squares) model, and finally, the traditional OLS model. If transaction costs are ignored, the EC-GARCH model is viewed as the best model. Given the usefulness of out-of-sample evaluation in lieu of relying on *ex post* performance, the authors reestimate each model using the initial 560 data points and a holdout sample of 200 data points. For each time interval, they calculate the one-day-ahead hedge ratios and compute again the model parameters with the addition of one more observation. This process is repeated

until the holdout sample has been eliminated. Once again, the smallest variance occurs with the EC-GARCH model.

An additional test looks at whether hedging that reduces risk is valuable in terms of increasing utility, net of transaction costs, for investors who work within a mean–variance framework. Once again, the dynamic-hedging strategy wins out. Finally, the authors show that time-varying hedge ratios reflect the prepayment risk resulting from changes in interest rates. This feature renders the dynamic-hedging model especially appealing because prepayment risk is an integral part of MBS hedging.