REMOVE YIELD CURVE RATE UNCERTAINTY FROM BACKTESTING

It is a best practice to backtest an Asset Liability Management (ALM) model periodically. At the simplest level, the modeler selects a historical period of known financial results and then compares, or tests, those actual results to the ALM model output generated back at the beginning date of the historical period. The primary goal is to isolate and quantify how well given assumptions drive model output to align with realized net interest income.

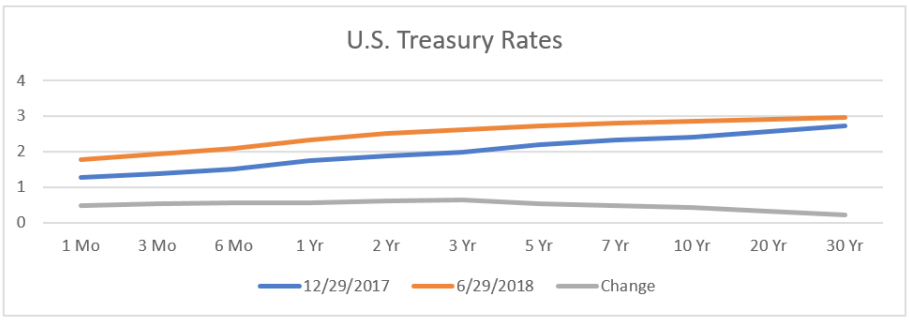
Perhaps the market has become increasingly competitive over the past few quarters which has driven down spreads on new loan originations, and now the model forecast for interest income is too rosy.

Alternatively, it is possible that as the Fed tightened in earnest the past year by raising the Fed Funds Target Rate, institutions yawned and did not bother being the first of their peers to raise customer deposit rates. As a result, the betas assigned to deposit repricing are too high and interest expense is exaggerated. A thorough backtesting framework allows for verification of which assumptions are driving the discrepancies between model simulations and actual results.

A common approach is to compare the two yield curves from the beginning and ending point of the backtesting period, and then select which scenario in the ALM model most closely matches the rate movement. For example, say a six-month backtest comparing 4Q2017 to 2Q2018 is chosen. U.S. Treasury rates (UST) on average increased +49 bps during this window. A common model scenario is an Up100 basis point (bps) ramp with a static forward curve over the first year which would equate to +50 bps over six months; a close match overall to the average yield curve change of + 49

bps. By looking at the model output for this scenario as of 4Q2017 versus actual yields and income for the institution in the first half of 2018, the logic is the impact due to changes in the UST curve will be removed from the analysis. In other words, since the model already ramped up UST rates +50 bps in that scenario over six months, it follows that any variance between projected and actual yields may be attributed solely to model assumptions.

U.S. Treasury	1 Mo	3 Mo	6 Mo	1 Yr	2 Yr	3 Yr	5 Yr	7 Yr	10 Yr	20 Yr	30 Yr
12/29/2017	1.28	1.39	1.53	1.76	1.89	1.98	2.2	2.33	2.4	2.58	2.74
6/29/2018	1.77	1.93	2.11	2.33	2.52	2.63	2.73	2.81	2.85	2.91	2.98
Change	**0.49**	**0.54**	**0.58**	**0.57**	**0.63**	**0.65**	**0.53**	**0.48**	**0.45**	**0.33**	**0.24**



Next, it is necessary to bifurcate variance due to balance/composition changes versus rate to further isolate which assumptions are responsible for the deviation from actual results. Common reasons for differences due to model assumptions would be prepayment speed, reinvestment spreads, and repricing betas in addition to growth assumptions or the lack thereof. However, the backtesting technique described thus far has several shortcomings.

Consider a few what-if scenarios:

1. If average UST rates rose +75 bps over the six-month window, would the Up100 12-month ramp or the Up200 12-month ramp be a better fit? One is lower and the other higher by 25 bps after six months.
2. If UST rates spiked +80 bps in the first two months, then tumbled -40 bps in the next two months and ended up averaging +50 bps over six months, then the constant ramp of the Up100 is not a great proxy, especially when you layer in the volatility of prepayments coupled with repricing rates as those instruments are replaced.
3. If most assets on the balance sheet are tied to UST and funding is tied to the LIBOR/swap curve, which scenario do you analyze for the backtest if UST rates rose an average of +50 bps but the LIBOR/swap curve only increased +25 bps?

The forward matrix functionality in ZMdesk allows one to build a custom backtesting forward matrix for numerous tenors and indices and populate this matrix with observed yield curve rate behavior over a given period. By rerunning the model and tying it to this matrix, the problems outlined above are no longer a concern. The model and corresponding market data file from the beginning of the lookback period is rerun for the base case except that the scenario will reference this backtesting matrix instead of 'static' or 'implied' forwards. Consequently, one can be confident yield curve changes are not intermingled with the model assumptions when performing the backtest.

Finally, it is important to note while this technique removes yield curve impacts, it is difficult to completely isolate rate versus volume/growth/composition impacts with arithmetic formulas. It can come close. One method is to separate the variance into three components: explicitly due to volume, explicitly due to rate, and a third category mix of both rate and volume. The mix category is usually small enough that it may be ignored as de minimus for the analysis. In this example, actual total commercial loan interest income exceeded the model by +$3.117mm primarily due to running a static balance sheet. Actual commercial loan balance growth of +$87.897mm accounted for +$3.807mm of the variance, actual commercial loan yields were -6 bps lower than the model

projected and accounted for -$637k of the variance, and the mix due to both volume and rate was -$51k. Considering that many models are run with static growth, the rate component is the primary focus. This backtest looks reasonable and could be due to commercial loans being added at a lower spread during the backtesting period.

	Actuals	Projected	Variance		Variance Source		
			Amount	%	Volume	Rate	Mix
Average Commercial Loan Balance	1,178,911,934	1,091,013,999	87,897,934	8.06%			
Total Commercial Loan Interest Income	50,359,653	47,242,293	3,117,360	6.60%	3,806,092	**(637,382)**	(51,351)
Average Commercial Loan Yield	4.27%	4.33%	**-0.06%**			-0.1%	

It would be advisable to perform an historic analysis covering the backtest period to calculate a weighted average origination spread for commercial loans and possibly update the repricing spread for this generic instrument.

About the Author

Phillip Reschke is Client Experience Manager for ZM Financial Systems and has more than 15 years' experience in capital markets, ALM and funds transfer pricing. He previously served as an Officer and ALCO Member responsible for all aspects of ALM/IRR and liquidity, from model assumptions to ALCO packet creation and finally presentation to ALCO. For more information visit w3.zmfs.com or email sales@zmfs.com.