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Bank Asset/Liability Management

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The Challenges of EVE/NEV in Extreme Rate Environments

Measuring Economic Value (EV) of financial instruments in the balance sheet during unusual economic environments, including unusual interest rate forecasts can expose both critical model capabilities as well as accepted model assumptions. It may also expose model limitations. These calculations and assumptions test the underlying theories and their established (and sometimes, hazy) reflection of reality.

Bear in mind that EV is not the same as Market Value (MV). EV could be thought of as a simplified, *two-dimensional* reflection of MV. More accurately, EV is a discounted cash flow (*DCF*) valuation generated by most conventional Asset Liability Management (*ALM*) models. EV also lacks the omnipotence of the market, especially the timing and volatility of anticipated future market interest rate movements as well as other changing economic factors, which may influence the price a potential purchaser would be willing to pay for an instrument.

We recently observed that the Economic Value of Equity/ Net Economic Value (collectively, *EVE*) ratio for several client institutions was trending less than their book equity. In many cases, this result was at least partially attributed to the calculated EV of NMD liabilities being valued less favorably than their carrying value suggesting to some that, at least theoretically, institutions would have to pay others a premium to take their deposits. To illustrate our observation recent baseline ALM model results for a sample institution are presented in the Table 1 on page 2.

Usually the NMD EV result is based upon a present value calculation on the assumed NMD cash flows using a replacement instrument cost curve with varying tenors or maturity term points. Many institutions rely on their region's FHLB bullet borrowing rates to construct their replacement funding curve. The NMD liabilities would be valued based upon their anticipated monthly cash flows being applied against various tenors of FHLB borrowing offering rates used to construct an

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Table 1: EVE results using a Sample Institution's Historical NMD Assumptions

EVE Measures:	-200	-100	Base Case (Flat)	+100	+200	+300	+400	Book Equity
EVE Ratio	3.09%	6.15%	8.59%	10.30%	11.37%	11.98%	12.53%	11.22%
EVE Ratio at Risk	-5.50%	-2.44%		1.71%	2.78%	3.39%	3.94%	
EVE at Risk	(131,870)	(60,143)		43,607	71,291	86,960	100,980	
% EVE at Risk	-65.67%	-29.95%		21.72%	35.50%	43.31%	50.29%	
% Policy Limits	-15.00%	-10.00%		-10.00%	-15.00%	-20.00%	-25.00%	
In Policy?	**No**	**No**		**Yes**	**Yes**	**Yes**	**Yes**	

Note in Table 1 that this Sample Institution's Base Case EVE of 8.59% is much less than their book equity of 11.22% and this institution is out of EVE policy in the declining rate scenarios (blue line falls below the red Policy Limit line).

alternative funding curve for EV calculation purposes. Added to the constructed FHLB curve is a static non-interest cost adjustment to account for the additional cost of originating and holding deposits versus simply calling the FHLB to borrow funds. This adjustment normalizes the differences in cost between these two different funding vehicles.

Most advanced ALM models today will calculate an EV by applying monthly cash flows to their corresponding alternative funding yield curve versus using a static spot rate. So, for NMD liabilities one-month balances are valued against one-month FHLB rates and, one-year balances valued against twelve-month FHLB bullet borrowing rates and so on. Traditionally, this has created a favorable valuation, especially when the FHLB curve is positively sloped, intuitively supporting the premise that *"cheap deposits are worth more in a rising rate environment"* and vice versa. So why are NMD EV results trending lower than book? Let's consider three of the main factors that inform an NMD EV calculation: Non-Interest/servicing cost value adjustments, overall shape of and the interest rates used to construct the alternative funding curve and finally, the cash flow estimates of the NMD liabilities themselves.

The first factor for consideration for the impact of NMDs on EV value results is the degree to which non-interest cost adjustment assumptions are not properly reflective of current operating conditions. An analysis determined that the non-interest cost adjustments used for ALM modeling for our Sample Institution were outdated and not acknowledging recently implemented operating efficiencies. To assess potential EV impacts, an alternate model was run using lower non-interest cost-based information compiled from other institutions that had recently re-evaluated their NMD *servicing* costs.

Lowering the *servicing* cost helped bring the Sample Institution's base case (flat rate) NMD EV back in line with the market by generating an unrealized core deposit premium of 1.037, consistent with premiums paid for deposits in actual recent M&A deals. Prior to this adjustment the ALM model was calculating an unrealized core deposit loss of 0.967. The EVE/NEV results of implementing this change are shown in Table 2 below.

While we can clearly see in the results displayed in Table 2 that this servicing cost adjustment improved the Sample Institution's EVE/NEV profile, both in terms of a base case EVE of 11.12% versus 8.59% (as observed in Table 1) and also reduced EVE volatility in various rate shocks,

Table 2: Revised EVE after updating the EV "non-interest/servicing cost" spreads for NMD accounts

EVE Measures:	-200	-100	Base Case (Flat)	+100	+200	+300	+400	Book Equity
EVE Ratio	7.11%	9.09%	11.12%	12.39%	13.04%	13.33%	13.76%	11.22%
EVE Ratio at Risk	-4.01%	-2.03%		1.27%	1.92%	2.21%	2.64%	
EVE at Risk	(103,975)	(53,610)		34,251	51,760	58,830	70,017	
% EVE at Risk	-38.25%	-19.72%		12.60%	19.04%	21.64%	25.76%	
% Policy Limits	-15.00%	-10.00%		-10.00%	-15.00%	-20.00%	-25.00%	
In Policy?	**No**	**No**		**Yes**	**Yes**	**Yes**	**Yes**	

the Sample Institution remains out of policy in declining rate environments.

Our second factor for consideration is that, since 2018, we have seen a gradual flattening to inversion of many FHLB borrowing curves to the point where short-term borrowings cost as much and some cases, more than intermediate term borrowings. To illustrate this point, the following Table 3 shows a sampling of historical FHLB rates over time for a given district.

Table 3 shows how the Sample FHLB yield curves morphed form a normal upward sloping curve at the end of 2016 to a much flatter curve by the end of 2018 as short term rates climbed much higher than their long term counterparts with an inversion occurring in the *belly* of the curve where most NMD cash flows would fall. From the end of 2018 to the end of 2019, the FHLB curve generally retained its shape but dropped about 90 basis points at all points across the curve.

It is commonly understood that the retention of NMD account balances are viewed as a positive indicator of an institution's strong and valuable relationship with their depositors, yet we observe several recent instances where ALM models are treating longer term NMD liabilities as a negative contributor to EVE. Rather than a change in the underlying funding benefits that these deposits offer, the value deterioration here is due to the flat-to-negatively sloped FHLB borrowing curve, meaning longer term borrowing would actually cost the institution less than short term borrowings. It further suggests that holding longer term NMDs are costlier than borrowing from the FHLB while holdings of shorter term and more volatile NMDs such as MMDAs less so. This economic anomaly runs counter to a normally functioning marketplace.

Is it possible that the negatively sloped FHLB borrowing curve is significantly contributing to the Sample Institution's poor NMD valuation (and resultant EVE/NEV calculation)?

This question brings us to our third factor for consideration, the assumed cash flows of the NMD liabilities. To test this, VBC reverted back to the original non-interest/servicing costs approved by the Institution's ALCO (Table 1 results). Then, VBC ran a *double decay speed* deposit stress test scenario. The NMD decay speed acceleration caused the Sample institution's NMD accounts to have a significantly shorter average life of 3.7 years (about ½ the average life of 7.3 years reflected in Tables 1 and 2) and otherwise held all other inputs constant. Now, the following Table 4 shows the significant improvement of EV volatility by simply assuming the NMD account average lives are shorter than the Sample Institution's deposit decay analysis suggests.

In summary, it was determined that a smaller portion of the Sample Institution's poor NMD EV calculation can be attributed to an undervaluation of their NMD accounts due to using too high of a non-interest or servicing cost spread against the FHLB funding curve (see Table 2). But, a more impactful portion is actually attributed to the NMD's

Table 3: Historical Sample FHLB Borrowing Rates

	3 mo	6 mo	9 mo	1 yr	2 yr	3 yr	4 yr	5 yr	10 yr
12/31/2016	0.86	0.96	1.13	1.20	1.53	1.82	2.09	2.32	3.17
12/31/2017	1.69	1.84	1.97	2.09	2.19	2.31	2.45	2.53	3.02
12/31/2018	2.75	2.83	2.90	2.86	2.79	2.82	2.84	2.93	3.40
12/31/2019	1.90	1.90	1.90	1.91	1.87	1.91	1.92	2.00	2.43

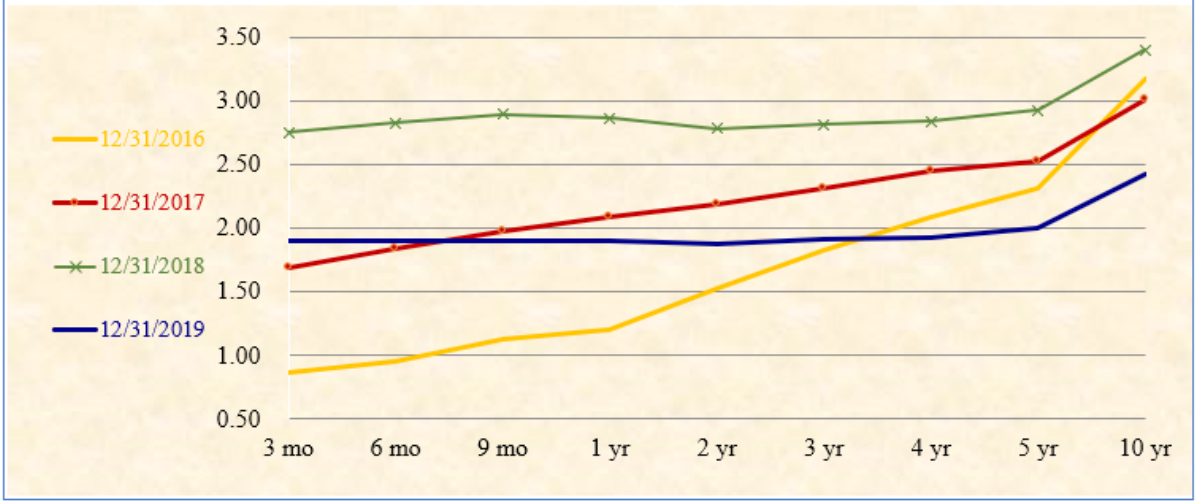

Table 4: Revised EVE after SHORTENING average lives of the NMD accounts

EVE Measures:	-200	-100	Base Case (Flat)	+100	+200	+300	+400	Book Equity
EVE Ratio	7.93%	8.02%	8.37%	8.52%	8.27%	7.76%	7.35%	11.22%
EVE Ratio at Risk	-0.44%	-0.35%		0.15%	-0.09%	-0.61%	-1.02%	
EVE at Risk	(9,153)	(7,895)		3,019	(3,807)	(17,383)	(28,049)	
% EVE at Risk	-4.69%	-4.05%		1.55%	-1.95%	-8.91%	-14.37%	
% Policy Limits	-15.00%	-10.00%		-10.00%	-15.00%	-20.00%	-25.00%	
In Policy?	Yes	Yes		Yes	Yes	Yes	Yes	

Note in Table 4 that this Sample Institution's Base Case EVE of 8.37% is much closer to the EVE calculated in Table 1 since we reverted back to the original servicing cost adjustment. However, this institution is now in EVE policy in the declining rate scenarios (blue line remains above red Policy Limit line).

long average life of about 7.3 years valued against a mildly inverted yield curve with the inversion most significant in the portion of the curve heavily weighted in the NMD EV calculation (see Table 4). Without additional analysis, it would not be a stretch of the imagination for an ALCO Committee to simplistically draw the conclusion that the Institution could bring its declining EV back in policy by simply selling NMD accounts and replacing the funding with overnight borrowings.

However, a more enlightened ALCO would be aware that the alternative funding FHLB yield curve inversion may be anomalous and will not likely last over the expected cash flows of these NMD liabilities and further, there is still customer relationship value in holding these accounts. Therefore, the declining rate EVE/NEV Policy violation may be an acceptable risk for the Institution and, for this reason, a policy exception should be noted in their ALCO Meeting Minutes.

While IRR measurement methods are static in nature, balance sheets and market conditions seldom are. Not only does the level of interest rates change, yield curves change slope. After a review of the incremental effects of non-interest expense adjustments and the inversion of the FHLB curve, the Institution is electing not to sell or otherwise shorten the average lives of their NMD liabilities simply to bring a declining rate EVE back into policy. They understand that this is a representation of their Interest Rate Risk and not an actual market valuation.

In conclusion, the questions that these NMD stress testing examples raise are firstly; is the discounted cash flow method of valuation appropriate in all rate environments, and secondly; should you examine how your model deals with inverted yield curves or negative rate forecasts. In low rate environments does the model include mean reversions or other methods to deal with yield inversions or extremely low rate environments. And, in these situations is it actually realistic that there is potentially a negative core deposit intangible.

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