Vol. 33, No. 12 December 2017

Bank Asset/Liability Management

Prepared by Peter Mihaltian

On Beta Models of NMD Rates

Many advances in interest rate risk measurement and management of bank balance sheets in recent years have largely been about *better data* feeding more *robust analytics* and real-time *ongoing monitoring*. At the same time, progress in the adoption of more robust models of non-maturity deposits (NMD) has been slow. Well-known and better modeling methodologies have not been adopted at many banks, where asset/liability managers and risk modelers rely on inferior, but familiar legacy analytics, so long as they are not challenged by regulators.

So-called "*beta models*" of NMD rates (see Box A) used by deposit modelers are one example of inferior models that continue to be used by bank asset/liability managers. These models are also used by some vendors when conducting deposit studies and by those producing IRR measures on an out-sourcing basis.

Box A

Beta Rate Model (BRM)

$$DR(t) = DR(t-1) - \beta(\delta) * \Delta MR(t) \qquad \ldots(1)$$

Where.

$DR(t)=$ the deposit rate in month t

$MR(t)=$ the indicative market rate used to motivate changes in market-rates

$\beta(\delta) =$ a value between 0 and 1 that is a function of δ, the sign of the in market rates to provide for asymmetric response in down and up rate scenarios.

Beta models of NMD rates are over simplistic. They are neither analytically robust, nor stable. They produce inconsistent results depending on whether interest rate scenarios are rising or falling and are sensitive to the current starting position of deposit rates. What's more, there exists a much better solution: the *Partial Adjustment Model* (PAM) that is consistent with economic theory and oligopolistic pricing behavior. *Partial Adjustment Models* are used by academics to model deposit pricing.

In This Issue:

LexisNexis®
An A.S. Pratt® Publication

Benefits of BRM to IRR Modelers

Why has the use of the *beta rate model* persisted? There would seem to be two explanations which are profiled below:

Simplicity: The BRMs principal defect, its lack of analytical complexity and subtlety, is at once its principle virtue: It's easy to use. BRMs can be estimated in a simple spreadsheet using data readily available from banks' treasury departments. Output, simulated deposit rate paths, will typically pass uncritical visual inspection. Results will *look right* in plain-vanilla monotonically rising rate scenarios. However, when BRMs are put to a more robust test, the simulations are less satisfactory. However, this rather significant limitation is seldom either observed or commented upon.

Regulatory Acceptance: Many bank examiners, whether aware of the underlying problem or not, are seldom observed to object to the use of BRMs and incorporation of their output into IRR calculations of NII and EVE. Occasionally bank examiners have been seen to comment when the beta values are of the same for rising and falling market rates.

Flaws in Beta Rate Models and Comparison to Partial Adjustment Models

Sensitivity to Current Deposit Rates: All asset/liability management modelling processes begin their simulation of NMDs with a month-end balance and for rate paying NMDs, deposit rates., As seen in the equation in Box A, even minor changes in current deposit rates will generate a different deposit rate path, even if the market rate scenario is unchanged. This effect becomes more obvious when *ramp* deterministic rate scenarios are utilized. This is because the deposit rate stops changing as soon as the market rate flattens.

BRMs are not utilized by academic researchers. They do use variants of the PAM (See Box B) which provides a gradual adjustment of deposit rates in response to changes in market rates, since the simulated deposit rate only adjusts by a proportion of the difference between the target rate and the prior month's deposit rate.

By contrast to BRMs, a PAM model will generate a different path with different starting NMD rates, but will generate stable long term or *equilibrium* deposit rates from equation (2). The resulting rate simulations are more consistent with economic theory that in the long run the level of deposit rates is a function of the level of market rates.

In Exhibit 1, we compare BRM and PAM rate simulations of a $100,000 tier of average national MMDA rates from our proprietary rate deposit rate database for the period January 1998 – January 2016. When both models are estimated using the Solver function, as was described in a prior BALM article[1], a graph of results confirms that BRM quite dramatically underperforms the PAM.

[1] See "Robust Models of Deposit Rates," BALM (January 2017).

Box B

Partial Adjustment Deposit Rate Model

As an approximation, deposit rates can be simulated using a four factor "partial response" model, which is summarized by two equations:

Target Rate Equation: $DR^*(t) = S + P * MR(t),\quad DR^*(t) \geq 0$ ...(2)

Actual Deposit Rate: $DR(t) = MAX\{DR(t-1) + \lambda(\delta)^* [DR^*(t) - DR(t-1)]\}$

Where,

$MR(t)$ = the market interest rate in week t that motivates the change in the deposit rate which is assumed to be the 1 month Libor rate for core deposits and matched maturity for CDs.

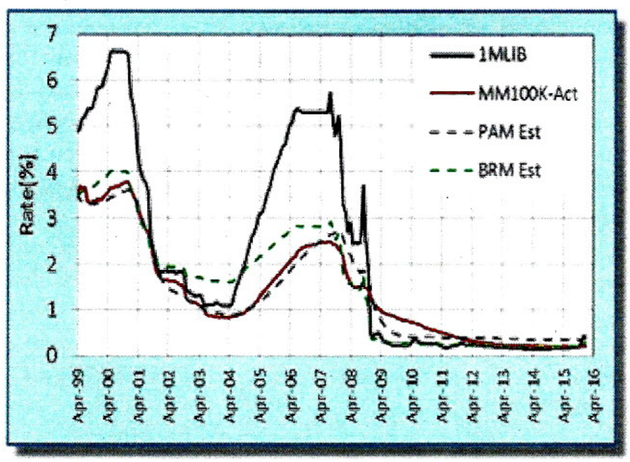
$DR^*(t)$ = theoretical "target" or equilibrium deposit rate in week t should market rates evolve to a specific level and remain there

S = spread coefficient in the target rate equation

P = proportionality coefficient in the target rate equation

$\lambda(\delta)$ = adjustment speed coefficient that is allowed to vary depending on the sign of δ or $sign[DR^*(t) - DR(t-1)]$

Exhibit 1. Comparison of Partial Adjustment Model and Beta Model in Simulation of Deposit Rate History



A Failed *Work-around* for BRM to Account for Lagged Response to Rate Shocks

In order to better capture pricing adjustment lags, some users of BRMs *defer* rate adjustment by a few months in the early months of a stress based shock of market rates. These results are rarely consistent with the way banks actually adjust deposit rates which is over time to changes in market rates.

To facilitate comparison, we simulated both PAM and BRM models with a 300 basis point rate shock to an arbitrary rising short rate scenario.[2] As indicated, we have applied a 3-month lag to the adjustment. Please note that in the fourth month the deposit rate jumps to the targeted proportion (β) of the change in market rates from the beginning of the simulation. It then holds that proportion level for the entire time horizon of the simulation.

[2] Parameter values were chosen so that the target rate (equation (2)) was the same as BRM modeled rate in the long-run.

By contrast, the PAM simulation adjusts to the *target rate* tied to an explicit factor. A simple visual inspection of the graphed results reveals the essentially unrealistic result provided by the BRM and the more realistic depiction derived from the PAM model.

Exhibit 2. Simulation of Rate Models in Deterministic 300 bp Rate Shock

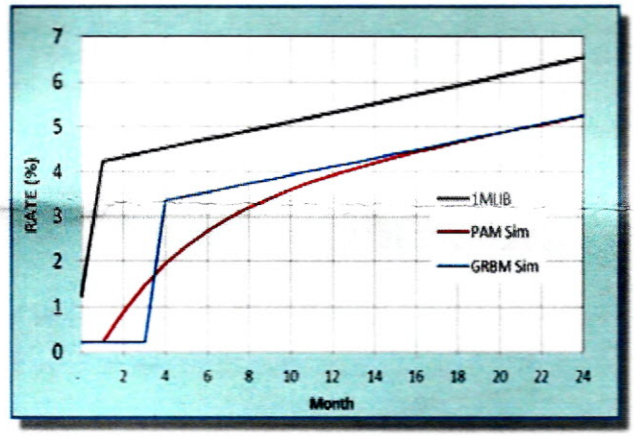


Exhibit 2 Parameter Values

GRPM:		β = .95	
PAM:	S = -.25	P = .9	λ = .2

How Much Difference Does Your Model Choice Make?

When we have discussed this issue with bank asset/liability managers in the field, one commonly-encountered response is, *"how much difference will it make?"* Of course, without rigorous sensitivity testing and benchmarking analyses, we can't be certain. However, in light of the multiple NMD rates frequently modeled in NII and EVE sensitivity analyses, the intuitively obvious answer is *"the error is potentially material."*

Equally important, one must consider the question of risk culture: why do bank A/L managers continue to use demonstrably inferior measurement methodologies, generating undocumented but potentially important modeling error, when a better methodology exists, is well documented, readily available, and relatively easy to implement?

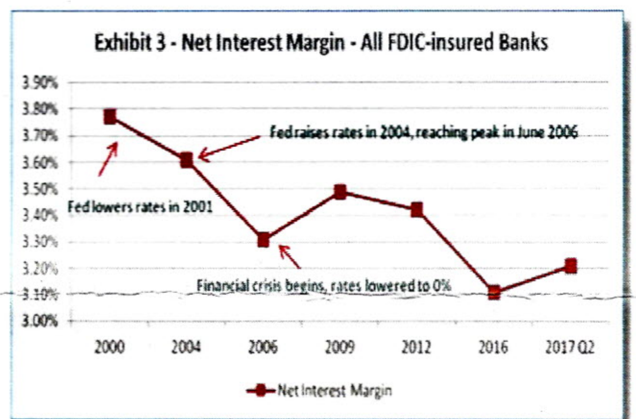
— Michael Arnold, Ph.D., Principal
— Bruce Lloyd Campbell, Principal
ALCO Partners, LLC

Is Your Institution Really Asset Sensitive?

After close to 10 years of historically low interest rates, many financial institutions appear poised to finally pop their champagne bottles with the prospect of sustained Fed Funds rate increases on the horizon. After years of net interest margin (*NIM*) compression due to low yields, weak loan demand and the accumulation of interest earning overnight asset balances, many bank asset/liability managers are convinced their banks' balance sheets are asset sensitive. They expect their asset yields will increase more and faster than liability yields, leading to increased NIMs. However, before beginning the celebrations, prudent A/L managers should be asking themselves if their banks really are as asset sensitive as their models may show.

Do Rising Rates Lead to Higher NIMs?

When looking at historical data, it is clear that rising interest rates have not always lead to increased NIMs. For the purposes of this article, we looked at NIM data for all FDIC-insured banks from the end of 2000 until June 2017, the latest data available, and discerned that overall NIMs have declined by about 56 bps during that period. There were two periods where the Fed lowered rates (2001 recession and 2007 financial crisis) and one period of rate increases (2004 – 2006). During the Fed rate hikes between June 2004 and December 2006, NIMs actually declined by about 30 bps for the overall bank universe (see Exhibit 3).



Source: FDIC Statistics on Depository Institutions (SDI)

For community banks with assets between $100MM and $1B, their NIMs increased by about 4 bps between June 2004 and the end of 2006 (see Exhibit 4). While certainly better than the performance of the overall bank universe, this small increase should make institutions wonder if they really were as asset sensitive as their models may have shown during that time period.