Better Simulation Models of NMD Rates
Introduction and Summary

Can vendor and bank ALM modelers of non-maturity deposit (NMD) rates over-rely on statistically fitting models to the bank's own rate histories when modeling NMD rates as inputs to their IRR models? We examined this issue and present our conclusion: *Yes*, *we believe so*…

Accepted practice in bank asset/liability managers' and vendors' estimations of NMD rate models used to simulate future rate paths begins with extracting the available rate history. Modelers then employ traditional econometric methodologies to estimate coefficients in structural NMD rate models of various forms. In most cases, given a sufficient history that includes a rate cycle, the models will fit history extraordinarily well. In other words, these models are excellent predictors of past behavior. As we discuss below, unfortunately this methodology has only limited application to the real purpose of the models: that of simulating over long periods NMD rates that are credible to bank management and to those involved in pricing NMDs.

Our ongoing analyses of deposit rate simulation models used in IRR analyses, as well as our evaluation of the alternative techniques for estimating them, leads us to conclude that:

- Even small banks will typically have two dozen or more NMD products that require pricing by a committee. The process always adheres to strict tiering and cross-product constraints. In other words, NMD rates contain a rank order, e.g., high tiers are priced above low tiers or savings rates above NOW account rates.

- NMD rate models fit to history, when using econometric methodologies, often simulate rates and paths that are inconsistent with committee member practices and their expectations of results (*"How we will price going forward"*).

LexisNexis®

An A.S. Pratt™ Publication

Importantly, when put to the test of rate scenarios that contain market, up or down, turning points, e.g., stochastic rates, such models will generate crossing rate paths that violate settled and unvarying pricing practices.

• Models that simulate in a manner consistent with pricing committee expectations and pricing practices should be the main objective. Statistically estimated models will frequently fail to meet this objective.

In this context, we believe it is appropriate for modelers of NMD rates to *use* history to provide guidance, i.e. as informative, not dispositive, for simulating rates under various stress scenarios called for in interest rate risk regulations. Modelers should be wary of reflexively *fitting* models to those histories.

NMD Rate Model Purpose

Commercial bank balance sheets contain many deposit products with administered rates. According to the FDIC's quarterly report (3Q2017) on commercial bank balances, "Interest Bearing Deposits" comprise just over 50 percent of the funds for the 17 trillion dollars in assets report of assets and liabilities in the system. How banks price these products under various rate scenarios used to measure IRR will, therefore, have material impact on bank measures of earnings-at-risk and EVE-at-risk.[1] Therefore, we conclude the credibility of the rate simulation models for these administered rates is of far greater importance for measuring IRR than the extent to which the NMD rate models fit history, as measured by the commonly used statistical measures.

Limitations of NMD Rate Histories

The quality and availability of NMD rate history present immediate challenges to traditional reliance on estimations based strictly on history. The data are frequently messy and many modelers simply to not have or take the time and resources to obtain, validate, scrub and store the data; accordingly, shortcuts dominate. Absent a robust database of record, analysis can differ from time to time and from user to user, even within the same bank.

Meaningful quantification of pricing responses to changes in market rates can be derived only when the period reported includes a rate cycle – changes in momentum marked by upward and downward turns in the broad market. Because we have experienced no such rate cycle more recently than 2007, many rate histories simply cannot support statistically derived estimates about NMD rate responses to changes in market rates.

Given employee turnover, mergers and acquisitions, and changes in internal bank processes, it shouldn't be surprising that we have found many banks have not kept a sufficient history of their NMD rates. Even then, the pricing responses following the financial meltdown in the fall of 2008 may not provide the best indicator regarding how banks will respond to declines in interest rates in the *more normal* economic environments incorporated in IRR analyses.

Further complicating the problem is the *noise* inherent in the types of historical data files typically found in banks. Many rate histories contain rates calculated as weighted averages from individual account histories. Historical offer rates published by the bank can provide a better guide to actual pricing behavior, given that weighted average rates typically blend published with exception pricing and distort the calculations.

The linking and mapping of products through time is also a challenge. The loss of *institutional memory* can be costly when there is no one in the bank who recalls, for example, whether the name "Super Saver Money Market Account" for a product that is no longer be offered refers to a savings or an MMDA product. In other words, building the time series and grouping similar products from past data may require some subjective judgments.

The single most important issue driving simulation of NMD rates is how the committee that prices these liabilities expects to price in the future. We all know the standard industry disclaimer: "The past is no guarantee…" Sometimes history is expected to be replicated; often not. But the experience and judgment of the pricing committee should always dominate. If members think future pricing may deviate, even a little, from past pricing responses, modelers will error if they rely only on estimates of simulation model parameters from those histories. Informed expectations must be incorporated into a simulation model.

Our conclusion is that, while statistics can be a powerful and useful tool, it is only a tool and the user must understand and control it. Modelers should be wary of overuse and overreliance on econometrics and statistics for determining parameters in simulation models.

Additional Limits of Econometric & Solver Estimated Models for Simulations

As we have written in prior BALM articles[2], the *gold standard* against which model integrity and results are best judged is the partial response model ("PAM"), as presented and described in Box A.

PAM is the structural form used by trained academic

Box A

Partial Response 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: $DR^*(t) = S + P * MR(t), \quad DR^*(t) \geq 0$

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

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

$\lambda(d)$ = adjustment speed coefficient that is allowed to vary depending on whether rates are rising or falling

and regulatory agency researches to fit deposit rate histories. Results have been shown to simulate future rates extraordinarily well.

Identifying a simple technique for deriving product-level pricing parameters that are stable across time and applicable to most market rate scenarios has previously challenged both modelers and regulators.

We encourage readers inclined to rely on econometric models estimated from history to test their results in stochastic market rate scenarios. Econometric models fail most visibly in this context, due principally from their inability to capture and model cross-product constraints. Crossing rate paths frequently result in paths that no experienced modeler believes reflect prices that will actually be adopted by a bank's pricing committee. They are often characterized as *problematic* when, in truth, they are simply *invalid*. While cross product constraints can be added to these models, so as to keep the crossing rates from occurring, this approach is conceptually inconsistent with the econometric methodology; as a result, and more importantly, it introduces path-dependent errors that may be difficult to identify and mitigate.

We have shown that econometric techniques have significant limitations and the need for their continued use is questionable, especially when results are compared to optimization algorithms embedded in the Excel Solver.

Models we have estimated using the Solver do not suffer from this inconsistency. In this approach we are estimating simulation models directly, by using the Solver to discover parameters that simulate history, using simulated deposit rates as lagged dependent variables.

Yet this simple approach, too, has challenges. The application of the Excel Solver, however, is not the last stop in our search for a robust and durable set of parameters for each product. It introduces a different complexity.

While we have found the Solver tool to be extraordinarily useful in estimating parameters for a single product and generating simulation models that out-perform econometrically estimated models, the parameter estimates have been proven over time to be highly unstable and sensitive to the starting point and exact rate history being fit. These issues arise because the partial response model estimated as a simulation model contains a *flat error surface*, that is, many parameter sets do nearly as well as the optimal fit. Moreover, even small changes in data inputs can generate materially different parameter sets. What can be done?

Alternatively, when we begin the estimation process with a multi-product simulation model, such as the one incorporated in our *RateSim[3]* tool, we are able to determine parameters simultaneously for all of the NMD rate products. We obtain highly satisfactory results with minimal loss of measure correlation; the slight decline in the statistical variables used to assess such fits is more than offset by the robust properties of the resulting parameter sets.
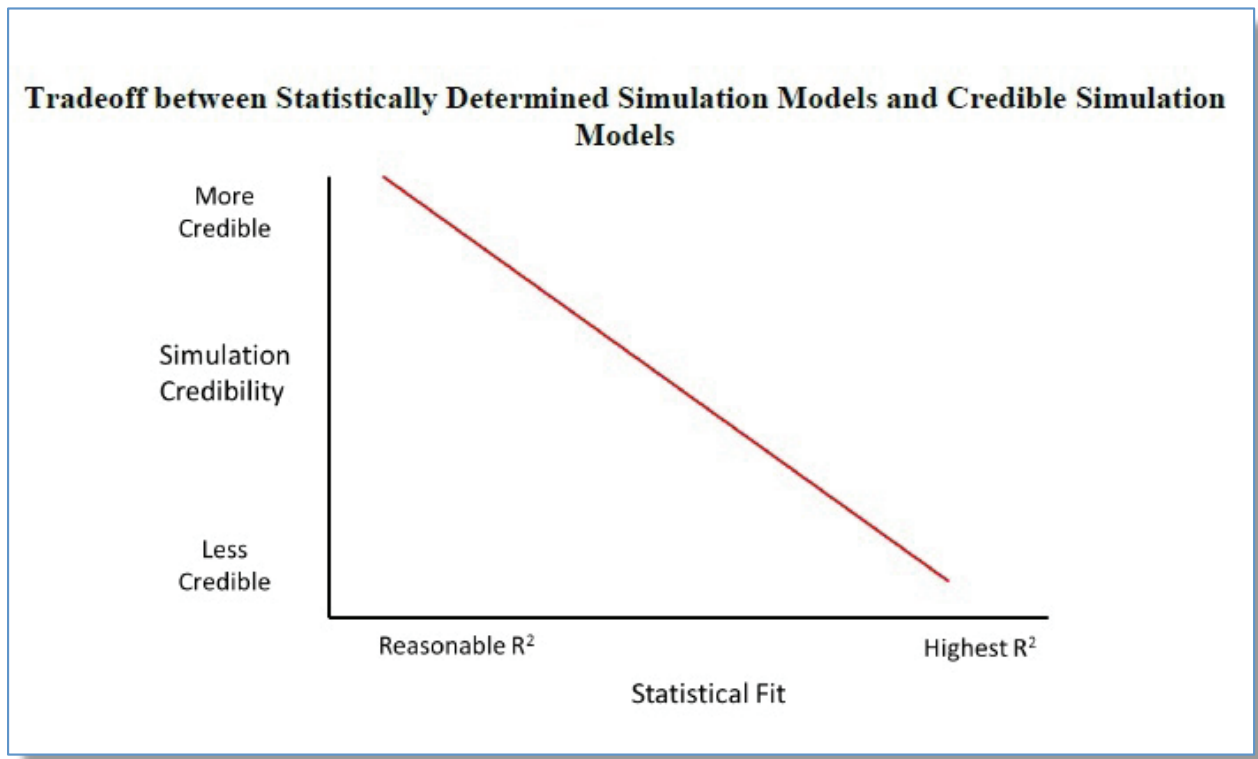
We plot this conclusion in Exhibit 1 on page 4. The figure depicts the trade-offs we believe are inherent in the choice between simulation models that have visibility and credibility for experience model owners and for knowledgeable members of committees responsible for pricing deposits and for periodically assessing the statistical fits of models designed to do so.

What Deposit Pricing Committee Members Know and Don't Know

Our single most important finding concerns the *role of experience and judgment* in the bank's modeling and simulation of NMD rates.

When deposit pricing committee members are asked about their expectations for future rates, most will, quite reasonably, respond "I don't know" or "It depends on what our competitors do." Most people recognize they honestly aren't able to predict future deposit rates with any degree of confidence.

Exhibit 1

Tradeoff between Statistically Determined Simulation Models and Credible Simulation Models

[Chart: A downward-sloping red line showing the tradeoff. Y-axis labeled "Simulation Credibility" ranging from "Less Credible" (bottom) to "More Credible" (top). X-axis labeled "Statistical Fit" ranging from "Reasonable R^2" (left) to "Highest R^2" (right).]

Certainty increases, on the other hand, when stakeholders are asked how deposit prices will be priced _relative to one another_. Pricing hierarchies and cross-product constraints and the rank order of NMD rates are well understood. High tier rates are always expected to be priced above low tier rates. Lower tier MMDA rates are usually expected to be priced above a Passbook Savings Account. Interest Checking remains the lowest-rate paying NMD product in the branch system.

The quality and availability of NMD rate history present immediate challenges to traditional reliance on estimations based strictly on history.

To build and maintain credible simulation models, bank asset/liability managers can convert this institutional memory and knowledge into the parameter sets derived from partial response models. But to do so they should simultaneously model the set of all related NMD rates, not just the NMD rate for a single product. Visual feedback, i.e.

real-time graphic representation of rates in an interactive format, under multiple scenarios then becomes a path to finding optimal responses consistent with both experience and expectation. Results can be tested against history, i.e., _back-tested_, but it is now placed in a subordinate role to judgment. The fitting of models to history becomes an input into the process instead of a goal.

Our conclusion from working with our clients on this issue after completing the process, the pricing committees, Treasurers and CFOs are far more satisfied with the deposit rate simulations they have adopted and the risk reports that embed them.

— _Michael Arnold, Ph.D. &_
Bruce Lloyd Campbell
ALCO Partners, LLC

Notes
[1] In analyses of our client balances sheets, the lagged response of deposit rates is a major source of earnings opportunity in the rising rate scenarios and of earnings risk in the down scenarios.
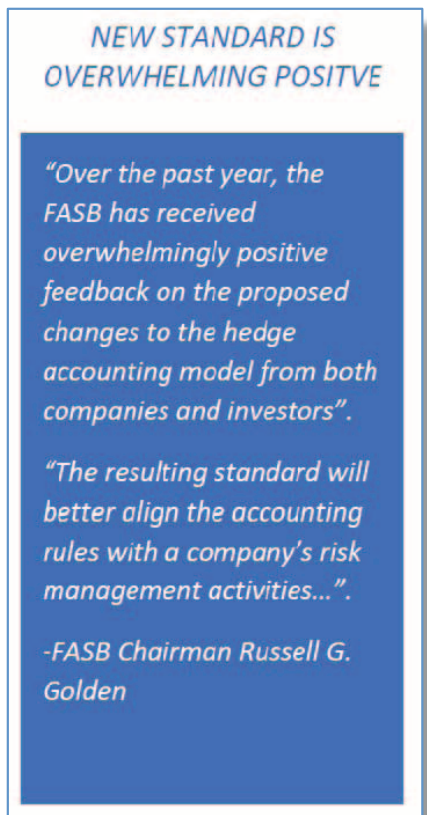[2] For example, see BALM (Oct 2016 and Jan 2017)
[3] See "Robust Models of Core Deposit Rates - II" BALM (June 2017)

Positive Changes Come to Hedge Accounting

The Financial Accounting Standards Board (FASB) has issued new guidance that greatly simplifies the use of hedge accounting and is overwhelmingly positive for community financial institutions. The new standard allows financial institutions to make more effective use of derivative products to hedge interest rate risk.

This new guidance addresses the third and final area of the multiyear financial instruments project of the standard setting body. Numerous pronouncements by FASB, including new standards for lease accounting, revenue recognition, and accounting for credit impairment, are resulting in extensive projects requiring dramatic changes in accounting and disclosures that have generally been viewed as negative for the industry. In contrast, the changes in the hedging area are overwhelmingly positive and allow much more flexibility to protect against interest rate risk. The information below represents our understanding of the new accounting pronouncement but, due to its technical nature, we recommend discussion with your auditors regarding any hedging transactions you may consider implementing.

> **NEW STANDARD IS OVERWHELMING POSITVE**
>
> *"Over the past year, the FASB has received overwhelmingly positive feedback on the proposed changes to the hedge accounting model from both companies and investors".*
>
> *"The resulting standard will better align the accounting rules with a company's risk management activities...".*
>
> -FASB Chairman Russell G. Golden

What has changed?

Existing accounting rules generally require derivatives to be carried at fair value, with changes in value flowing through the income statement, unless they are classified as effective hedges and meet very detailed documentation requirements. These requirements, especially ongoing effectiveness calculations, prevented most institutions from hedging known risks, even with effective methods, due to the potential volatility in the income statement and the fear of restatement due to misapplication of hedging rules. Some of the more beneficial changes under the new pronouncement are as follows:

- Allows the hedging of pre-payable and callable instruments such as mortgage loans, mortgage backed securities (MBS) and callable bonds.
- Permits partial term hedges, for example, hedging the first or last 5 years of a 10-year financial instrument.
- Allows greater use of key-terms matching and short-cut hedge accounting.
- Eliminates the separate reporting of hedge ineffectiveness. Any mismatch between the hedge and the hedged item will be reported when the hedged item impacts earnings, i.e., when and where the hedge income/expense is recorded.
- Ongoing monitoring of the effectiveness of a hedge can be made on a qualitative basis rather than a strict quantitative approach.
- Initial hedge effectiveness documentation will still be required but the institution will have more time to prepare the documentation as opposed to concurrent documentation now required. This will most likely be a great benefit for smaller institutions with limited resources.
- Reduces risk of accounting restatements by allowing an entity that elects the shortcut method to continue hedge accounting using a *long-haul* method if use of the shortcut method was not or is no longer appropriate.
- Any contractually specified rates may be designated in cash flow hedging relationships, making hedging pools of Prime based loans easier.
- Adds the Securities Industry and Financial Markets Association Municipal Swap Rate as an acceptable US benchmark interest rate for fair value hedges.

What should I be considering?

The ability to do partial term hedges, improvements to cash flow hedge accounting and the expansion of hedge accounting for pre-payable loans and securities opens the door to several new hedging strategies that better align GAAP with an institution's risk management activities. This is particularly true for institutions that are traditional

mortgage lenders, have significant exposure to MBS, or that have significant floating rate core deposit portfolios if those core deposits have a contractual rate. Because of these changes, there are numerous hedging transactions that are now possible that were not previously allowed under GAAP. For example:

- Hedging amortizing, pre-payable instruments, e.g., consumer and commercial loans, mortgage backed securities, SBA DCPC securities. using a *last-of-layer* approach.

- Partial-term hedging of bullet and callable fixed rate assets, e.g., consumer and commercial loans, as well as, treasury, agency, corporate, municipal, SBA and other securities. The term of the hedge can be customized to meet the institution's overall risk management needs and does not need to match the maturity of the instrument(s) being hedged.

- Partial-term or full-term hedging of fixed rate funding. This will allow institutions to convert new or existing fixed rate liabilities to a floating rate and customize the term of the hedge to better meet their overall risk management needs.

FASB has issued new guidance that greatly simplifies the use of hedge accounting and is overwhelmingly positive for community financial institutions.

What are my next steps?

The final rule was published in August 2017. The required adoption date is for years beginning after December 15, 2018 for public companies and December 15, 2019 for private companies. Early adoption is permitted but may require adjustment for some existing hedging transactions. Adoption is all or nothing and we anticipate many banks will implement early; we see little reason to wait as this pronouncement is overwhelmingly positive.

At time of adoption, the bank can also make a one-time election to transfer, without penalty, securities from held to maturity to available for sale. We anticipate this change will have minor impact on community financial institutions but it could impact the marketplace somewhat if large banks take advantage of the opportunity to reclassify longer securities that could not previously be hedged because of concerns about fluctuations in reported capital.

Want to learn more?

Vining Sparks Interest Rate Products (VSIRP) has recorded a webinar that is available for financial institutions that want to listen to highlights of the new pronouncement from your office. The webinar discusses the new standard in greater detail and illustrates the key hedging strategies that will be allowed by the new standard. We invite you to listen to the webinar to give your management team an in-depth understanding of the changing guidelines along with an overview of strategies that your bank can deploy to increase your competitiveness, improve profitability, and protect against interest rate risk.

— Rick Redmond
Vining Sparks

Asset/Liability Management Software Vendors — A 2018 Update

This issue of *BALM* features our annual listing of asset/liability management software vendors. The updated listing displayed in Exhibit 2 includes a *sampling* of some of the more prominent ALM software providers, including their key contact information.

The models provided by these vendors offer tools for identifying specific interest rate risk and enterprise risk management characteristics, transfer pricing solutions, auditing controls, and budget development tools.

An effective integrated risk management process is critical to long-term banking success, especially in light of our ever-expanding global environment. Accordingly, it is important that bank ALM professionals recognize interest rate risks long before they become a problem. The job of balancing assets and liabilities, the use of new and highly complex financial instruments, the difficulty of expanding more and more into countries where little market data is available combined with the volatility of our global financial markets have all exposed financial institutions to an unparalleled variety of risks. For these reasons, a rock-solid *integrated* software package is essential in carrying out the responsibilities required of all bank asset/liability management professionals.

Things to Consider

The following considerations should be weighed prior to selecting your asset/liability management model vendor:

Exhibit 2
Asset/Liability Management Software
2018 Update

Software Vendor	Contact	Telephone	Web Site
The Baker Group	Jeff Caughron jcaughron@gobaker.com Matt Harris mharris@gobaker.com	(800) 937-2257	www.gobaker.com
Bank Reporting Sciences	Michael Fasone mfasone@bankreportingsciences.com	(888) 252-6361	www.bankreportingsciences.com
*cor*financial	Alvin Taylor – N. America almeter@corfinancialgroup.com Leon Price – International Leon.Price@corfinancialgroup.com	(347) 837-2642 011-44 20 3848 4261	www.corfinancialgroup.com
FIMAC Solutions, LLC	Greg Doner gdoner@fimacsolutions.com	303-320-1900x 777	www.fimacsolutions.com
Fiserv — Risk & Compliance	Mukund V. Chavan Mukund.Chavan@fisglobal.com	(800) 872-7882	www.riskandperformance.fiserv.com
Kamakura Corporation	James McKeon jmckeon@kamakuraco.com Andrew Zippan azippan@kamakuraco.com	 (808)791-9888	www.kamakuraco.com
Olson Research Associates	Brad Olson btolson@olsonresearch.com Susan Regan sregan@olsonresearch.com	410-290-6999	www.olsonresearch.com
Oracle	Chris Spofford chris.spofford@oracle.com	(941) 907-0930	www.oracle.com
Plansmith Corporation	Tom Parsons tparsons@plansmith.com	(800) 323-3281	www.plansmith.com
Profitstars (a Jack Henry Company)	Lesley Karstens ljkarstens@profitstars.com	(800) 356-9099 (402) 431-9600	www.profitstars.com
Quantitative Risk Management	Charles Richard charles.richard@qrm.com	(312) 782-2855	www.qrm.com
SS&C Technology	Patrick Runyon prunyon@sscinc.com	(952) 857-2711	www.ssctech.com
SunGard BancWare	Inese Knoha ambitinfo@sungard.com	(617) 717-3723	www.sungard.com/ambit
ZM Financial Systems	Joseph Luiso joe.luiso@zmfs.com Jerry Clark jerry.clark@zmfs.com	(919) 251-6587 (919) 241-5305	https://www.onlineALM.com www.zmfs.com

- *Regulatory Issues.* Bank asset/liability managers must have access to state-of-the-art automated tools that provide both standard and highly advanced modeling methods for use in today's increasingly complex regulatory environment. It is imperative that your ALM software provides concise reporting thereby allowing your Board and ALCO to monitor risk limits and policy compliance.

- *Vendor Support Issues.* Vendor support is an extremely important factor in ALM software selection and implementation. Vendor provided support is a critical part of the software implementation process and should be an *absolute* priority to your final decision. Important software vendor support characteristics should include the following:

  - Competency in the financial institutions industry;

  - Geographic proximity — It is prudent to select a vendor who is geographically close to your financial institution;

  - Integration skills — Your selected vendor should have expertise in integrating their software with your systems;

  - Product expertise — A demonstration at a financial institution that is using your vendor's software system can demonstrate vendor reliability and software installation success; and,

  - Responsiveness and availability — Your vendor should be available to your staff seven days a week.

Your selection of commercially available software to support your risk management and ALM operating requirements as well as future strategic initiatives is a critical success factor in your bank implementing and maintaining a successful ALM process.

Final Thoughts

Although this vendor list does not include every available ALM software vendor, it provides the bank asset/liability manager and your bank's ALCO with a sampling of the distinguished software vendors currently offering asset/liability management modelling tools.

Vendors interested in being included in future surveys should contact *SCI* at i*nfo@southeastconsulting.com* or 704.338.9160.

— Jennifer Brooke
Southeast Consulting, Inc.

2018 Asset/ Liability Management Compensation Survey

Our 2018 *Bank Asset/Liability Management Newsletter* ALM Compensation Survey data collection process is now underway. As in years past, our 2018 ALM Compensation Survey will be designed to provide a profile of the salary, bonus and cash compensation practices for asset/liability management practitioners within the U.S. financial institutions industry. Our annual ALM Compensation form is included in this issue. Please complete and return the enclosed survey form no later than May 15, 2018 to Southeast Consulting, Inc. The results will be published in the July 2018 issue of *Bank Asset/Liability Management.* Be a part of this important survey by helping us collect a representative sample of national and regional ALM compensation practices.

— Jennifer Brooke
Southeast consulting, Inc.

2018 ASSET/LIABILITY MANAGEMENT (ALM) PERSONNEL COMPENSATION SURVEY
Please return by May 15, 2018

Level of responsibility:

Institution _____

Address _____

City _____ State _____ Zip _____

E-mail address _____

Position Title _____ Salary _____

Bonus or incentives _____

Asset size of institution (in millions) _____

Annual budget for ALM _____

Years of banking experience _____

Years of asset/liability management experience _____

Degree(s): ☐ PhD   ☐ Masters   ☐ Bachelors   ☐ Associate   ☐ Other   ☐ None

☐ ALCO chairman
☐ ALCO member
☐ A/L model operator/analyst
☐ Chief financial officer
☐ A/L risk manager
☐ Investment manager
☐ Treasurer
☐ Other _____

Have you been affected by industry consolidation through mergers and acquisitions (position change; reassignment; address change, etc.)? Please comment.

_____

_____

Experience (check all items that apply):

☐ Derivative products
☐ Duration
☐ Foreign exchange transactions
☐ Gap analysis
☐ Investments
☐ Liquidity analysis
☐ Market value analysis
☐ Off-balance sheet transactions
☐ Option-adjusted pricing
☐ Purchased servicing
☐ Simulation analysis
☐ Risk-based capital
☐ Credit risk
☐ Other _____
☐ Other _____

ALM model used:

Currently _____

Previously _____

_____

_____

How *often* is this model used?

☐ Monthly
☐ Quarterly
☐ Semi-annually
☐ Annually
☐ Other _____

How is this model used?
Budgeting _____%
Planning _____%
ALM _____%
Other _____%
Total   100%

Primary type of institution (select only one):

☐ Bank
☐ Credit union
☐ Savings institution
☐ Consulting firm
☐ Investment bank
☐ Regulatory agency
☐ Other _____

How would you classify your financial institution's balance sheet?

☐ Simple
☐ Typical
☐ Complex

Summary of your position responsibilities (use additional paper to continue comments): _____

_____

Please send your response to *info@southeastconsulting.com* or to:
Southeast Consulting, Inc.
P.O. Box 470886
Charlotte, NC 28247-0886