Choosing the Right ALM Modeling Solution:
In-House and Outsourced Solutions and Risk Assessments

By William J. McGuire, Ph.D.
Sixth Edition
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A special thanks to our eleven sponsors without whom this publication would not have been possible:

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Thank You to Our Author

Many thanks to Bill McGuire, a contributing author, frequent speaker, superb educator, and good friend of FMS for over twenty five years.
Dear ALM Specialist:

As the leading provider of asset/liability management education and information for financial institutions, FMS is often asked to provide guidance and insight to institutions that need to purchase or upgrade an asset liability modeling solution.

In response to those requests, in five previous editions we have partnered with one of the industry’s leading ALM educators, Bill McGuire, PhD. and Chairman Emeritus of McGuire Performance Solutions, Inc., to create a tool that can be helpful in choosing the right ALM modeling solution for your institution.

In this, our 6th edition, we have expanded the publication’s scope and address not only in-house models, but also outsourced solutions and the increasingly important area of model risk assessments — validation and verification services.

So, whether you are just beginning your search for an ALM solution, considering changing either your in-house or outsourced provider, or considering a shift from in-house to outsourced, or vice versa, this book will provide you with valuable guidance. In addition, given the current regulatory scrutiny of model risk assessment, it provides excellent insight on what to look for in validation services.

We are extremely grateful to the eleven ALM vendors who have supported our goal of providing valuable information to the industry, and appreciate their willingness to co-sponsor this publication. They are:

- ALMFirst, Inc.;
- Alpha-Numeric Consulting, LLC;
- Austin Associates;
- Darling Consulting Group: Farin & Associates;
- FIMAC Solutions LLC;
- Financial Institution Management Associates Corp.;
- FinPro, Inc.;
- Mark H. Smith Inc.;
- McGuire Performance Solutions;
- McQueen Financial Advisors, Inc.;
- R2Metrics;
- and Velligan/Blaxall, LLP

Finally, I’d be remiss if I did not thank Tracy Dagnon of my staff for the excellent work she performed on the design and production of this work.

Sincerely,

Richard A. Yingst
President/CEO
Financial Managers Society, Inc.
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William J. McGuire, Ph.D.
Chairman Emeritus of McGuire Performance Solutions, Inc.

Dr. McGuire brings over 35 years of industry experience to the issue of choosing the right ALM modeling solution. He is a nationally recognized expert on financial model risk assessment, statistically derived core deposit, loan and CD behavior assumptions, and the use of ALM models to analyze interest rate risk (IRR) and earnings potential. Dr. McGuire is widely published in the area of ALM, is a frequent speaker at industry forums and serves on the faculty of the ABA Stonier National Graduate School of Banking.

Dr. McGuire is Chairman Emeritus of McGuire Performance Solutions, Inc. (MPS), a MountainView company. MPS was founded in 1995 by Dr. McGuire to provide industry leading quantitative and technical solutions for balance sheet performance and risk management in financial institutions. In addition to statistical quantification of non-contractual loan, core deposit and CD behavior assumptions, MPS provides model risk assessments for a wide range of basic and advanced financial models, valuations for acquisition accounting applications, and benchmark IRR model behavior assumptions. MPS was acquired by MountainView in early 2014.

Prior to MPS, Dr. McGuire was a Senior Vice President at the Sendero Corporation. There he had management responsibility for the Sendero service bureau, client support, and the Sendero Institute, and served on the firm’s senior management team. Before joining Sendero, he was a founder and president of Performance Analysis Inc., a supplier of Outsourced IRR analysis reports. That company was sold to Fiserv Inc., parent of Sendero Corporation, in mid-1992.

Dr. McGuire was a Vice President at the Federal Home Loan Bank of Cincinnati from 1987 to 1992. While there, he served as a member of the Bank’s senior staff, ran an Outsourced IRR analysis service, and planned and participated in numerous asset-liability management educational and training sessions. Dr. McGuire also contributed to several regulatory initiatives, including a leadership role in the task force that designed the thrift industry’s groundbreaking IRR requirement, Thrift Bulletin-13. Before joining the Bank, Dr. McGuire taught finance and economics at the university level for 10 years.

Dr. McGuire has an undergraduate degree in business administration and a master’s degree in economics from Ohio University, in Athens, Ohio. He holds his Ph.D. in economics from The University of North Carolina at Chapel Hill. Learn more about Dr. McGuire and MPS at www.mpsaz.com.

About Financial Managers Society

The Financial Managers Society, Inc., founded in 1948, is the only individual membership society exclusively serving financial executives, auditors, and risk managers from financial institutions.

FMS members include over 1,400 CFOs, controllers, CEOs, COOs, treasurers, financial analysts, investment officers, internal auditors, and risk managers from banks, thrifts and credit unions. Nearly 175 vendors who provide goods or services to the industry are Affiliate Members of the Society.

FMS fulfills its mission of “Advancing the development of financial professionals within the financial institution industry” by offering educational conferences, seminars and webinars; disseminating function specific information through a variety of delivery vehicles; and by providing electronic and on-site forums for the exchange of best practices and practical applications. Learn more about FMS at www.fmsinc.org.
Preface to the 6th Edition

The financial institutions’ sector has changed dramatically since the financial crisis of 2008-2009. Unrelenting margin pressures from adverse market forces and unprecedented regulatory demands have made the benefits of robust balance sheet management more obvious and more critical. This elevates the role of having the right ALM modeling solution, with a particular focus on the ability to produce accurate IRR analysis reports.

Changes in the regulatory environment relating to financial models have been especially significant. ALM models are expected to be accurate — not conservative — measures of expected performance, earnings-at-risk and equity-at-risk outcomes. This expectation is accompanied by mandates for independent model risk assessment (model validation) and institution-specific loan, core deposit and CD behavior assumptions. Implementation of an ALM modeling solution is also now expected in almost all institutions, even those with comparatively small (e.g., less than $100 million) asset sizes.

The greater regulatory requirements parallel expanded business needs. Balance sheets are now more multifaceted and dynamic, and embedded behaviors more uncertain, requiring greater than ever IRR and other risk analysis precision. ALM modeling solutions need to be capable of analyzing high levels of balance sheet complexity and producing precise risk projections.

Given such challenges, the good news is that financial model capabilities and analysis accuracy have developed along with the greater need for precision. Models are now more capable, and there is an ALM model or specialized modeling solution to meet every need.

IRR analysis solutions are commonly obtained from traditional in-house ALM models or Outsourced services. In either approach, however, greater balance sheet complexity, and the increased importance of precise forecasts and wider ranges of IRR testing (e.g., analyses of the impacts of yield curve shape changes) have escalated the importance of independent model risk assessments. Verification of key model technical elements, validation of IRR forecasts, and confirmation of model governance, are now integral components of every in-house ALM model or Outsourced IRR analysis solution.

What does the future hold for ALM modeling solutions and associated IRR analyses? Expect more emphasis on model technical capabilities and forecast accuracy, including more behavior assumption and model outcomes back testing. Loan prepayments, core deposit re-pricing and decay (runoff) and CD options will hold center stage in light of their material implications for IRR analysis accuracy. Expect regulatory focus on tighter integration of model outputs into decision-making, better developed model governance, and closer links between ALM models and other risk modeling.

This 6th Edition incorporates recent incremental regulatory IRR guidance and relevant ALM model related developments, trends, and emerging issues. It is designed to provide practical guidance for choosing the right ALM modeling solution, whether that be an in-house ALM model or an Outsourced IRR analysis service.
Introduction

Asset/liability management (ALM) is an expected component of financial institution performance analysis and risk control. This has come about because ALM provides a powerful context for conceptually understanding the balance sheet behaviors that drive performance and risk and supports more intelligent financial management. Regulators and financial markets recognize the value of robust ALM management activity and incorporate ALM-related performance and risk measures into their evaluation criteria. The benefits of a successful ALM solution have never been clearer.

A handicap for many smaller asset size or otherwise budget constrained institutions to effectively apply modern ALM techniques is that they often do not have timely measures of current or future balance sheet outcomes. This results in lost earnings opportunities and potential risk exposures.

Fortunately, there are solutions. Cost-effective ALM simulation models are available that meet the performance and risk analysis needs of almost every financial institution. Most institutions can now have the in-house ALM model-based quantitative foundation required for a successful solution. But cost-effective solutions that meet the earnings at risk and equity at risk analysis needs of institution are also available through third party outsource providers. Thus, every institution now has an available choice of an IRR analysis solution, depending on needs, ALM culture, staffing, and budget.

This publication provides guidelines for choosing the right ALM in-house model and the right IRR analysis outsource provider and ensuring their ongoing accuracy. It employs both conceptual and practical perspectives to examine salient issues. The presentation is divided into three parts:

**Part 1** develops a general framework for determining an appropriate in-house model. Key concepts to understand, questions to ask, and features to review are presented, and decision aids are provided to assist in your evaluations. Leading ALM model vendors provide responses to FMS’ objective In-House Model Solution Questionnaire and descriptions of their services for review and reference.

**Part 2** offers a general framework for determining whether outsourcing an ALM model based IRR analysis solution is a correct choice and for choosing a specific provider. Key concepts to understand, questions to ask, and features to review when considering an Outsourced IRR analysis solution provider are presented. Leading ALM outsourcing providers provide responses to FMS’ Outsourced Model Solution Questionnaire and descriptions of their services for review and reference.

**Part 3** General guidance as to assessing model risk, including validating in-house ALM models and Outsourced IRR analysis solutions, is provided. Specialized insights into in-house ALM models versus Outsourced IRR analysis services are discussed, and key insights relevant to choosing a model risk assessment provider are delineated. Leading providers of model risk assessments for both in-house and Outsourced solutions provide responses to FMS’ Model Risk Assessment Supplier Questionnaire and descriptions of their services for review and reference.
A Framework for Choosing the Right ALM Model

Deciding whether to acquire an ALM model\(^1\) and how capable of a model to choose is fundamentally a capital budgeting decision. The same benefit versus cost methodology governing the choice of a new core processing system, for example, applies. The question is whether the level of expected future benefits, compared to current and expected future costs, is favorable. If yes, the action signal is on. If no, then no action is the right answer.

Let us begin by looking at how to choose the right level of ALM model (i.e., how powerful it is) by developing a conceptual decision framework. This establishes the global benefits and costs associated with an ALM model as a component of an overall ALM process solution. This same framework will apply later, when you buy a specific ALM model.

**ALM Model Benefits**

The benefits of an ALM model emanate from its ability to quantify the behaviors of existing balance sheet holdings and forecast future earnings and value-related outcomes in a timely fashion. This translates into enhanced earnings performance — directly from better financial decision-making, and indirectly from enhanced regulatory compliance.

ALM models provide the equivalent of a speedometer in an automobile: a quantitative gauge of performance. With an ALM model, the balance sheet can be accurately pushed to its “speed limit” (i.e., maximum performance) while controlling risk. Having an ALM model also reduces the chances of going too slow, thus missing earnings opportunities or encountering unexpected risks.

What kind of performance gains can you expect from having the right ALM model? For an institution that does not now have a model, a 2-3 basis point gain in Return on Assets (ROA) and a proportionately larger gain in Return on Equity (ROE) are normally cited as typical results from a fully implemented ALM model. Results will vary by institution but earnings gains can almost always be expected.

On a day-to-day basis, the earnings advantage of an effective ALM model stems from a more precise understanding of fundamental short-term and longer-range balance sheet baseline performance and interest rate risk positions, as well as better-quantified liquidity and capital risk. This knowledge empowers management to avoid unduly conservative balance sheet holdings that limit earnings and more readily demonstrate regulatory compliance — lowering costs.

Over time, effectively using an ALM model strengthens management’s understanding of balance sheet behaviors and their associated performance opportunities and risks, leading, over time, to better financial decision-making and greater earnings.

---

1 Note that obtaining the analytical services of an ALM model can be accomplished in two ways. The first is the purchase of an in-house or internet-based ALM model that is run by the institution. The second is to acquire IRR analyses through an out-source arrangement with a third party, who may be the model vendor or firm that owns a copy of the model. The concept of the right ALM model for your institution’s particular balance sheet, and how to choose that model, are the same in either case although some details vary. See the section below on How to Choose an Outsourced IRR Analysis Solution for more discussion.
Multiple factors define expected ALM model benefits. Consider each in turn:

**Degree of capital leverage** is a crucial determinant of benefits from an ALM model. A lower capital-to-assets ratio enhances earnings performance but places a premium on accurately managing the balance sheet and controlling risk because of the thinner capital cushion. An ALM model provides the insights needed to manage with a lower capital position by accurately projecting potential future earnings and capital levels. Without an ALM model, the future is at best an educated guess. With an ALM model, management quantitatively knows where the institution is going and what potential capital exposures look like.

**Overall margin** (income less expense) is another crucial determinant of benefits from an ALM model. The balance sheet has to be managed to produce high earnings along a stable trend. Where overall margin is smaller, there is less of an innate earnings cushion to changes in earnings. Precise management and control of balance sheet outcomes thus become key priorities and key ALM model benefits.

**Degree of interest rate risk** (IRR) is a strong influence on the level of ALM model benefits. The need to precisely quantify and monitor earnings and value related interest rate related sensitivities increases with greater levels of IRR, and when multiple IRR influences are present in the balance sheet. Without an ALM model, unforeseen interest rate related sensitivities could easily turn into an unpleasant surprise. With an ALM model, the institution quantitatively knows its IRR position and can manage it effectively.

**Liquidity management style** is another key influence on the level of ALM model benefits. Precise projections of future cash flow behaviors are needed when stored liquidity positions are smaller. Because an ALM model tracks existing and future sources and uses of funds in detail, it is a natural solution for monitoring and controlling liquidity risk, a metric under increased regulatory scrutiny.

**Financial decision-making style** is also an influence on the level of ALM model benefits. Where “steady as she goes” is the best description of the financial management culture, there is limited need for a tool to forecast current possible alternate balance sheet outcomes. A more active financial management style, however, requires timely strategy evaluations. ALM model benefits increase in this environment because the model can support the fast-paced quantitative decision inputs needed by management and the Board.

**ALM-related culture** is also an influence on ALM model benefits. When upper management and the Board understand and trust model outputs as a basis for financial decision-making, ALM models make significant earnings enhancement and risk control contributions. On the other hand, when the model is inappropriately viewed as just an expense or as a regulatory mandate without business value, benefits are constrained to well below their potential.

**Regulatory compliance** is a significant ALM model benefit. As a general rule, regulatory-related ALM model requirements are a subset of normal business needs (that is, business and regulatory ALM model benefits often strongly coincide). Examiners look for an ALM model that is appropriate in light of the institution’s balance sheet size and complexity, capitalization, IRR and liquidity positions and its general management style. An exception to this practice may occur when an institution is deemed to be at high risk or already in regulatory duress.

As noted in Exhibit 1, expected benefits from an ALM model increase quickly as basic financial management decision and regulatory needs are linked to modeling activities and better management inputs are produced. Not surprisingly, benefits increase more slowly as the model addresses less vital business and regulatory needs, and eventually, new uses of the model are exhausted and the benefits curve flattens.

Unfortunately, ALM model benefits are typically not quantifiable at reasonable levels of precision. However, the benefit concepts outlined above can be combined with balance sheet information to obtain a general sense of ALM model benefits.
EXHIBIT 1: ALM Model Benefits

Benefits of an ALM model

Initial uses have high added benefits

Later uses have less-crucial impacts and lower added benefits

More Powerful ALM Model

- Higher capital leverage
- Smaller overall margin
- Greater IRR/ more IRR sources
- Greater liquidity management needs
- More active decision-making style
- Greater/more specific regulatory mandates
**EXHIBIT 2: ALM Model Benefits Self-Grading Checklist**

Mark the scales for each ALM model benefit driver in the area that best describes your institution’s situation.

<table>
<thead>
<tr>
<th>Lower ALM model benefits</th>
<th>Mid-level ALM model benefits</th>
<th>Higher ALM model benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Capital Leverage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>More than 10% K/A</td>
<td></td>
<td>Less than 6% K/A</td>
</tr>
<tr>
<td><strong>2. Level of Overall Margin (Income - Expense)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Significantly less than peer group</td>
<td></td>
<td>Significantly higher than peer group</td>
</tr>
<tr>
<td><strong>3. Interest Rate Risk Indicators</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Repricing Mismatch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Close repricing mismatch in next 12 months (e.g., gap&lt;10%)</td>
<td></td>
<td>Significant mismatch in next 12 months (e.g., gap &gt;15%)</td>
</tr>
<tr>
<td>• Maturity Mismatch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Close maturity match between long-term assets and liabilities</td>
<td></td>
<td>Significant mismatch between long-term assets and liabilities</td>
</tr>
<tr>
<td>• Driver (Repricing) Rate Mismatch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Few driver rates (e.g., &lt;5)</td>
<td></td>
<td>Many different driver rates (e.g., &gt;10)</td>
</tr>
</tbody>
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Continued on next page
EXHIBIT 2: ALM Model Benefits Self-Grading Checklist

(Continued)

<table>
<thead>
<tr>
<th>Lower ALM model benefits</th>
<th>Mid-level ALM model benefits</th>
<th>Higher ALM model benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Optionality Behaviors</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limited mortgage product, callable agency investments and/or convertible FHFB advances (e.g., &lt;10% assets)</td>
<td>Significant mortgage product, callable agency investments and/or convertible FHFB advances (e.g., &gt;20% assets)</td>
<td></td>
</tr>
<tr>
<td><strong>CD Option-Related Behaviors</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100% penalty on all CDs/no bump-up type products</td>
<td>Weak penalties on many CDs/multiple bump-up type products</td>
<td></td>
</tr>
<tr>
<td><strong>Core Deposit Funding</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 10% core deposit funding</td>
<td>More than 40% core deposit funding</td>
<td></td>
</tr>
<tr>
<td><strong>Complexity Influences</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No CMOs or other structured instruments</td>
<td>Holdings of CMOs, REMICs or other structured instruments (e.g., &gt;5% assets)</td>
<td></td>
</tr>
<tr>
<td><strong>Off-Balance-Sheet Items</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No off-balance-sheet items</td>
<td>Extensive and/or complex off-balance-sheet items</td>
<td></td>
</tr>
</tbody>
</table>

Continued on next page
### EXHIBIT 2: ALM Model Benefits Self-Grading Checklist

(Continued)

<table>
<thead>
<tr>
<th>Lower ALM model benefits</th>
<th>Mid-level ALM model benefits</th>
<th>Higher ALM model benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4. Liquidity Position</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquidity ratio significantly less than peer group</td>
<td>Liquidity ratio significantly higher than peer group</td>
<td></td>
</tr>
<tr>
<td><strong>5. Management and Board Decision Style</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-interventionist decision-making style; few strategies considered; limited business plan forecasting</td>
<td>Actively manage the balance sheet; frequent strategies considered; comprehensive business plan forecasting</td>
<td></td>
</tr>
<tr>
<td><strong>6. Regulatory Mandates</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very limited regulatory based ALM modeling requirements</td>
<td>Regulator essentially mandates ALM modeling to assess IRR and monitor performance</td>
<td></td>
</tr>
</tbody>
</table>

### Summary

Based on the general direction of marks above, the level of benefits associated with an ALM model at my institution is:

- **Low** (Mostly lower benefit marks)
- **Moderate** (Mostly low mid-point benefit marks)
- **High** (Mostly high mid-point benefit marks)
- **Advanced** (Mostly higher benefit marks)
Whether expected ALM model benefits justify acquiring an ALM model or upgrading an existing ALM model to a more powerful level depends on the related costs. Let us consider these below and then put benefits and costs together and make a decision.

**Costs Associated with an ALM Model**
Quantifying the costs of an ALM model is often easier than quantifying benefits because many relevant elements can be directly valued. A full review, however, will show that many ALM model-related costs are indirect and cannot be precisely valued. But a comprehensive assessment must recognize all cost elements.

*Exhibit 3: ALM Model Costs* depicts the drivers of the all-in costs (direct and indirect) of an ALM model. The major cost elements are the level of the model (how fundamentally powerful it is); model options specified; installation activities (setting up the model so it technically functions); implementation activities (customizing the model to match your institution); behavior assumption service fees (e.g., for prepayment and core deposit inputs); one-time investments to integrate the model into your ALM process solution, ongoing user-related costs (time spent running the model, training, etc.); and annual maintenance fees.

As a rule, all-in ALM model costs normally increase quickly as more powerful (and more complex) models are specified. This increase especially relates to initial outlay and model installation/implementation costs. Once a model is implemented, ongoing costs rise more linearly with the ALM model level.

Multiple factors define expected ALM model all-in costs. Consider each in turn.

**Initial outlay** is normally a significant part of the total. The initial outlay includes the cost of searching for the right ALM model, purchase (or upgrade) price, expenses for any specialized supporting software or hardware and user training time.

Purchase price varies with the model level chosen or the degree of upgrade obtained. Model options and add-on services add to this total.

Supporting software or hardware costs are often an important consideration, particularly for high-powered/complex ALM models. Be sure to inquire about these needs when purchasing or upgrading a model. Networked versions of an ALM model often require their own servers and installation-related items. If your institution is running on a virtual server (or planning to), be sure that the model is compatible with that environment.

Most of the initial costs for an ALM model are direct and can be readily monetized. But, be sure to include the *indirect* costs of your search time and user orientation. A significant outlay of time is often required to make a smart ALM model choice and properly educate users, and that time has an opportunity cost.
**EXHIBIT 3: ALM Model Costs**

- **Costs of an ALM model**
- **Up-front costs can be significant**
- **Increasing model capabilities are exponentially more costly to implement, maintain and use**

- **Initial outlay**
- **Installation costs**
- **Implementation costs**
- **Behavior assumption service fees**
- **Ongoing operating costs**
- **Maintenance fees**
Installation of an ALM model makes the model function in a purely technical sense. This includes (1) setting up, defining and auditing data extract capabilities; (2) designing a chart of accounts (the asset and liability categories to be modeled) that properly reflects your institution’s balance sheet; (3) populating the chart of accounts with category-level definitions and contractual inputs that reflect specific underlying balance sheet contracts; (4) specifying behavior inputs (e.g. for loan prepayments, core deposits and CD’s); (5) initial test runs of the model; and (6) defining rudimentary reports. The installation also includes user training that focuses on how to populate and operate the model. Some ALM model vendors come on-site for model installations, but most now do it remotely.

Installation is usually included in an ALM model’s price, and it is technically counted with that outlay. Be sure to recognize the time spent in user training and by institution staff assisting the model installation. These again represent costs — even if they are not direct outlays.

Implementation of an ALM model is the process that makes a model function as an effective ALM decision-making and risk-analysis tool. Implementation customizes every facet of the model to your specific situation. A key element in this is to ensure that loan prepayments (contractual maturity loans), loan payoffs (indeterminate maturity loans), core deposit supply, re-pricing, decay rates, CD options (such as bump-up outcomes), and CD early withdrawal inputs reflect your institution’s specific experience. Best practice behavior inputs are forecasts based on statistically quantified recent institution history. Custom peer behavior data, available now for loans, core deposits and CD’s, may be acceptable in some cases.

The implementation needs to seamlessly integrate the model into your institution’s asset/liability management committee (ALCO) activities, policies, procedures and user controls. This includes defining the model’s requisite normal compliance and business applications (e.g., IRR analyses, business planning and liquidity model interface) and any special uses (e.g., sensitivity and stress testing of IRR and other risk positions, back testing and other reviews of model outcomes and behavior assumption accuracy).

The all-in cost of successfully implementing an ALM model as the nucleus of an ALM process solution is often several times the model’s initial outlay. So be keenly aware of this mainly indirect, but still very real, element of model cost.

Obtaining loan and deposit behavior assumptions requires paying the fees associated with ongoing third-party vendor services or developing in-house assumptions. Either approach is a notable cost associated with an ALM model. Vendor fees also normally apply to obtaining cash flow information for derivative instruments and interest rate data. Because of the specialized expertise required, these costs can be significant.

Ongoing operating costs are mainly staff time associated with running the model and quality assuring outputs. ALCO time spent interpreting model forecasts and for its annual ALM function review are also factors. Periodic independent verification of ALM model accuracy is a further cost element (see discussion of this in “Keeping ALM Modeling Solutions Accurate Over Time” below).

Modeling complexity is a key driver of the level of ongoing use-related costs. For example, balance sheet size and complexity (e.g., a large chart of accounts with numerous embedded options or a large and diverse core deposit base requires a more highly specialized model and franchise-specific behavior assumptions). Management style (how the model is used and how often it is used) and, in some instances, regulatory mandates (e.g., equity-at-risk analyses), are also factors.

The ease of physically running the model, maintaining its underlying databases, defining behavior assumptions, and producing risk analysis reports are other factors that contribute to ongoing operating
costs. Some of those costs can be minimized by specifying a strong model control environment and developing clear procedures. But the ease of performing user activities varies significantly among models. Carefully assess this often overlooked but potentially important cost issue during the search process. If incremental hiring of highly specialized ALM staff is needed, that is, obviously, another cost to include.

Model maintenance fees are charges by ALM model vendors to offset the costs of ongoing model development and user support. They are an easily quantified direct outlay (usually some percentage of the model’s initial purchase price annually). Payment of a model maintenance fee ensures access to vendor-provided model support staff, free or low-cost availability of model upgrades, and other benefits (newsletters, etc.).

While model maintenance is a cost, it is also one of the best model-related investments you can make. It keeps your model up-to-date and functioning at its maximum capability and provides access to model specific technical expertise. Thus, a recommendation: Stay current on model maintenance as long as your institution uses its ALM model.

**Your institution’s ALM culture** can affect all-in ALM model costs just as it normally can affect model benefits.

When upper management and the Board understand and trust model outputs as financial decision making inputs, ALM model functions run more smoothly and thus at lower cost. This is because adequate staff and resources are more likely to be dedicated to the ALM modeling area (an area of current concern in many institutions). Accurate model data are more readily obtained on a timely basis from the line of business areas because everyone appreciates their importance to success.

However, if the model is viewed as purely an expense, or as only used to meet regulatory mandates, modeling is a chore. Lack of buy-in by upper management and the Board can lead to higher costs as everyone just goes through the motions in an unsupportive climate.

While there is no way to define a final quantitative ALM model cost value, insights can be derived from the points outlined above. *Exhibit 4: ALM Model Costs Self Grading Checklist* provides a checklist for qualitatively ascertaining your institution’s expected ALM model costs. Examine each point and “grade” your situation. A preponderance of marks in one portion of the scales indicates the expected general cost level of an ALM model for your institution.
EXHIBIT 4: ALM Model Costs Self-Grading Checklist

Mark the scales for each ALM model cost driver in the area that best describes your institution’s situation.

<table>
<thead>
<tr>
<th>Lower ALM model costs</th>
<th>Mid-level ALM model costs</th>
<th>Higher ALM model costs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Initial Outlay Required</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entry-level ALM models</td>
<td>Advanced-level ALM models</td>
<td></td>
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<tr>
<td><strong>2. Installation Requirements</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simple model and simple balance sheet</td>
<td>Advanced model and/or very complex balance sheet</td>
<td></td>
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<tr>
<td><strong>3. Implementation Requirements</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simple model, compact ALCO process and simple balance sheet</td>
<td>Advanced model, comprehensive ALCO process and/or very complex balance sheet</td>
<td></td>
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<tr>
<td><strong>4. Behavior Assumption Service Fees</strong></td>
<td></td>
<td></td>
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<tr>
<td>Few options and less than 10% core deposits</td>
<td>Many options, derivative instruments and more than 40% core deposits</td>
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</tr>
</tbody>
</table>

Continued on next page
EXHIBIT 4: ALM Model Costs Self-Grading Checklist

(Continued)

<table>
<thead>
<tr>
<th>Lower ALM model costs</th>
<th>Mid-level ALM model costs</th>
<th>Higher ALM model costs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>5. Ongoing Operating Costs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simple model, easy to use model, simple balance sheet, limited types of model applications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advanced model, specialized users required, very complex balance sheet, broad range of model applications</td>
<td></td>
<td></td>
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</tbody>
</table>

| **6. Model Maintenance Fees** |
| Low initial model costs and/or low fee percent |
| High initial model costs and/or high fee percent |

**Summary**

Based on the general direction of marks above, the level of costs associated with an ALM model at my institution is:

- Low (Mostly lower cost marks)
- Moderate (Mostly low mid-point cost marks)
- High (Mostly high mid-point cost marks)
- Advanced (Mostly higher cost marks)
Comparison of Benefits and Costs of ALM Models

When are costs too high to justify buying (or upgrading) an ALM model? That depends on the level of benefits compared to the level of costs. Don’t just look at costs!

*Exhibit 5: ALM Model Benefits and Cost Relationship* combines the benefit and cost relationships depicted in *Exhibits 1 and 3.*

Before point A, an ALM model is not justifiable because all-in costs are greater than associated benefits. Beyond point C, a more capable ALM model is not justifiable because costs exceed obtainable benefits.

Simple “yes or no” situations such as A or C are rare. The question confronting decision makers is most often this: Given all the choices available, what is the right ALM model for my institution? The answer is that the right model is the one that provides maximum benefits relative to costs. But how to determine this?

The best way to assess model benefits versus costs is to first establish the fundamental advantages of having any ALM model (that is, rule out being before point A). Then sequentially compare the extra benefits derived from higher-level (more powerful and complex) models or model options to their incremental all-in costs. The best ALM model for your institution lies where increases in the all-in costs related to adding

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**EXHIBIT 5: ALM Model Benefit and Cost Relationships**

![Diagram](image-url)
more model power just begin to overtake increases in all-in benefits associated with the enhanced model power. Given the imprecision of most cost and nearly all benefit data, a range of optimal outcomes (e.g., outcomes around point B) is most likely. Such a range is not a problem, though, because a general answer provides adequate guidance for model choice.

**Capability Levels of ALM Models**

Different models generally fall into distinct ranges of capability, referred to as model levels. This tendency sorts out model choice for most institutions into easy-to-review specific groups of models. Just a rough determination of an optimal model level (such as obtained above) is sufficient to start down the right path.

The three general model levels are entry, intermediate and advanced.

**Entry-level ALM models** are the simplest of ALM modeling solutions. They provide basic levels of balance sheet simulation precision for a limited outlay. The problem is that entry-level ALM models often cannot adequately address complex balance sheets or properly deal with option-related complexities embedded in CMO’s, callable investments or convertible FHLB advances. They also generally have limitation with regards to loan, core deposit and CD behavior modeling. Only so much can be delivered for the low price! An entry-level ALM model would be a good choice for an institution whose marks in Exhibit 2 are consistently in the “Lower ALM model benefits” portion of all scales.

**Intermediate-level ALM models** are the right choice for institutions that have needs beyond entry-level models but do not require an ALM model with the most advanced capabilities. In recent years, this class of models has advanced significantly in terms of innate model capabilities. In addition, intermediate level ALM models can now often be upgraded to include advanced features such as record level processing. Since this class of model has remained largely constant in price over time, a significant gain in their innate benefit-to-cost ratios has recently taken place.

Intermediate-level ALM models can now handle complex balance sheets and properly forecast all sources of optionality. They are capable of modeling categories with unusual behaviors, for example, loan prepayments, core deposit behaviors, hybrid ARM’s, teaser rate categories, CD bump-up terms and CD early withdrawals. An added benefit is that many models can also simultaneously interface with budgeting and planning applications. Limited off-balance-sheet instrument modeling capability (which is an issue only if your institution has such items), is a weakness in some cases, however.

An intermediate-level model is a good choice for an institution whose marks in Exhibit 2 were consistently in the center areas of the “Mid-level ALM model benefits” portion of the scales. Be aware, though, that a single unique need (such as yield curve shape change IRR analysis capability) can mandate another, more capable, model.

**Advanced level ALM models** are the solution for institutions that need maximum ALM model capabilities. This may be due to balance sheet complexity, special business lines or regulatory mandates. Full in-house capabilities to handle all types of balance sheet complexity and embedded optionality, unique loan core deposit and CD behaviors, complex off-balance-sheet items and other advanced features justify their higher costs. A capability usually found only at this level is stochastic (a.k.a. Monte Carlo) modeling, an element of advanced regulatory compliance mandates. An advanced-level ALM model is required for any institution whose marks in Exhibit 2 fall in the “Higher ALM model benefits” portion of the scales.

The definition of an “advanced” ALM model has broadened over the last several years. Special application models for assessing performance and risk for mortgage pipelines, mortgage servicing rights, derivative instrument valuations and value at risk (VaR) are now common options where required by business lines or regulatory mandates. Models combining loan prepayments and credit risk inputs are also now seen as “advanced,” as are those that test for other than temporary impairment (OTTI) of
investments. And of course, for the largest asset size institutions, an integrated capital stress test model (which includes an ALM model component) are a regulatory requirement.

By following the benefit versus cost principles above, you can narrow your model choice process, and its cost, because models that are either underpowered or overpowered are readily ruled out for further review. However, there are two final issues to consider before moving on to the ALM model selection process.

**The Broader Context of ALM Models**
The complete scope of balance sheet management and risk control benefits related to an ALM model will only be apparent when it is fully implemented and integrated into your institution’s overall ALM process solution. There is more to success than just a model!

*Exhibit 6: Data to Decision ALM Process Solution* illustrates the key components of a “data-to-decisions” solution. Within the data-to-decisions framework, formally defined and tightly coordinated links connect all components of the institution’s ALM process solution. This maximizes model benefits because it cost-effectively applies the model in a results-oriented role.

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**EXHIBIT 6: Data-to-Decisions ALM Process Solution**

1. Data Extracts | The Right ALM Model | Implementation of ALM Model
   
   Analytical Capability

2. Risk Assessment | Business Plan Evaluation | Performance Management | Regulatory Compliance
   
   Performance and Risk Management (ALCO)

3. Risk Reporting | Management Reports | Board Presentations
   
   Communication and Decisions
Success starts in component 1, by having access to all relevant data, the right ALM model, and completing a full implementation. The ALM model becomes the engine that powers the institution’s understanding of balance sheet value, performance potential and risk.

In component 2, the ALM model is put to work. This includes creating model outputs that quantitatively assess balance sheet performance, IRR test positions and business plan strategies within surrounding ALCO policies and procedures (a.k.a. model governance). This component also includes defining the model’s user control environment, specifying efficient processes for running the model and setting mandates for periodic independent third party model risk assessment.

Finally, in component 3, model analyses and forecasts are transformed into decisions. This is accomplished by developing communication materials specifically designed to meet the unique needs of each model output audience.

A fully implemented data-to-decisions ALM process solution ensures that the sum of any ALM model implementation is more than that of its parts. ALCO, senior management and the Board are fully empowered with timely, quantitative insights into the institution’s future balance sheet performance and risk potential.

The many advantages of the data-to-decisions solution lead to a key suggestion - keep that framework firmly in mind as your ultimate goal when choosing an ALM model. With that broader perspective, ALM model features and their benefits are highlighted as to their importance and can be better specified to support your success.
Review Elements and Criteria for Choosing the Right ALM Model

Once the general level of your optimal benefit-cost ALM model level is determined, you can assemble the specific group of models to evaluate. The best place to start your list is in the “Vendor Responses to FMS Questionnaires” sections later in this publication. There you will find comprehensive information from our sponsor vendors. Another good place to look is the industry publication *Bank Asset/Liability Management Newsletter*. It presents an annual survey of active ALM model vendors and each of their model’s features.

**General Requirements**

Before you begin examining ALM models, use *Exhibit 7: Balance Sheet Influences on ALM Model Capabilities* to identify your institution’s balance sheet value and performance behavior sources. Check any that warrant special review because of their magnitude or special features, in particular, options. Review your marks from *Exhibit 2* to reinforce key areas of need. Undertaking this exercise alerts you to your micro-level ALM model related requirements.

**EXHIBIT 7: Balance Sheet Influences on ALM Model Capabilities**

<table>
<thead>
<tr>
<th>Asset/Liability Category</th>
<th>Repricing Mismatch</th>
<th>Maturity Mismatch</th>
<th>Amount of Repricing</th>
<th>Embedded Options</th>
<th>Indeterminate Behaviors</th>
<th>Complexity Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Loans</td>
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<td>Fixed or floating (caps/loans/etc.)</td>
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<tr>
<td>Teaser rates/other special features</td>
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<tr>
<td>Unique prepayment behaviors</td>
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<tr>
<td>Consumer Loans</td>
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<td>Fixed or floating (caps/loans/etc.)</td>
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<td>Teaser rates/other special features</td>
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<td>Unique prepayment behaviors</td>
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<td>Mortgage Loans</td>
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<tr>
<td>Fixed or adjustable (caps/loans/etc.)</td>
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<tr>
<td>Teaser rates/hybrid ARMs</td>
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<tr>
<td>Special features</td>
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<td>(prepayment lockouts/interest only/etc.) Unique prepayment behaviors</td>
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<td>Investments</td>
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<td>Callable/other options</td>
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<tr>
<td>Complex (derivative) products</td>
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<tr>
<td>Time Deposits</td>
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<td>Callable/other options</td>
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<td>Early withdrawal behaviors</td>
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<tr>
<td>Core Deposits</td>
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<td>Repricing and average life behaviors</td>
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<tr>
<td>Teaser rates/other special features</td>
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<tr>
<td>Wholesale Funds</td>
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<td>Fixed or floating (caps/loans/etc.)</td>
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<tr>
<td>Callable/convertible/other options</td>
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<tr>
<td>Off Balance Sheet</td>
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<tr>
<td>Simple deposits/caps or loans/etc.</td>
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<tr>
<td>Complex (derivative) products</td>
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<tr>
<td>Other Items of Note</td>
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<tr>
<td>Mortgage servicing portfolio</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Mortgage origination pipeline</td>
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*Note: Expand this matrix to the level of category detail required by your institution’s balance sheet.*
Look first at each ALM model under review to reaffirm its ability to analyze all of the ALM-related behaviors found in your institution’s balance sheet. Examine especially whether the ALM model is functionally capable of modeling the contractual re-pricing and maturity behaviors of every category represented and the special indeterminate behaviors of core deposits, lines of credit, etc. Then confirm that it has the functionality to model baseline and interest-rate-related cash flow dependencies that arise from all categories and the types of optionality embedded in your balance sheet.

Bottom line: To be successful, an ALM model must be able to analyze and forecast your institution’s complete set of underlying balance sheet characteristics. For every category or instrument, in every time period, and in every interest rate scenario, your ALM model needs to have the capability to accurately intake contractual information from underlying systems data, apply contractual inputs and behavior assumptions, and forecast outcomes accurately in alternate interest rate environments. Major elements to consider in your ALM model selection review follow.

**Re-pricing mismatch** is caused by all elements of the balance sheet because of the varying physical re-pricing opportunities present across categories. Re-pricing balances should be input primarily into an ALM model through detailed downloads of re-pricable balances data from your institution’s underlying systems. Verify that all category rates can be readily defined relative to specific index rates and via driver rate-pricing relations. (Ensure also that all relevant caps and floors can be specified for re-pricing balances.) Manual inputs and adjustments should be minimal. Verify that parallel specifications can be applied to the pricing defined for new balances (growth or replacement) entering future balance sheets.

**Maturity mismatch** is also caused by all elements of the balance sheet because of the varying physical maturity points present across categories. Maturity related attributes should be input primarily into an ALM model through detailed downloads of information from underlying systems. Again, manual inputs and adjustments should be minimal. Be sure to verify that all applicable maturity information can be easily defined for balances entering future balance sheets.

**Amount of re-pricing** for a given interest rate change depends on each category’s driver rate (the financial market index rate that pricing is tied to), a beta relationship (specifying the degree of re-pricing that occurs for any given change in the driver rate), and re-pricing lags (how quickly re-pricing occurs). Review how these relationships are defined and entered into the model for categories tied to common financial sector driver rates. Then explore how re-pricing for categories with administered pricing, such as core deposits and some credit cards and lines of credit, are specified.

Re-pricing limits (e.g., one-time, periodic and lifetime caps/floors) on existing balances normally come directly from system downloads, but verify this. A key issue to review is how categories are aggregated from underlying record-level data. Models vary in this regard, in some cases averaging away large differences in underlying re-pricing limits. Determine how re-pricing limits on replacement and new volume can be input and review how temporary teaser rates are addressed.

**Embedded options** on both sides of the balance sheet are now significant sources of performance for many institutions. But they add to IRR exposures by creating cash flows or other outcomes that are unique to specific interest rate scenarios. Embedded options require special, and often very detailed, model treatments. Continuous option behaviors derive from ongoing prepayments, most notably in mortgage-related categories, but many consumer and commercial loans also often have prepayments. Core deposit decay (see below) is also a form of continuous option. Teaser rates, and caps and floors, are another common source of balance sheet optionality.

Switch options cause outcomes to change dramatically at a specific time and interest rate level. They are most commonly encountered in the investment portfolio in the form of calls on certain holdings. On
the funding side, they are mainly found in convertible FHLB advances. Time deposits (CDs) are subject to early withdrawals in rising interest rate environments and possibly also to options such as “bump-up” features. Be sure to clearly understand how switch options can be defined and are assessed in the model.

Complexity risk (option-related risk magnified by derivative structures) is typically found in collateralized mortgage obligations (CMOs). Complexity risk is usually difficult to assess accurately in an ALM model without importing investment specific cash flows. This is because behaviors are specific to individual instruments and vary uniquely in each interest rate path. If applicable, verify each model’s ability to specially define and accurately assess complexity risk.

In short, ascertain whether each ALM model reviewed can adequately define and analyze all option-related behaviors in your institution’s balance sheet. Option modeling is often addressed via user input tables (e.g., discrete prepayments or other behaviors that link to interest rate levels), but more precise continuous equation-based solutions are also available. Many loan and deposit option behaviors are institution specific, so be sure the model has the flexibility to intake custom input data.

Check, in particular, how switch options are handled because some models are weak in this area and require special solutions. Avoid models that require manual input of switch option behaviors if possible, as it is time-consuming and error prone. Many intermediate-level models now offer add-on “portfolio analyzer” tools that allow record level model treatments. This is a key enhancement because it allows relatively inexpensive models to conduct instrument-level modeling (including options).

Review in detail how well complexity risk is handled (for example, how are CMO cash flows and options in FHLB advances obtained and entered?). If importing external cash flows is a supported method, determine what input sources are supported by the model, the interest rate scenarios allowed, and the cost of the ongoing subscription involved.

Stochastic modeling applications have an added requirement for option-related inputs. The range of potential interest rate paths is very large and, by definition, so is the range of required option inputs. Simple prepayment tables or other mechanical approaches are not sufficient here because the model must define and apply thousands of unique (for each interest rate path) option behaviors. Thus, look for the ability to obtain continuous option inputs from external sources or to embed institution specific option behavior equations into the model. Note that this feature can also be valuable in non-stochastic analyses. For example, scenarios that test for basis-risk-related IRR and yield curve shape changes require unique option inputs in such interest rate forecasts.

Indeterminate behaviors are most notably found in core deposits, but credit cards and lines of credit have some similar characteristics. Contractually, core deposit categories can re-price immediately (i.e., on an administered basis) and have overnight maturities. However, many categories normally exhibit limited re-pricing, with little simultaneous interest rate related supply sensitivity, and long average lives. Review how each model allows you to define core deposit re-pricing (overall magnitude, time lags, and floor rates), supply relations to re-pricing, and existing balances decay (runoff) and its interest rate sensitivity. Do the same for other categories in the balance sheet with indeterminate behaviors as well.

In stochastic modeling applications, the required range of indeterminate behavior inputs notably expands. Simple decay tables or other mechanical approaches are not sufficient. Look again for the ability to embed into the model custom behavior equations that will produce behavior inputs specific to each scenario. This advanced feature can be valuable in non-stochastic model uses also, as unique inputs are automatically created by scenario.

IRR analysis capabilities are essential to model success and robust capabilities are required. Determine how basic IRR scenarios are derived by the model (rate shocks and linear rate ramps are usually
generated internally). Also, establish how external interest rate scenario data (such as from econometric forecasts services) and non-linear rate ramps that assess basis risk and yield curve shape changes) can be entered. External interest rate data should be directly through a spreadsheet interface but that is not always available.

In model equity-at-risk analyses, review how present values and effective durations are calculated. Key issues relating to core deposits and other categories with indeterminate behaviors need to include capabilities to seamlessly input interest rate scenario specific decay rates and enter separate non-interest expense input data.

**Off-balance-sheet positions** are often simple and well within the capabilities of even intermediate level ALM models. However, these positions can be complex enough to require the intake of specific cash flows or specialized advanced modeling. Review your institution’s off-balance-sheet holdings (if applicable) and investigate each model’s capabilities relative to your needs.

**Interfaces with liquidity position assessments and other risk analyses** are an area of great concern given industry experiences in the recent financial crisis. Liquidity and contingency funding models should be based on the same data as the institution’s ALM model. This is not only for consistency, but also because model information incorporates all cash flow (i.e. sources and uses of funds) influences. Ascertain whether liquidity-related analyses can be produced by the model itself or how readily model cash flow data can be brought into your institution’s liquidity and contingency funding models.

Similar conditions apply to the volume data used in loan credit quality analyses, alternate projections of net interest income and net non-interest income performance, and capital stress testing. A best practice solution is for the ALM model to serve as the central engine for all risk related cash flows and act as a consolidator of individual capital risk elements into their final integrated stress testing format.

**Ease of model use and reporting** should be specifically evaluated. Look back at your search so far. Has verifying model capabilities been a direct and easy-to-follow process? If so, then the model interface is likely to be satisfactory. Did you have trouble following the general flow of each model? If no major problems surfaced, that is an indication that the ALM model will be easy (or at least straightforward) to use.

Review also how flexible the model is with respect to producing IRR analysis outcomes and other ALM-related reports. A model with limited reporting functionality can still be a satisfactory solution if model data can be readily sent to spreadsheets or other programs with stronger report creation capabilities.

**Vendor condition, user support and current user references** are also areas to review. At a general level, determine the financial condition of the vendor, the history of recent model updates, and the types of user support offered and the number (and location) of support staff available. Also ascertain whether clients similar to your institution in asset size, charter type and operating characteristics use the vendor ALM model under review. Specific client references can come later; this general review is just to ensure that a given ALM model might warrant more detailed assessment.

For those models that you believe meet all of the above criteria, the focus can now turn to specifics. What to seek and specifically evaluate in ALM models is outlined next.

Three classes of capabilities are delineated to organize the discussion: keystone ALM model requirements, advanced ALM model optional requirements and model governance needs. Keystone requirements are necessary for a successful model implementation at any financial institution. Advanced requirements are required by particular institutions only, based on unique needs. Model governance needs apply to all institutions, however, although with varying degrees of intensity.
Keystone Requirements

A good ALM model is easy to use and maintain, capable of modeling all relevant balance sheet behaviors/options, and produces meaningful forecast outputs. Running the model should take a reasonable amount of time, using non-specialist staff as much as possible.

Questions to ask relating to keystone requirements for an ALM model are listed below. Use the answers to these questions along with the previously completed Self-Evaluation Checklists (Exhibits 2 and 4). Complete the ALM Model Decision Matrix (Exhibit 8) for each model under consideration.

Data extract, download and input data capabilities are essential to the efficient running of an ALM model. As a rule, minimize manual data entry as much as possible. Questions to ask:

1. What are the model’s system extract requirements and how are they fulfilled?
2. What other data download requirements are there and how are they fulfilled?
3. Can separate contractual re-pricing and maturity balances be easily identified?
4. How are record-level contractual inputs, such as amortization, balloon point, caps and floors, teaser rates, etc., brought into the model?
5. How are investment premiums and discounts input and assigned over time?
6. Are automated capabilities for importing model-related data (e.g., rate scenarios, loan prepayments and core deposit decay rates) offered?

Accurate assignment of category rates and re-pricing inputs is an important part of using an ALM model. A key issue is being able to automatically define asset and liability pricing relationships (e.g., from key driver rates using equations) so changes in interest rates across scenarios internally reset category rates to new levels. Questions to ask:

1. How is the pricing of existing balance sheet categories input and updated?
2. Can driver rate equations (e.g., category pricing = spread + beta × driver) in the model be defined and modified? How is this done?
3. How can lags be built into asset and liability re-pricing relationships?
4. How are the rates on future balance sheet categories input and updated?
5. How can cap and floor rates, teaser rates, time limits on teasers, etc. be applied to specific categories in the model?

Easy creation of new volume growth and re-pricing/maturity inputs ensures that future balances can grow or diminish along specified paths and are placed at appropriate points or across proper maturity ranges. Questions to ask:

1. How are the potential multiple maturities of new volume (future) balances defined and input?
2. Can new volume balances be uniquely amortized? How are specific pricing and other behaviors assigned to new volumes?
3. What controls does the model have to avoid negative new volumes?
4. How are category-level new volumes replicated or assigned to other categories?
5. Can defined groups of assets and liabilities be assigned a common growth rate?
6. Can the growth of all assets and liabilities be jointly specified (e.g., holding the entire balance sheet constant or defining a universal percentage of growth)?

Comprehensive option input capabilities are necessary given increasing optionality in balance sheets. The model must be capable of defining unique option specifications in every period, for every category, in every interest rate scenario. Questions to ask:
1. How are options such as loan prepayments and puts/calls defined by category in Base Case (a baseline with no change in future interest rates scenario)?

2. How are prepayments, puts/calls and other option-related behaviors for existing balances applied in individual interest rate scenarios?

3. How are options applied to future balances in Base Case and each rate scenario?

4. CD early withdrawal potential exists and CD options such as bump-up features are increasingly common. Are there any model limitations to modeling these options?

5. What vendor-supplied or external sources are available for model prepayment rates and other option inputs? What controls do users have to tune external prepayment or other inputs to institution-specific conditions? What is the cost of external services?

6. Can custom equations for option behaviors be embedded? How is this done?

**Accurate definition and modeling of indeterminate behavior categories**, primarily core deposits but also including line of credit (LOC) type holdings, is underdeveloped in many ALM models. However, because of the unique nature of indeterminate behaviors and the frequently significant size of underlying balances, accuracy here is vital to precise results. Questions to ask:

1. How is core deposit/LOC re-pricing (both the beta and lags) specifically defined?

2. Can floors (or caps) be imposed on category-level core deposit/LOC rates paid?

3. Can different core deposit re-pricing behaviors (e.g., asymmetric re-pricing and lags) be applied in different rate scenarios? How is this established?

4. How are maturing (decay/runoff) balances defined in each interest rate scenario?

5. What vendor or externally sourced national average-type core deposit re-pricing and average life/value inputs are available? What are the sources and what is the cost?

6. How can external indeterminate behavior assumptions (from third party or in-house sources) be input into the model? Is there a standard (i.e., automated) interface?

7. Can custom equations for indeterminate behaviors be embedded in the model? How is this done?

**Ready availability of IRR rate test scenarios and interest rate forecasts** expedites running an ALM model in many applications. Questions to ask:

1. How are standard rate shock and linear rate ramp IRR test scenarios created in the model or input into it?

2. Can rate scenario data be adjusted in special cases (e.g., interest rate floors)?

3. What vendor-supplied or external sources are available for advanced IRR tests (e.g., scenarios where each rate moves at its own speed to examine basis risk or to test for yield curve shape change risk)? How is such data imported into the model? What are the sources of such scenarios and what is their cost?

4. What vendor-supplied or external sources are available for “realistic” interest rate forecast scenarios (e.g., econometric model produced)? How is such data imported into the model? What are the sources of the external forecasts and at what cost?

5. What is the historic accuracy of vendor-provided realistic rate forecast inputs?

**Equity-at-risk analyses** are now commonly produced because of their comprehensive (all balance sheet time periods) view of balance sheet behaviors and potential future rate-related exposures. Most ALM models—even those in lower price ranges—can effectively perform this task. But not all. Questions to ask:

1. What methodologies are available to calculate present values and durations?
2. Does the model calculate all present values from specific scenario cash flows? If not, what approximation approach is employed?

3. What user override options are available if alternate values (e.g., external investment pricing data or Outsourced core deposit valuations) are employed?

4. Is a stochastic (Monte Carlo) valuation approach available? Is the functionality standard or an added cost option? If the latter, what is the cost of the upgrade?

5. How are present values and durations for core deposits specifically calculated? How are non-interest-related expense inputs incorporated?

**User operation procedures** for an ALM model should be intuitive and efficient. While this is often a personal issue, certain concerns are important. Questions to ask:

1. Is the general menu layout and flow for using the model logical and intuitive?
2. Can multiple IRR rate shock/rate ramp assessments be run in a single operation?
3. Can multiple business plan analyses (e.g., by scenario) be run as a single operation?
4. How are “what if” strategies input and evaluated? How fast can multiple-strategy results be produced and compared?
5. Can budgeting information be run concurrently with the balance sheet forecasts? Can ALM model inputs/outputs be moved directly to such models?
6. Can ALM model inputs/outputs be moved directly to profitability/funds transfer pricing (FTP) applications?

**Report production** in an ALM model should be intuitive and efficient. Model outputs should effectively communicate forecast results or be exportable to spreadsheets or other systems that produce best practice presentation materials. Questions to ask:

1. What are the presentation capabilities of standard model reporting?
2. How are standard regulatory IRR analysis reports and typical business plan projection reports produced?
3. How are comparative results for different scenarios or strategies presented?
4. How can ALM model outputs be directly exported to common spreadsheet software?
5. How are documentation reports of ALM model data, category set up, inputs and assumptions produced?
6. Is a specialized report writer or similar tool included as a part of the ALM model?

**Support for sensitivity/stress testing and outcomes/assumptions testing** is important for meeting new regulatory guidance. Questions to ask

1. How can specialized alternate interest rate scenarios be defined? This includes non-standard traditional rate shock and rate ramp type projections and user specified non-linear scenarios for testing for basis risk and yield curve risk.
2. How can individual interest rates or selected subsets of interest rates be changed to test for specific sources of basis risk (e.g. LIBOR versus Prime)?
3. Are there any limits on defining extreme rate tests (e.g. a +500 bp rate shock)?
4. Is there standard functionality that compares (back tests) prior period model forecasts to subsequent actual outcomes? Over what time horizons can this be done?
5. Is there standard functionality that compares (back tests) prior period model option or behavior inputs (e.g. prepayments or core deposit decay rates) to subsequent actual outcomes? Over what time horizons can this be done?
Model’s interface with liquidity analyses is a newly important area to assess. Using the ALM model as a cash flow source for liquidity and contingency funding plan models is the best solution for leveraging the information in the model. Questions to ask:
1. What liquidity projections are produced in the model or in directly related software?
2. Can model base liquidity projections be altered to produce “what-if” sensitivity tests or contingency funding plan type stress testing?
3. How can ALM model data be exported to in-house liquidity and contingency funding plan models?
4. What capabilities does the model have for producing detailed maturity gap analyses as liquidity analysis tools?

Vendor condition, user support and references are key elements of the long-term relationship you are entering into when you purchase an ALM model. Questions to ask:
1. What is the corporate history of the vendor and its current financial situation?
2. What was the first release date of the ALM model under review? How many times has it been significantly enhanced or upgraded in the last three years?
3. How is model user support provided? At what times is phone support available, from what location(s), and what statistics describe recent support experiences?
4. Does the vendor have an ombudsman or some other method to resolve conflicts?
5. What current references can the vendor provide for institutions in my general asset size, charter and operating type demographic that use the model?

The delivery mechanics of the purchase close out the inquiry. Questions to ask:
1. What is the cost of the model, including all options and annual maintenance fees?
2. How long does a typical ALM installation take and what does the vendor do?
3. When can my ALM model’s installation be scheduled (if applicable)?
4. Does the vendor come on-site for any portion of the ALM model implementation?

Advanced Requirements
ALM models are increasingly asked to perform advanced tasks as part of expanded balance sheet management challenges. Such applications are most often driven by larger and more complex balance sheets, and often lead to more detailed views of performance and risk. In addition, regulatory mandates are increasing and adding complexity.

Advanced features in ALM models are listed below. Keep in mind that not all institutions need these features. As above, use the notes along with the Self-Evaluation Checklists (Exhibits 2 and 4) and the ALM Model Decision Matrix (Exhibit 8).

Stochastic modeling (Monte Carlo) capabilities are required when an institution needs high-precision estimates of the current and interest-rate-related value behaviors of categories with significant embedded options. Most ALM models, which use industry standard single-path, rate-dependent, present-value methodologies, cannot fully value an existing embedded option or accurately measure value changes as rates change.

While this is not always a constraint (equity-at-risk assessments do not require trading-floor levels of precision, for example), as more optionality enters balance sheets and is applied off balance sheet, this limitation may become more meaningful. Further, advanced regulatory mandates often require stochastic valuation capabilities. Questions to ask:
1. What methodologies are available to calculate stochastic present values?
2. What methodologies are available to define the implied forward yield curve? What approaches can be applied to smooth the estimated curve?

3. What models are available for producing the stochastic rate paths by scenario? Are advanced methods available? If advanced methods are proprietary, what test results are available?

4. Can rate paths be developed from random feeds and what advanced controls (e.g., the degree of lognormality or variance dampening techniques) can be applied?

5. How are option inputs and indeterminate behaviors applied to cash flows in each stochastic rate path?

6. Can custom equations (e.g., based on vendor or institution-specific analyses) be embedded for model inputs such as loan prepayments or core deposit behaviors?

7. Can interest income and interest expense be estimated in a stochastic context? How is this accomplished?

Specific rate-dependent investment cash flow data are required when complexity risk or extreme optionality is present in category balances (for example CMO’s or structured FHLB borrowings). Cash flows may be produced internally by the model, but more typically they are input from external sources. Questions to ask:

1. What capabilities does the model have to internally generate interest rate dependent cash flows for complex instruments by scenario? Does the vendor charge a separate fee for the “reverse engineering” that produces cash flows?

2. How are externally produced cash flows obtained and input into the model for complex instruments? What are the source(s) and what is the cost of such data?

3. How are underlying assumptions and outcomes (e.g., prepayment speeds and payment waterfalls) documented?

Off-balance-sheet items are increasingly used. Although many ALM models can effectively handle simple off-balance-sheet items, not all are equally capable or comprehensive. Questions to ask:

1. How are typical off-balance-sheet positions specifically defined and input?

2. How are option-related behaviors in off-balance-sheet positions defined, input and applied (if applicable)?

3. How are specialized reporting requirements (e.g. FAS 133 accounting treatments) supported in the model?

Budgeting, profitability and funds transfer pricing (FTP) are increasingly combined with traditional ALM-related activities. Some models offer advantages in interfacing with these applications. Questions to ask:

1. Are there effective ways to interface the ALM model and budgeting, profitability and FTP models? How is this done?

2. Can detailed, multicenter budgeting be efficiently done within the ALM model?

3. What integrated reporting capabilities exist among the models?

Executive information systems (EIS) are increasingly a part of institution information technology solutions. Some ALM models offer synergies with EIS. Questions to ask:

1. Can ALM model results be passed to the institution’s EIS? How is this done?

2. Do EIS and ALM models share common data inputs and category specifications?

3. Are integrated ALM and EIS reports available?
Credit risk adjustments to loan inputs in ALM models are beginning to be addressed. This is now a very advanced level of model capability but at some point in the future it will be a required function. Questions to ask:

1. Can loan inputs in the model incorporate credit quality adjustments? That is, can expected to be non-performing loans be identified and segregated?
2. What separate treatments can be applied to expected recoverable balances versus loan balances expected to be written off?

Interface with capital stress test models is necessary only where asset size requires an annual regulatory capital stress test or your institution otherwise mandates such testing. Questions to ask:

1. Can existing and new (or replacement) volumes consistent with regulatory stress test scenarios be modeled and passed to external stress test risk models?
2. Can the specific interest rates associated with annual regulatory stress test scenarios be readily

EXHIBIT 8: ALM Model Decision Matrix

<table>
<thead>
<tr>
<th>Row Number</th>
<th>Function/Feature</th>
<th>Notes on Importance</th>
<th>Importance Rank (A)</th>
<th>Model Capabilities</th>
<th>Notes on Capabilities</th>
<th>Capability Rank (B)</th>
<th>Weighted Rank (C)</th>
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Initial Cost of Model

Annual Maintenance/Other

Notes on Costs

Overall Benefit/Cost Comparison Grade

Notes to Overall Grade

Importance Rank Values (A)
4 = Must have; 3 = Very important; 2 = Like to have; 1 = Future need; 0 = Not necessary

Capability Rank Values (B)
4 = Excellent; 3 = Good; 2 = Fair; 1 = Poor; 0 = Does not have

Weighted Rank Values (C)
Calculated as Importance Rank x Capability Rank

Overall Benefit/Cost Comparison Grade
4 = Excellent; 3 = Good; 2 = Fair; 1 = Poor; 0 = Not recommended
input into the model and income-related stress tests conducted?

3. Can the model serve as a consolidator model for income-related stress test outcomes and those for other risk analyses, e.g. liquidity, credit risk, operation risk?

**Model Governance Interface**

In addition to the successful technical implementation of an ALM model, there is also the need for a surrounding model governance solution. The scope and nature of this will vary by institution, but as a general statement a simple model can be accompanied by a limited governance solution while more complex models require broader and more in-depth programs. Review models in light of the cost of developing a model governance solution (new or incrementally from your existing one) relative to the business control advantages and regulatory compliance needs associated with it.

**The model control environment** needs to assure that users complete and document key modeling steps and report production routines in each model run. User checklists and other formal recording approaches are normally employed.

Questions to ask:

1. Can model production and report generation requirements be organized into a set of key user activity steps?
2. Can the model record and save to a separate file a list of production actions taken?
3. To what extent can existing model control documents be used for the new model?

**Model documentation** needs to create a “corporate memory of model data, category set up definitions, contractual inputs, behavior assumptions and report specifications.” The scope of model documentation required will be determined by the complexity of the model implementation.

Questions to ask:

1. Can all model specifications and data be organized into a set of key topics?
2. Can the model create and save to a separate file a listing of all current specifications?
3. To what extent can existing model documentation be used for the new model?

Model related policy guidance must be comprehensive and current. While the scope and types of model related polices required will be determined by the complexity of the model implementation, even a simple model needs to be comprehensively documented.

Questions to ask:

1. To what extent can existing model-related policies be used for the new model?
2. Can the model’s application be described in the form of an “implicit user contract” between ALCO and the Board to ensure congruity of intent and action?
3. Does the model policy fit into a current IRR or ALM policy or is a separate model policy a better way to approach policy guidance?

**Final Comments on Choosing an ALM Model**

It is usually a significant and resource intensive process to properly assess ALM models based on their real value to your institution. However, the time and effort spent is well worth it. Making a correct choice ensures a solution that provides benefits for years.
In-House Model Vendors

Farin and Associates: Foresight
FIMAC Solutions LLC: FIMACMountain<sup>SM</sup> – A/L<sup>©</sup>
FIMAC Solutions LLC: Risk Analytics<sup>®</sup> ALM Model<sup>©</sup>
A. GENERAL INFORMATION

1. Vendor contact information
   Farin and Associates
   5951 McKee Road Suite 201
   Fitchburg, WI 53719
   800.236.3724
   info@farin.com
   www.farin.com

2. Describe the general nature of the current client base (charters, asset range, business models)
   FARIN ALM clients include community-based financial institutions, commercial banks, state
government economic development authorities, consultants, specialty lenders, thrifts and
credit union charters.

   Client Asset Ranges: $30 million to $10 billion

3. Number of active in-house clients
   175

4. Describe any relevant special client characteristics addressed by the model (e.g. mortgage servicing rights, loan pipeline management, indirect lending)
   The model’s capabilities include, static and dynamic modeling, budgeting, forecasting, incorporating mortgage servicing values, complex investment structures, stress testing, liquidity analysis and holding company analysis

B. MODEL USER SUPPORT PROGRAM

1. Toll-free, phone-based user support group (enter “yes” or “no”)
   Yes – 1-800-236-3724

2. Location(s) of the phone support group
   Fitchburg, WI and Seattle, WA

3. Hours during which phone support group operates
   8:00 am – 6:00 pm Central

4. Number of phone support group staff normally available
   7

5. Typical time to resolve client inquiries by phone support group
   Calls are answered as received. Resolution of the issue depends on the complexity and the
   experience of the user. Generally 5 to 10 minutes.
6. Web-based user support function (enter “yes” or “no”)
   Yes

7. If your response to question 6 is “yes”, typical time to resolve client inquiries by web-based user support function?
   Inquiries are answered as received. Resolution of the issue depends on the complexity and the experience of the user. Generally 5 to 10 minutes.

8. Other unique client support characteristics of special note (e.g. user training institute, annual user conference, local user groups)
   FARIN offers an on-line support site with FAQs, instructional videos, key assumption downloads and model upgrade links. We also provide both real-time and recorded education/support sessions for use in diagnosing common problems during off-hours.

   For complex problems, we offer remote desktop control services that will allow our support staff to take control of the user’s desktop to resolve and train on the situation or issue.

   Our user help system and knowledge base are Web-based and updated in real-time, allowing users access to the most up-to-date information and answers to issues.

   In addition to the initial user training, FARIN offers client directed, face to face training sessions.

C. MODEL INFORMATION

1. Model name
   Foresight

2. Current version number
   5.2.17.21

3. Date of last major model update
   May 2015

4. List operating system and the version employed plus any other required associated software
   Windows 7 SP 1 (or higher), x86 or x64

5. Can clients opt for a vendor-supplied outsource modeling service using the same model?
   Yes

6. What other vendor-provided financial management products directly interface with the model?
   FARIN’s iPrice Loan and LoanEDGE pricing systems share many elements. Using our export function, clients link to other programs such as cost accounting applications, management reporting systems, mortgage servicing rights, credit risk assessment systems and more.

   FARIN’s Core Analytics (non-maturity core deposit study) results are loaded directly into the model.
7. What is included in the initial vendor-provided model installation?

Model installation includes database build, creation of a customized chart of accounts with client interaction, development of row match rules, initial load of 3–6 months of data, the creation of a base plan with cash flow validations, 2½ days of new user training at FARIN’s offices or the client’s location, basic model installation with client IT staff.

FARIN can also be engaged in many different capacities, including extended IT roles, as educational specialists for the ALCO and Board, as ALCO Advisors on strategy and risk and as an outsource of model installation (SaaS).

8. Do you offer direct client support beyond initial model installation, i.e. advanced application, risk analysis consulting, or extended model implementation assistance?

Yes

D. DATA EXTRACT AND INTAKE

1. Briefly describe the model’s available intake capabilities for balance sheet information (e.g. general ledger, maturity, and re-pricing detail) from an existing data processor system

FARIN Foresight can accept many different file layouts to accomplish the task of interfacing application data to the ALM model. We look for common data on financial contracts such as maturity/repricing data, caps, repricing information, call data, etc., to accurately model the underlying cash flows of the instruments in the client’s database. If data is lacking in the underlying core system, FARIN Foresight can, with the proper information, help to create missing data from elements that are available. This flexibility helps make FARIN Foresight an efficient and accurate model to configure and maintain.

2. Briefly describe the model’s capabilities for in-taking non-contractual behavior assumptions (e.g., loan prepayment, core deposit repricing and decay, CD options)

FARIN Foresight can accept non-contractual assumptions in a variety of ways, entered by hand, downloaded from spreadsheets and inputs from third parties.

E. CHART OF ACCOUNTS

1. Identify any special features and/or limitations of the model’s ability to address the balance sheet behaviors listed below

FARIN Foresight allows an unlimited number of chart-of-account categories, nested as deep as necessary. Categories can have child categories and accounts, and those child categories can also have child categories and/or individual accounts.

Categories function like summary accounts. They will inherit many of the properties of typical accounts and some properties, like balance and budget values, will be available at the category level. Accounts holding more detailed data and modeling will be done at the account level.

Each institution’s chart maintains a list of special accounts that are used for model balancing and built-in ratios or features. These special accounts, with the exception of the balance sheet and income statement accounts, can be used by the institution as any account in the model’s chart of accounts.

- Re-pricing and maturing balances for categories without embedded options
In-House Model Vendors

No limitations in modeling the most basic of instruments. These instruments have no options, therefore they reprice as cash flows occur or as contracts allow. Data provided on repricing from core systems will drive the specific future rate.

- **Interest rate adjusted re-pricing and maturing balances for categories that have continuous and call/put embedded options**
  Continuously callable instruments can be modeled using FARIN Foresight as a repricing instrument based upon contractual provisions, with a separate final maturity date. The call function can be set to a specific strike price related to an index, curve or rates where the model will review the remaining final maturity of the instrument using current rates and determine if, based on the curve, the option has triggered a call event. Repricing, maturity and call events are separate items in FARIN Foresight and can be combined on any instrument as needed.

- **Re-pricing and maturing balances for unique categories (e.g., hybrid ARMs, teaser products, step-up/callable CD’s or FHLB advances)**
  In FARIN Foresight, existing data has its own repricing information such as next reprice date, subsequent reprice, frequency, rate index, margin and caps. This information is used on existing positions to determine rates. For planned purchases, the overall account characteristics define the basic structure and then assumptions on current rates, repricing rates, calls, etc. are handled as an assumption within the plan.

- **Re-pricing and maturing balances for indeterminate behavior categories (e.g., core deposits, lines of credit, credit card outstandings)**
  For the purposes of modeling indeterminate accounts, the client may elect to apply decay rates to create assumed “maturity structures” for valuing cash flows. However, repricing is a function that is controlled via assumptions on offer rates and will be applied to the entire balance in the period being analyzed. We have separated the assumed core deposit run-off from the projections of balance levels and allowed the user to control expected outcomes when forecasting income at risk and future balance levels.

2. Are there any limitations on automated control of pricing, re-pricing, embedded caps/floors, or teaser rates?
   No

3. Can the model effectively amortize discounts/premiums in any defined alternate interest rate scenario?
   Yes, users have the ability to define the amortization of discounts or premiums on a straight line basis, level yield basis or with the projected cash flows of the associated balances. If the institution has a specific schedule to write down, the model accepts a “cash-flow definition” for the projected write-down by rate environment.

4. Can the model effectively address unique balance sheet items (e.g. off-balance-sheet positions, mortgage servicing rights, loan pipelines, indirect lending)?
   Yes
F. PRICING, RE-PRICING, OPTION-RELATED CAPABILITIES, INTEREST RATE SCENARIOS AND MISCELLANEOUS

1. How are contractual inputs (e.g., pricing spreads, re-pricing limits) entered?
   Via data downloads, spreadsheets or manually

2. How are interest rates and driver rates input and periodically updated?
   All FARIN-supplied external rate drivers (over 150 driver rates) are updated via a Web interface by a click of the mouse. User-defined rates must be entered by client.

3. How are pricing and re-pricing relationships defined and updated?
   Pricing and repricing relationships must be handled in two discussions.

   First, for the existing contracts such as adjustable-rate loans FARIN offers two options. The data can be received on the loans during the import function or the client can use “default” data in lieu of specifics from the processor. The specifics on the loans can be imported from the core system with specific repricing information on each loan regarding the index, spread, floor, cap, ceiling rates and dates or frequency of repricing.

   As for nonmaturity accounts, and for all new balances that are booked in a forecast, the relationships on the offer rate can be set using a traditional spread/index relationship, or FARIN can apply a formula using multiple factors to calculate a rate, or a specific rate may be entered. Additionally, trends/regressions on offer rates can be built with enough historical information.

   Assumption updates are dependent upon the method in use.

4. How does the model define investments or FHLB advances with puts or calls in alternate interest rate scenarios?
   FARIN Foresight stores each investment or bond as a separate event with specifics on the put, call or comparison in that contract. These conditions are kept within the database so periodic updates can be done without having to re-enter these conditions, one simply updates the balances.

5. How does the model define re-pricing and apply decay rates (or similar inputs) to core deposits by interest rate scenario? How does the model calculate core deposit present values? Can user-defined non-interest expense inputs be accurately applied in core deposit present value calculations?
   Both pricing and decay is specified by interest rate scenario. Cash flows are generated and they are present valued back using a discount rate function. Costs can be inserted as a (negative cash flow) into the cash flows that are generated and they also will be present valued back.

6. How does the model intake and apply rate ramps (and/or rate shocks) that test for yield curve shape change basis risk?
   The model can import rate ramps or the user can define their own. FARIN also supplies external rate drivers (over 150 driver rates) are updated via a Web interface at the click of the mouse.
7. Describe the model's analysis and reporting capabilities for standard IRR tests and other forecasts.

FARIN Foresight uses standard income simulation techniques to project the amount and timing of cash flows on all instruments, replacing runoff balances with client-controlled projections for future activities. The analysis horizon can be as short as 1 month and as long as 72 months. Results can be examined under any combination of interest rate projections or forecasts over the selected horizon, and various reports showing earnings at risk levels can be run to report risk levels.

In addition to the earnings at risk, Foresight calculates value at risk using discounted cash flow analysis. This analysis can be run on current, past or projected future balance sheet positions. When running under a projected scenario, the model allows users to run a series of baseline interest rate projections that would occur during the forecast, then stresses those new rate levels to create a lattice of projected value-at-risk possibilities based upon possible interest rate movements. This process is called dynamic value at risk; it must be considered under multiple interest rate forecasts during the projection period to accurately assess all potential risks.

8. Can the model export outputs and reports to spreadsheets or other financial information reporting products?

Yes – all reports in the model can be exported to CSV files for use in any other application. In addition, reports can be directly exported individually, or as a group, to Adobe PDF format for ease of report packet production.

9. Can the model readily produce outcome analyses (e.g. back tests and retrocasts) of prior forecasts and behavior assumptions?

Yes

10. What internal liquidity analysis capabilities does the model have? Can the model interface with typical internal liquidity models and contingency funding plan spreadsheets?

FARIN Foresight contains a liquidity report that is based on the projected sources and uses of funds in a plan. This approach helps identify key assumptions in managing liquidity levels and plan for stress tests on these assumptions to understand the implications of a missed projection. This reporting can include dynamic projections of external funding sources, stress test key assumptions such as deposit run-off or prepayment speed changes. These are typical adjustments and tests found in many contingency funding plans. Of course, all outputs can be saved to formats compatible with external spreadsheets should the client prefer to use a different format or methodology.

11. Does the model have stochastic forecasting capability? If so, describe it.

Yes - The user selects the forecast and set of output parameters desired. The user may also define the number of rate paths to run. Output is saved to a CSV file to make the output file results easy to manipulate in Excel.

As a part of the Monte Carlo engine, users may elect to run forecast market value calculations at the end of the forecast to test the long-term interest rate risk in the resulting strategies. This option helps to more fully assess the trade-off between income and value at risk in the different what-if scenarios.
To calculate market rate paths, the user selects a base Yield Curve. FARIN Foresight displays the estimated historical volatility for the selected Yield Curve over the selected number of historical periods. This is purely for informational purposes to help explain how history may or may not impact future volatility. The user is asked to supply a volatility level for the curve in the analysis.

Output from the model can display any information requested in the output metrics.

12. Can custom (institution-specific) equations for loan prepayments, core deposit behaviors, and CD options be embedded in the model to drive cash flow behaviors by interest rate scenario?

Yes - FARIN Foresight has the ability to use formulas to drive future projected balances and offering rates. These assumptions can be written to adjust levels based upon many different factors, including market interest rate levels.

G. OPEN-ENDED COMMENTS

The FARIN Foresight Asset/Liability Management model is independently certified to fully and accurately perform mandated regulatory analyses and reporting of interest rate risk for both income-at-risk and value-at-risk metrics. FARIN Foresight provides industry best practice functionality for institutions that aspire to use their ALM solution for more than basic regulatory compliance—for example, as a strategic business tool to optimize net interest margin, assess risk exposure and develop appropriate contingency funding plans for various forecasted economic environments.

FARIN Foresight provides tremendous flexibility in tailoring a system to fit the client’s unique needs. An unlimited, intuitive and highly adaptive chart of accounts can be maintained, thus supporting a variety of important financial management activities such as forecasting, budgeting and regulatory analysis. FARIN Foresight’s extensive features substantially improve productivity and decision processes.

The model can be housed on FARIN’s servers (“cloud based”) making accessing the model as easy as having an internet connection. This FARIN server based option also will free up the IT department’s time from having to deal with model version updates and hardware issues.

The model allows institutions to meet specific ALCO objectives by providing:

- Income and Market Value (NEV) calculations
- Simulation of interest rate shocks, ramps and yield curve twists
- Complete, meaningful and understandable reports that are supported by thorough, in-depth analytics and communication of all risks in the ALCO process
- Cash flow projections at detailed or summary level for easy updating
- Branch or entity-level reporting for accountability and performance
- Numerous options for use of historical data in projections and reporting of financial performance trends
- Full IRR analysis supporting both current and future views of your risk position
- Comprehensive budgeting features
- Integrated liquidity analysis and testing
- Graphing capabilities to help you quickly transform outputs into actionable decisions
FARIN Foresight provides a framework to test countless interest rate scenarios and strategy combinations, showing the Institution the impact of individual components as well as the entire balance sheet and income statement. In addition to the Asset/Liability components, FARIN Foresight offers full budgeting and planning support as budgets are typically a sub-set of the income forecasts used for ALM and liquidity analysis.

FARIN is committed to ensuring that an investment in FARIN Foresight earns a real return for an institution in its compliance, knowledge and decision-making processes.

When you partner with FARIN, you benefit not only from a quality product, but also from the experience of our people. An ALM model is only as good as the company and the staff supporting the solution. FARIN has been serving the financial analysis needs of community based institutions for over 30 years. Our focus is solely on financial analysis, we are not distracted by offering a core data processing model, brokerage or investment services. This means our clients receive the highest level of service, a cutting edge product and the ability to act swiftly to changes in regulations.

FARIN staff is composed of former CEOs, ALCO members, controllers and financial analysts who understand both our products and your business. Routinely, FARIN staff is asked to lead education sessions for regulators, national industry groups such as CUNA, FMS, Graduate School of Banking in Madison, WI and Federal Home Loan Banks. In other words, FARIN understands the needs and pressures of your work life, and we are here to make certain that FARIN Foresight becomes a valuable, indispensable asset for you and your team.
A. GENERAL INFORMATION

1. Vendor contact information
   sales@fimacsolutions.com or dial 877-789-5905, Ext. 1

2. Describe the general nature of the current client base (charters, asset range, business models)
   We service banks, thrifts, and credit unions nationally and off shore clients through our Cloud based format offered by FIMACMountain\textsuperscript{SM} – A/L\textsuperscript{©} solution that is a member of our integrated suite of solutions on FIMACMountain\textsuperscript{SM}.

3. Number of active in-house clients
   Many hundreds of clients utilize FIMAC Solutions for their ALM/IRR modeling needs.

4. Describe any relevant special client characteristics addressed by the model (e.g. mortgage servicing rights, loan pipeline management, indirect lending)
   The solution has unlimited capabilities to define and manage any on or off-balance sheet account type or cash flow or notional cash flows while allocating non-interest income or expense against production volumes.

B. MODEL USER SUPPORT PROGRAM

1. Toll-free, phone-based user support group (enter “yes” or “no”)
   Yes

2. Location(s) of the phone support group
   Denver, Milwaukee and Minneapolis

3. Hours during which phone support group operates
   9:00 am to 7:00 pm Eastern time

4. Number of phone support group staff normally available
   3-5

5. Typical time to resolve client inquiries by phone support group
   Less than 1 hour

6. Web-based user support function (enter “yes” or “no”)
   Yes, through on-line model wiki and on-line user group
7. If your response to question 6 is “yes”, typical time to resolve client inquiries by web-based user support function?
   Unknown

8. Other unique client support characteristics of special note (e.g. user training institute, annual user conference, local user groups)
   Monthly educational opportunities on-line, monthly on-line webinars, user conference, specifically assigned assistance specialist, direct client visits.

C. MODEL INFORMATION

1. Model name
   FIMACMountain™ – A/L©

2. Current version number
   V1.0

3. Date of last major model update
   V1 is the current release

4. List operating system and the version employed plus any other required associated software
   Cloud based. Supports all browsers and recent browser versions.

5. Can clients opt for a vendor-supplied outsource modeling service using the same model?
   Yes

6. What other vendor-provided financial management products directly interface with the model?
   FIMACMountain™ – Fixed Income Accounting©, FIMACMountain™ – Budget©

7. What is included in the initial vendor-provided model installation?
   Cloud based, so user needs only a browser. Data requirements are delivered to client to build an extract from the core system. Initial objective and subjective data input assistance is included in cost. We will work with the client's core processor as required or necessary to build the extract if the core provider has not already built an extract for FIMACMountain – A/L.

8. Do you offer direct client support beyond initial model installation, i.e. advanced application, risk analysis consulting, or extended model implementation assistance?
   We provide whatever assistance the client may need to be successful, initially and ongoing from a model operators perspective. Support is also provided through our consultancy for any and all other ALM/IRR and related needs.

D. DATA EXTRACT AND INTAKE

1. Briefly describe the model's available intake capabilities for balance sheet information (e.g. general ledger, maturity, and re-pricing detail) from an existing data processor system
   Clients are provided a data requirements document for delivering GL, sub-ledger, income
statement, and other data as may be available for import through core or other source extracts. Our internal Data Wizard accepts properly labeled data in any format and molds to our input specifications allowing for extreme ease of initial and continuing data imports. Clients may import any data required.

2. Briefly describe the model's capabilities for in-taking non-contractual behavior assumptions (e.g., loan prepayment, core deposit repricing and decay, CD options)

Our solution allows for modeling of any asset or liability account impacted by non-contractual optionality, including off balance sheet notional balances. Optionality may be varied by scenario or rate environment by account code type at the user’s option. Once entered, assumptions remain until changed or modified.

E. CHART OF ACCOUNTS

1. Identify any special features and/or limitations of the model's ability to address the balance sheet behaviors listed below

- Re-pricing and maturing balances for categories without embedded options
  Full capabilities utilizing the capture of delivered sub-ledger detail or client entered detail, or both.

- Interest rate adjusted re-pricing and maturing balances for categories that have continuous and call/put embedded options
  The solution handles all American, Bermuda, and European option types

- Re-pricing and maturing balances for unique categories (e.g., hybrid ARMs, teaser products, step-up/callable CD’s or FHLB advances)
  Full capability and functionality through user provided optionality of non-contractual and from sub-ledger detail or CUSIP level detail (as automatically imported from independent providers as an included function of the solution).

- Re-pricing and maturing balances for indeterminate behavior categories (e.g., core deposits, lines of credit, credit card outstandings)
  User directed modeling as to balances, rates, behavioral characteristics, discount rates, decay rates, etc. User can direct maturing or new balances into any maturity, rate, or account type of their choice. Balances are not required to return to the same category.

2. Are there any limitations on automated control of pricing, re-pricing, embedded caps/floors, or teaser rates?

No. Such items are retained until changed, but may be changed or modified at any time and under any dynamic balance(s) or rate scenario(s) that may be built by a user.

3. Can the model effectively amortize discounts/premiums in any defined alternate interest rate scenario?

Not in Version 1.

4. Can the model effectively address unique balance sheet items (e.g. off-balance-sheet positions, mortgage servicing rights, loan pipelines, indirect lending)?

Yes, and with inclusion of any non-interest income or expense generated through such activities.
F. PRICING, RE-PRICING, OPTION-RELATED CAPABILITIES, INTEREST RATE SCENARIOS AND MISCELLANEOUS

1. How are contractual inputs (e.g., pricing spreads, re-pricing limits) entered?
   Limits are set by user. Pricing spreads are set initially then user defines spread variance estimates as rate environment or other influencing factors change. The same process is followed for decay and early withdrawal analysis. Any rate or balance may be modified under varying scenarios.

2. How are interest rates and driver rates input and periodically updated?
   Driver rate curves are available for selection within the solution and are updated daily or user may define their own. External rate curves may be chosen by date of the curve, including retroactive curves for back testing or other purpose. An entire set of external rates are available within the solution as updated on a daily basis. Once linked to an external rate, the linkage is retained until modified.

3. How are pricing and re-pricing relationships defined and updated?
   Pricing and re-pricing are defined by mutual agreement. Pricing may be imported or manually entered. Re-pricing is directed by the client and if applying to a new scenario of either rates or balances or both, client directs (through mutual agreement) expected re-pricing behavior for inclusion in the modeling process.

4. How does the model define investments or FHLB advances with puts or calls in alternate interest rate scenarios?
   The likely exercise or not of the option is remodeled at any new scenario or alternate rate environment as necessary.

5. How does the model define re-pricing and apply decay rates (or similar inputs) to core deposits by interest rate scenario? How does the model calculate core deposit present values? Can user-defined non-interest expense inputs be accurately applied in core deposit present value calculations?
   Repricing is any event, cash or non-cash, that triggers the necessity for price/yield adjustment. In the event of scheduled decay, the model considers it repricing and adds a new balance to the existing non-decayed balance with a new “open” date, then reapplies the decay rates to the newly constructed balance, unless otherwise directed by the user. Decay rates can be defined as narrowly or widely by time ranges as is desired by the user. Decay rates can be set to a defined change in alternative rate environment(s) or entered manually within defined scenarios at the users’ choice.

6. How does the model intake and apply rate ramps (and/or rate shocks) that test for yield curve shape change basis risk?
   Users point to, or set a base driver rate curve. They may then direct the curve into any alternative scenarios utilizing varying levels of rates, parallel or non-parallel, that they choose, be it ramp, twist, inversion, or any shape or slope desired. No limits as to minimum or maximum rates allowed within alternative rate environments modeled.
7. Describe the model's analysis and reporting capabilities for standard IRR tests and other forecasts.

A standard set of Executive reports and other standard reports set are available with Limits/Ranges included. Industry accepted Key Performance Indicators (KPI's) are embedded while the user has the capability of creating their own from hundreds of points of available data and create free-form inputs with numerators and denominators.

8. Can the model export outputs and reports to spreadsheets or other financial information reporting products?

Yes. Unlimited output of any data held, calculated, or entered including all assumptions.

9. Can the model readily produce outcome analyses (e.g. back tests and retrocasts) of prior forecasts and behavior assumptions?

Yes. It has embedded functionality allowing the user to utilize any time horizon desired.

10. What internal liquidity analysis capabilities does the model have? Can the model interface with typical internal liquidity models and contingency funding plan spreadsheets?

The model produces cash flow and repricing volumes separately under any scenario or rate environment modeled. Any results may be exported or a client generated report set developed to routinely provide any output required, including chart and graph generation on the fly or built and retained for repeat usage.

11. Does the model have stochastic forecasting capability? If so, describe it.

Monte Carlo simulation is available for those desiring such routines.

12. Can custom (institution-specific) equations for loan prepayments, core deposit behaviors, and CD options be embedded in the model to drive cash flow behaviors by interest rate scenario?

Yes

G. OPEN-ENDED COMMENTS

Cloud based FIMACMountain℠ - A/L℠ is the newest fully compliant advanced solution available today. A very powerful dynamic as to rates and balances model that is affordable and scalable from the small institution upward to the highest levels of sophisticated modeling needs. Subscribe only to those features that are right for your organization, and add or remove them at will. It unites with our Budget℠ and Fixed Income Accounting℠ solutions as yet another integrated solution in our FIMACMountain suite.

All data, source data or modeled data and results are available for export. Use only the standard output pages or design your own output, charts, and graphs with the built in graphics routine. No more exporting to a spreadsheet just to build charts and graphs on the fly. Take advantage of a large list of industry standard Key Performance Indicators as well as build your own unique KPI’s. The solution is designed to provide any measurements and analytics needed by any institution for standard ALM/IRR modeling and stress testing including liquidity modeling.

Global rates and rate curves traditionally utilized by institutions are available in the solution and are updated daily, with the ability to pick the date of choice and to look back in time to rates and rate curves chosen or for comparative analysis to allow for unparalleled back testing capabili-
ties, or simply utilize the standardized back testing built in. Model various curves for comparative results if desired. Any or varying rate lags desired for any account may be deployed under any scenario built.

FIMACMountain – A/L uses your GL account numbers and names and calculates at the instrument level from the imported sub-ledger information. Pricing and issue structure information and detail for CUSIP holdings are automatically embedded from independent nationally recognized data bases. Prepayment and other non-contractual cash flows are built and modeled in our multi-factor models. Exercise of any option, be it American, Bermuda, or European options may be calculated utilizing recognized lattice based OAS methodologies with Monte Carlo simulation also available.

Standard report sets include:

- EVE/NEV under any rate environment or balance scenario with 8 automatic levels of user defined shock from the base levels
- Forecasted NII and NI to any horizon
- Full report sets for all assumptions
- Standard and beta adjusted gap reports for cash flows only and a separate set for total repricing volumes.
- Stress test reports based on user defined settings that can be modified at any time.
- Full report sets disclosing all assumptions and rates
- Executive summary for ease of reading and understanding by all participants

General features and benefits include:

- User defined modeling. Choose your level of sophistication.
- Embedded “global” rates such as yield curves, indexes, money market rates, etc. received daily from the FRED data base maintained by the Federal Reserve Bank of St. Louis.
- Automatic CUSIP pricing and underlying terms and conditions embedded from recognized national providers.
- No mapping to another GL form. Utilizes each client’s own GL numbers and names.
- Operates and calculates utilizing specific sub-ledger data from each contract for exacting results. Stochastic or non-stochastic modeling choices.
- Choose from multiple standard OAS models for optionality determination and correct valuation.
- Standard report outputs and unlimited user defined outputs.
- Full reporting of Key Performance Indicators along with ability to design others.
- Built in graphics for creating specific user defined graphic presentations.
- All data received and modeled results are available for export. Standardized or on the fly creations are possible.
- Utilize static, growing, or shrinking balances as needed. Set any balance considerations by the month or longer.
- Future balances may be added at will to new or existing instrument types. Create new instruments.
- Ability to readily conduct stress testing from user defined scenarios, modify them, or create additional new stress scenarios.
- Shock or stress multiple yield curves for comparative analysis.
• Full disclosure of the resulting duration of all assets, liabilities, and capital to allow readers to understand the price volatility of each.
• True dynamic income simulation modeling for NII and expected cash flows.
• Easy data import utilizing our invisible data wizard. Add new account types or structures at any import.
• Capability to structure any on or off-balance sheet position and expected performance.
• A fully scalable model responding to the needs of users of all sizes and complexities with associated scaled pricing.
• Secure log-ins and security features built in. Multi-user capabilities as managed by a designated internal Administrator.
• FIMACMountain is hosted by Zoya, a managed data center and co-location for SaaS delivered solutions that comply with all federal banking laws, rules, and regulations.
• SaaS format architecture allowing for rapid response to regulatory or technological changes utilizing a relational data base separately partitioned for each user.
• Follows FIMAC Solutions’ hallmark of ease of front end operation and easy to read output.
• All commonly utilized browsers and versions are supported.
In-House Model Vendors

FIMAC Solutions LLC
www.fimacsolutions.com
Model: Risk Analytics® ALM Model®

A. GENERAL INFORMATION
1. Vendor contact information
   sales@fimacsolutions.com or dial
   877-789-5905, Ext. 1

2. Describe the general nature of the current client base (charters, asset range, business models)
   The Risk Analytics ALM Model has clients across all charter types who range in asset size from very small to multi-billion.

3. Number of active in-house clients
   Hundreds

4. Describe any relevant special client characteristics addressed by the model (e.g. mortgage servicing rights, loan pipeline management, indirect lending)
   The model has limited off balance sheet capabilities

B. MODEL USER SUPPORT PROGRAM
1. Toll-free, phone-based user support group (enter “yes” or “no”)
   Yes

2. Location(s) of the phone support group
   Denver, Milwaukee and Minneapolis

3. Hours during which phone support group operates
   9:00 am to 7:00 pm Eastern time

4. Number of phone support group staff normally available
   3-5

5. Typical time to resolve client inquiries by phone support group
   Less than 30 minutes

6. Web-based user support function (enter “yes” or “no”)
   Yes

7. If your response to question 6 is “yes”, typical time to resolve client inquiries by web-based user support function?
   Unknown as support can be “self-service” or through our Linked In user group.
8. Other unique client support characteristics of special note (e.g. user training institute, annual user conference, local user groups)

Continual on-line training/refresher classes, user conference, available webinars, and “on demand” customer support through each client’s assigned specialist.

C. MODEL INFORMATION

1. Model name
   Risk Analytics® ALM Model©

2. Current version number
   Rev 17232

3. Date of last major model update
   2007

4. List operating system and the version employed plus any other required associated software
   Windows operating system required and a current version of a commonly used web browser.

5. Can clients opt for a vendor-supplied outsource modeling service using the same model?
   Yes

6. What other vendor-provided financial management products directly interface with the model?
   Balance Sheet Manager®, Cash Sources & Uses®, and FIMACMountain® – Fixed Income Accounting®.

7. What is included in the initial vendor-provided model installation?
   We provide extract directions to the client. Upon receipt we map the data for the client into the model while working with them to determine the proper mapping. Upon completion, we then set up the model using generic assumptions and conduct a model run. The Risk Analytics model runs on our servers but is controlled by the client through our Data Capture® software that is resident on their PC.

   When the model run is complete, we then schedule training sessions utilizing the Data Capture format we created, while instructing the client on how to change and input the generic assumptions we utilized. As we have gone through the entire set-up and modeling process, the client then submits their newly recreated data set for processing. We then review the results together and again go over specific issues.

   When it is time for the next model run to be conducted, we join the model operator on the telephone to guide them through the process. In subsequent model runs, we are also available to assist upon request. We provide a very high level of customer training and support, initially and ongoing.

8. Do you offer direct client support beyond initial model installation, i.e. advanced application, risk analysis consulting, or extended model implementation assistance?
   Yes – all of the above.
D. DATA EXTRACT AND INTAKE

1. Briefly describe the model’s available intake capabilities for balance sheet information (e.g. general ledger, maturity, and re-pricing detail) from an existing data processor system

   We provide extract instructions for over 100 differing core systems or system versions. Clients deliver GL and sub-ledger data via electronic import.

2. Briefly describe the model’s capabilities for in-taking non-contractual behavior assumptions (e.g., loan prepayment, core deposit repricing and decay, CD options)

   Subjective assumption behaviors are manually entered into Data Capture by the model operator. Optionality terms are pulled from sub-ledger detail when available.

E. CHART OF ACCOUNTS

1. Identify any special features and/or limitations of the model’s ability to address the balance sheet behaviors listed below

   Answer

   • Re-pricing and maturing balances for categories without embedded options
     Risk Analytics utilizes a static balance sheet so all maturing and repricing balances are replaced at the currently defined reinvestment rate for the specified term.

   • Interest rate adjusted re-pricing and maturing balances for categories that have continuous and call/put embedded options
     Re-priced at specified rate and term as estimated by client.

   • Re-pricing and maturing balances for unique categories (e.g., hybrid ARMs, teaser products, step-up/callable CD’s or FHLB advances)
     Modeled as per sub-ledger detail or detail received from external CUSIP data bases, which is automatically provided to the user within the modeling process.

   • Re-pricing and maturing balances for indeterminate behavior categories (e.g., core deposits, lines of credit, credit card outstandings)
     Core deposits are assigned decay rates by a month or months of decay rate range as entered by the user as their defined decay ranges. Accounts can be assigned an estimated "prepayment" or attrition rate.

2. Are there any limitations on automated control of pricing, re-pricing, embedded caps/floors, or teaser rates?

   Pricing and re-pricing along with the “reinvestment” term are user defined entries. Any terms and conditions embedded in any contractual loan or deposit are taken from the sub-ledger detail and embedded in the modeling process.

3. Can the model effectively amortize discounts/premiums in any defined alternate interest rate scenario?

   No.
4. Can the model effectively address unique balance sheet items (e.g. off-balance-sheet positions, mortgage servicing rights, loan pipelines, indirect lending)?

No. User must input data to be utilized as model has no ability to model or handle off-balance sheet positions, but rather aggregates the entered net positions for modeling.

F. PRICING, RE-PRICING, OPTION-RELATED CAPABILITIES, INTEREST RATE SCENARIOS AND MISCELLANEOUS

1. How are contractual inputs (e.g., pricing spreads, re-pricing limits) entered?

The model does not utilize spreads, but rather a percentage movement estimate. Re-pricing limits are set by entering implied floors and ceilings.

2. How are interest rates and driver rates input and periodically updated?

The default driver rate curve is the UST curve and is embedded within the software as updated each month end. Also a large supply of various “Global” rates and Indexes are embedded. The user simply points accounts to those utilizing any of the Global rates and they are then automatically updated at each model run. They can be assigned a spread to a Global rate or create their own user defined rate index.

3. How are pricing and re-pricing relationships defined and updated?

Updates are through operator update in Data Capture by manual entry. Pricing and re-pricing are hard point entries by account code type. Operator must distinguish between repricing rates and rates utilized for NEV/EVE discounting.

4. How does the model define investments or FHLB advances with puts or calls in alternate interest rate scenarios?

Model does not conduct alternate rate scenarios other than the standard immediate and parallel rate shocks. In those instances pricing and optionality are embedded from CUSIP driven deal specific data and pricing acquired from embedded data libraries from recognized national providers. Expected cash flows are recalculated at the level of shock.

5. How does the model define re-pricing and apply decay rates (or similar inputs) to core deposits by interest rate scenario? How does the model calculate core deposit present values? Can user-defined non-interest expense inputs be accurately applied in core deposit present value calculations?

Decay rates are not modified at each rate shock, but can be changed at any time. Core deposit values are determined by utilizing the assigned decay curve discounted by an external replacement cost rate available to the client. The model does not handle associated non-interest expense or income by volume. Non-interest expense or income is a manually entered value.

6. How does the model intake and apply rate ramps (and/or rate shocks) that test for yield curve shape change basis risk?

The model conducts immediate and parallel rate shocks utilizing a static balance sheet. Rates shocks upward and downward may be selected up to 400 bps either direction.

7. Describe the model's analysis and reporting capabilities for standard IRR tests and other forecasts).

The model produces expected NII, NI, and NEV/EVE under all scenarios described in #6 above.
8. Can the model export outputs and reports to spreadsheets or other financial information reporting products?

No, although some data can be exported to the client upon request as pulled from our processing servers.

9. Can the model readily produce outcome analyses (e.g. back tests and retrocasts) of prior forecasts and behavior assumptions?

Those reports are included in the model output and can be set to a look back period defined by the user.

10. What internal liquidity analysis capabilities does the model have? Can the model interface with typical internal liquidity models and contingency funding plan spreadsheets?

No interfaces or exports. The model produces basic liquidity ratios and 4 sets of repricing volume Gap reports.

11. Does the model have stochastic forecasting capability? If so, describe it.

No.

12. Can custom (institution-specific) equations for loan prepayments, core deposit behaviors, and CD options be embedded in the model to drive cash flow behaviors by interest rate scenario?

Such can be embedded, with rate scenarios limited to those previously described.

G. OPEN-ENDED COMMENTS

The Risk Analytics model is a well proven, time tested, and audited deterministic model that is suitable for use by those institutions with non-complex balance sheets that do not require advance modeling and statistical techniques. Users that require advanced modeling should investigate our FIMACMountaingSM – A/L© solution.

The Balance Sheet Manager (BSM) module, at an additional cost, does allow the user to conduct dynamic rate and balance analytics after each Risk Analytics model run. BSM is a client PC based module that utilizes the modeled data from Risk Analytics as its base, and then allows a user to conduct “what-if” scenarios from that beginning set of results. Once a scenario is modeled, report sets can be generated and viewed on screen or printed. BSM is very graphically oriented for quick view and understanding of results and generally provides scenario results in less than 2 minutes.

The Risk Analytics model automatically delivers Variance and Back Testing Reports with the user defining or redefining the Back Test period. The Variance Report discloses balance and rate variances to those rates and balances utilized within the previous model run. Also available at additional cost is Cash Sources and Uses, a cash flow liquidity tool that allows for variances as to projections and scenarios. This tool can be utilized to conduct liquidity stress testing and to model expected Liquidity Contingency funding balances under multi-scenarios.
Choosing the Right ALM Modeling Solution: In-House and Outsourced Solutions and Risk Assessments

When is an Outsourced IRR Analysis the Right Solution

As noted in Part 1, financial institutions hold balance sheets that are diverse collections of financial instruments. Many distinct asset and liability categories, with multiple re-pricing and maturity specifications, varying driver rates, betas, re-pricing limits and embedded options, are normally represented. Because of the diversity of contributing behaviors, projecting the performance, earnings at risk and equity at risk outcomes for such balance sheets requires the use of an ALM simulation model.

However, an in-house ALM modeling solution, and its associated IRR analysis capability, have high costs that bear heavily on their benefits. As a result, many institutions choose to forego some benefits of an in-house ALM modeling solution (such as full control of analysis activities and an as-needed simulation capability) by outsourcing IRR analyses, the keystone regulatory and business output of any ALM modeling solution.

Outsourced ALM models used in IRR analysis applications usually have a notable cost advantage over in-house ALM models because the initial expense of the model, its support systems and staff can be allocated across a wide user base. A motivator of the recent increased popularity of Outsourced IRR analysis solutions is the desire to reduce costs in an adverse economic climate.

Outsourcing is most effective when IRR analyses are routine and require little manual customization. This is why out-source services typically run standard regulatory reports rather than business plans. In addition, outsourcing makes the most sense when model applications are simple and do not require significant interaction between the outsource provider and the institution.

When considering an Outsourced IRR analysis solution, first look at the provider’s qualifications and then at the ALM model being employed. The same criteria used for an in-house ALM model should be used in reviewing an Outsourced one. (See Part 1)

The Magnitude and Sources of the Institutions’s IRR

Whether an Outsourced IRR analysis solution is appropriate varies from institution to institution. Below are elements to consider in a potential outsourcing decision.

The most obvious constraint on outsourcing IRR analyses is balance sheet complexity. Outsourced IRR analysis solutions have made great strides recently in producing more custom and granular IRR analyses. However, if an institution has a complex balance sheet, with many structured products, extensive holdings of categories with embedded options, or unusual business lines, an in-house solution is usually required to properly analyze and forecast all behaviors. Note that balance sheet size is normally an independent influence here. A large but non-complex balance sheet can be a candidate for using Outsourced IRR analyses.

Baseline Earnings and Other Risk Positions

A higher level of dependable baseline earnings and no undue exposures to capital, credit, liquidity, or other risk positions is often a sign that an IRR analyses produced by an outsourced provider may be appropriate. The reason is that a less hands-on third party IRR analysis solution is adequate if a greater earnings cushion and fewer risks are present.
Cost and Staffing Considerations
An in-house ALM model requires a budget commitment for its initial cost and ongoing annual maintenance. The initial cost is normally significant and maintenance can be expensive. Outsourced IRR analysis solutions spread the cost of the ALM model and its maintenance across a user base, reducing the contribution from each institution.

While a degree of new indirect costs are incurred when outsourcing, namely more time spent coordinating analysis production and ensuring IRR forecast accuracy, these rarely offset the reduction in direct costs enjoyed.

Invoking Comparative Advantage
Many institutions that could maintain an in-house ALM model and conduct their own IRR analyses have decided to outsource the function. An advantage of doing so is that financial staff formerly assigned to the modeling area can be productively employed in other tasks. This recognizes and uses the institution’s comparative advantage in using staff expertise in institution-specific activities.

Regulatory Mandate for a Quickly Implemented IRR Analysis Solution
Implementing an in-house IRR analysis solution takes time. Frequently, however, there are instances where it is not feasible to obtain in-house produced IRR analyses quickly enough to meet regulatory requirements. In such a case, Outsourced IRR analyses are the answer. After immediate needs are met, the decision to bring IRR assessments in-house or keep it in an outsource mode can be made in a more thorough manner.

Institution Culture and IRR Analysis
Institution culture can influence whether the optimal degree of commitment to IRR analysis is in-house or Outsourced. Where upper management and the Board understand, trust and aggressively use ALM model outputs as a basis for financial decision making, IRR analyses should normally be more advanced and an in-house solution is favored. Where IRR analysis is viewed as primarily a regulatory mandate without significant business value, a less robust (but lower cost) Outsourced IRR analysis solution is likely adequate.

Model Governance Interface
Surrounding model governance is required when IRR analyses are Outsourced, just as with an in-house ALM model. The scope and nature of the solution again vary by institution; a simple model can be accompanied by a limited governance solution, while more complex situations require broader and more in-depth programs. Either way, it is important that your chosen IRR analysis solution can be supported by an adequate internally developed model governance solution, including a control environment, model documentation and appropriate policy guidance.

Final Comments on Outsourced IRR Analysis Solutions
In summary, the less IRR exposure an institution has, and the simpler and less diverse its sources of IRR, the better an Outsourced IRR analysis fits. In addition, the greater the need to reduce budget costs and headcount and the less regulators are pressing for an in-house ALM model, the more likely an institution is a candidate for outsourcing.

Finally, an institutional management culture that views IRR analysis as primarily a regulatory compliance task, the better the outsource fit because of reduced expectations. Take a close look at your institution’s overall culture and Board situation, and decide.
Choosing an IRR analysis outsource provider has some of the same quantitative elements of an in-house ALM model choice. But it normally also involves a more qualitative choice methodology. A service (i.e. IRR analysis) is being purchased and provided. The quality dimensions of both the ALM model supporting the IRR analyses and the relationship behind the out-source service are key factors.

It is best to establish the general level of IRR analysis required first, and then choose a specific service provider.

Establishing the Level of IRR Analysis Required

The benefits of an Outsourced IRR analysis solution arise from its ability to quantify existing balance sheet holdings and forecast embedded earnings at risk and equity at risk positions. The key is to ensure that the level of Outsourced IRR analysis produced meets the institution’s specific balance sheet complexity and regulatory mandates. A number of factors define the innate level of IRR analysis needed from Outsourced IRR analyses:

**Degree of capital leverage** is a key determinant of IRR analysis needs. A lower capital-to-assets ratio puts a premium on accurately assessing and controlling risk. IRR analyses will need to provide more detailed and more precise insights if a lower capital position is present because more accurate projections of potential outcomes are needed.

**Net interest income** (NII: interest income less interest expense) is another crucial determinant of IRR analysis need. Where NII is limited, there is less of a cushion to interest rate related changes in earnings. More precise understanding and control of balance sheet outcomes thus become more vital, increasing IRR analysis needs.

**Degree and nature of IRR** is a strong influence on the analytical level needed from IRR analysis. The mandate to precisely quantify and monitor interest rate related earnings and equity sensitivities increases with greater levels of IRR and when more (and more complex) IRR sources are present in the balance sheet.

**Regulatory requirements** are a defining element in determining the required level of IRR analysis. Generally, examiners look for IRR analyses that are appropriate in light of the institution’s balance sheet size and complexity, current IRR position, other risk exposures, and general financial management style. There is a definitive floor here, however: Any Outsourced IRR analysis solution chosen must meet regulatory needs.

**Your institution’s ALM-related culture** is also an influence on the level of required IRR analysis. Where upper management and the Board understand and trust ALM model outputs as a basis for financial decision-making, IRR analyses must be more advanced. Where IRR analysis is viewed as a regulatory mandate without significant business value, IRR analysis can be more generic and less timely.

The general guiding principle that can be drawn from the discussion above is that an Outsourced IRR analysis solution needs to be more precise when risk exposures or special needs are greater.
Needs from an Outsourced IRR analysis provider start high and rise quickly as basic regulatory mandates must be met first. Needs increase more slowly as the model addresses less vital needs. Eventually, the model’s incremental IRR analysis contributions are exhausted and the benefits curve flattens.

IRR analysis needs are rarely quantifiable. But the factors above can be combined with balance sheet information to obtain a sense of general IRR analysis needs. Self-grade your institution’s situation and establish a general (e.g. “low” versus “high”) need level.

At this point, let us assume that the general level of Outsourced IRR analysis needed for by your institution is established. Below is a framework guiding the next step - how to choose the right Outsourced IRR analysis solution provider.

**Choosing the Right Outsourced IRR Analysis Provider**

The first cut that IRR analysis outsource providers have to make is that their analytical capabilities meet your institution’s needs. That is, to be successful, an Outsourced IRR analysis solution must be able to define and forecast your balance sheet’s complete set of potential IRR related behaviors. This requires that for every asset and liability category, in every time period, and in every interest rate scenario, the outsource provider’s ALM model must be able to accurately define cash flow characteristics from underlying data, apply contractual inputs and behavior assumptions, and forecast IRR outcomes correctly.

Major elements to consider in your review of each provider’s capabilities follow.

**Re-pricing mismatch** is caused by all elements of the balance sheet due to the varying physical re-pricing opportunities present across categories. Re-pricing balances are input into an ALM model through its detailed downloads of maturity and re-pricing information from your institution’s underlying systems. Verify that these downloads can be readily done in the Outsourced environment and that data capabilities include the ability to assign specific rates, caps and floors, etc., to all re-pricing balances. Also review how pricing is assigned for existing balances and how new balances entering future balance sheets can be defined. Manual data input and adjustments should be minimal.

**Maturity mismatch** is caused by all elements of the balance sheet due to the varying physical maturity points present across categories. These attributes are input into an ALM model through its detailed downloads of maturity information from your institution’s underlying systems. Verify that these downloads can also be easily done in the outsource environment. It should be easy to assign amortization, option-related behaviors, decay, etc., to all balances. Again, verify that manual data input is minimal.

**Amount of re-pricing** for a given general interest rate change depends on each specific asset or liability category’s driver rate (the financial market rate that re-pricing is tied to), beta relationship (specified re-pricing that occurs for any given change in the driver rate) and any re-pricing lags (how fast re-pricing occurs) specified. Review how the outsource provider’s ALM model handles these behavior elements. Also, establish how categories with administered re-pricing, such as core deposits, are treated. Finally, confirm whether temporary teaser rates can be properly defined for IRR purposes.

**Embedded options** on both sides of the balance sheet are significant IRR sources. They create cash flow changes unique to specific interest rate scenarios and require special capabilities from Outsourced IRR analysis providers.

Continuous option IRR influences (behaviors that take place over time in portfolios of financial instruments) derive from ongoing loan prepayments, most notably 1–4 family mortgages, mortgage-backed securities (MBS’s) and other mortgage-related categories. Consumer and commercial loans
often also have prepayments. Decay (runoff) from existing core deposit balances and CD early withdrawals are liability side examples.

Many continuous options are non-contractual in nature (e.g. core deposit decay rates) or indirectly tied to their exercise through not always optimizing retail holders. The result is that existing contracts, other than national pool MBS investments, often foretell very little about how the options will behave. As a result, behavior assumptions depicting institution specific behaviors must be externally defined (based directly on institution history or that of a closely defined peer group). This is normally the institution’s responsibility.

The ALM model utilized to analyze IRR must have the capability of accepting category level, quantified behavior inputs for all relevant loan and deposit categories. Best practice solutions support inputs that are granular (by category), reset to new levels as interest rates evolve over time, and incorporate unique behaviors in each interest rate scenario. Thus, establish how outsource IRR analysis providers accommodate each type of behavior assumption relative to best practices. Providers of Outsourced IRR analyses must permit control of these inputs by individual users, as the behaviors defined are intensely institution specific.

Caps and floors are a further source of continuous option IRR influence. Re-pricing limits (e.g., caps and floors) on existing balances normally come directly from system downloads, but be sure to verify this. Also, determine how new volume re-pricing limits are input.

Switch option IRR influences (behaviors that change at a specific time and interest rate level for unique financial instruments) are often encountered in the investment portfolio in the form of calls or puts on holdings. On the funding side, convertible FHLB advances are a common example. Likewise, CDs may include embedded options such as “bump-up” features. Determine what the Outsourced IRR analysis provider’s capabilities are in these areas.

Complexity risk (option-related risk magnified by derivative structures) is found in collateralized mortgage obligations (CMO’s) and other structured investments and in some specialized business lines (e.g., mortgage pipelines or MSR’s). Complexity risk is difficult to model correctly in IRR analyses without importing instrument level, scenario specific cash flows because behaviors are specific to individual instruments and vary uniquely in each interest rate path examined. Inquire how cash flows for such instruments are obtained and modeled in Outsourced IRR analyses.

Off-balance-sheet positions (when present) are normally within the capabilities of Outsourced IRR analysis providers. However, these positions can be complex enough to require the intake of specific cash flows or specialized advanced modeling. Review your institution’s off-balance-sheet holdings and investigate whether the provider has the IRR analysis capabilities that meet special needs.

Meeting Your Institution’s Needs
The second cut that IRR analysis outsource providers have to make is that their IRR tests, program mechanics, cost, and general quality criteria meet your institution’s needs. Consider here the following areas for inquiry.

**IRR analysis testing dimensions** are essential. Determine what IRR test scenarios are available to the model (e.g. regulatory oriented rate shocks and linear rate ramps). Also, check whether non-linear rate tests that assess basis risk and specific yield curve shape changes are available. Establish the source of those scenarios and inquire if externally supplied non-linear IRR tests can be entered. Regulatory mandates now require more than just rate shock assessments, so be sure to establish these capabilities.
In equity-at-risk tests, review the methodology used to calculate present values, including how discount rates are established. A key issue relating to core deposits is whether non-interest expense inputs can be incorporated (best practice valuations can include this).

Stochastic valuation applications rarely add significant incremental equity at risk IRR analysis accuracy. However, they do assess option values more precisely, especially in complex instruments. Inquire as to the Outsourced IRR analysis provider’s capabilities in this area if it is relevant.

Supporting model governance
Ensure that the Outsourced IRR analysis solution can be supported by your internal model governance solution. This includes formal control environments for the provider and the institution, adequate model documentation and appropriate policy guidance.

IRR analysis program mechanics are the day-to-day details that are important in the often long-term relationship represented by an Outsourced IRR analysis service. These elements must be specifically and fully evaluated:

- Has the underlying ALM model used been independently certified by a third party
- How do you intake balance sheet data, contractual inputs, and behavior assumptions to the IRR outsourcing solution provider?
- At what point and by who is the “run-ready” IRR model approved?
- How fast are IRR analyses provided after the final model is approved?
- How are completed IRR reports sent back to the institution?
- Who is responsible for IRR position quality assurance?
- If needed, how are reruns of a period’s report handled?
- Are their written guidelines for service users and provider staff?
- What level of model documentation is maintained and available to clients?
- How are disputes between provider and clients remediated?

Service cost, vendor condition, and current user references are obviously key areas to review. The cost of Outsourced IRR analysis is determined in competitive markets. Thus, you get what you pay for! Institutions with less complex balance sheets and less innate IRR, and with otherwise favorable conditions as outlined above, can obtain lower cost basis level analyses. For institutions in alternate circumstances, higher level (and more costly) services will be required.

At a general level, determine the business history and financial condition of the provider, number of current active clients, the history of recent deliverable enhancements, and the number (and location) of support staff available. Also, ascertain whether clients similar to your institution in terms of asset size, charter type and operating characteristics use the Outsourced IRR analysis provider under review. Specific client references are valuable — inquire about program mechanics, delivery time, and report quality in particular.

Final Comments on Choosing an Outsourced IRR Analysis Provider
The last hurdle that an IRR analysis outsource provider has to clear is that the business relationship being entered into fits your institution’s risk and performance management culture. Technical quality of the IRR analyses delivered will be a foregone conclusion after the due diligence above but the chemistry must be present as well.
So think about how closely the outsource service meshes with your institution’s risk management process.

- Are IRR reports and analyses available in time for the requisite Board meeting?
- Do IRR presentations meet the communication needs of ALCO and your Board?
- Are consultative IRR interpretation and education solutions available?
- Do you and your staff work well with the provider’s staff?

The factors noted are obviously not purely quantitative in nature. But, as noted, an Outsourced IRR analysis solution is a service and qualitative elements do matter. In fact, the provider-client relationship will be a key success factor in the long term.
Outsource Model Providers

ALM First Financial Advisors, LLC
Austin Associates, LLC
Darling Consulting Group
Farin and Associates
Financial Institutions Management Associates Corp: FIMACMountainSM–A/L®
Financial Institutions Management Associates Corp: Risk Analytics® ALM Model®
FinPro, Inc.
Mark H. Smith, Inc.
McQueen Financial Advisors, Inc.
R2Metrics
Velligan-Blaxall Consultants, LLC
A. GENERAL INFORMATION

1. Vendor contact information

   ALM First Financial Advisors, LLC
   2911 Turtle Creek Blvd., Ste. 500
   Dallas, Texas 75219
   800.752.4628
   info@almfirst.com
   www.almfirst.com

2. Describe the general nature of the current client base (charters, asset range, business models)

   Client charters include:
   - Federal Savings Bank
   - Federal Savings Association
   - National Bank
   - Savings Bank
   - Credit Union

   Assets range from $39M - $55B with the majority between $150M - $5B

3. Number of active outsource clients

   ALM First currently serves more than 180 outsourced ALM model clients

4. Describe any relevant special client characteristics addressed by the model (e.g. mortgage servicing rights, loan pipeline management, indirect lending)

   The report presents results and assumptions for a net interest income (NII) simulation, an economic value NEV/EVE analysis, and a behavioral gap analysis, along with narratives that describe changes from previous analyses. Depending on the client contract, the report will include strategic advice for the balance sheet and/or investment portfolio. We also perform mortgage servicing rights analysis and incorporate results in the model.

B. MODEL USER SUPPORT PROGRAM

1. Toll-free, phone-based user support group (enter “yes” or “no”)

   Yes

2. Location(s) of the phone support group

   Dallas

3. Hours during which phone support group operates

   8:00 AM – 5:00 PM CT, although employees consistently make themselves available outside of normal business hours
4. Number of phone support group staff normally available
   15

5. Typical time to resolve client inquiries by phone support group
   ALM First strives to respond to client inquiries within a few hours; however, it depends upon the
   issue at hand.

6. Web-based user support function (enter “yes” or “no”)
   Yes

7. If your response to question 6 is “yes”, typical time to resolve client inquiries by web-based
   user support function?
   ALM First strives to respond to client inquiries within a few hours; however, it depends upon the
   issue at hand.

8. Other unique client support characteristics of special note (e.g. user training institute,
   annual user conference, local user groups)
   ALM First personnel are available via corporate phones, web-based email, and VPN that allows
   them to connect to the ALM First network from any location.

C. MODEL(S) USED IN OUTSOURCE ENGAGEMENT

1. Model(s) name(s)
   ZMdesk 4.3
   Fiserv AL 3.4
   Proprietary on-line what-if tool, ALM First On-Demand

2. Current version(s) number(s)
   ZMdesk 4.3
   Fiserv AL 3.4

3. Date(s) of last major model update(s)
   ZMdesk 4.3 – 9/30/15
   Fiserv AL 3.4 – 3/31/13

4. Do you also offer the model(s) as an in-house solution?
   ALM First consults with institutions that are looking at setting up these models in house.

5. What other vendor-provided financial management products directly interface with the model?
   • IRR analyses
   • What-if analyses
   • MSR valuations
   • Liquidity analyses
   • Investment portfolio analyses
   • CECL analyses
   • Merger valuations
   • Hedging with derivatives analyses
   • Mortgage pipeline hedging analyses
D. MECHANICS OF OUTSOURCE RELATIONSHIP

1. How are balance sheet data (G/L, maturity, repricing, and contractual options) and behavior assumptions (loan prepayments, core deposit behaviors, and CD options) transferred to you?

Clients upload balance sheet data to data rooms on ALM First’s secure website.

2. At what point and by whom is the “run-ready” IRR model approved?

Financial analysts perform and complete all quality control procedures prior to submitting the model to the Senior Analyst for the first round of reviews. The final model and output review is completed by the Director of Advisory Services.

3. How fast are IRR analyses provided to the client after the final data is approved?

After final data is approved, the turnaround time for an IRR analyses is approximately 4 weeks, depending on the responsiveness of the client. For subsequent analyses, ALM First’s internal metric is to produce the report within 10 business days.

4. How are completed IRR reports sent back to the institutions (e.g. Word, Excel, pdf)?

ALM First posts the reports in Portable Document Format on its secure website, and is also able to provide data via Excel or other specified formats.

5. Describe the format and content of your standard IRR client report.

- Balance Sheet Assessment
  - Overview and Trend Analysis
  - Change from Previous Analysis
  - Portfolio Overview
  - Economic Analysis
  - Balance Sheet Strategy
- Asset Liability Management Analytics
  - Report Overview
  - Balance Sheet Composition
  - Economic Value (NEV/EVE) Shocks & Comparisons
  - Net Interest Income (NII) Projections & Comparisons
  - Behavioral Gap
  - Model Sources and Assumptions
- Economic Review & Outlook
- Investment Analytics
- Methodologies & Assumptions

6. Who is responsible for IRR analysis quality assurance?

At least 4 staff members will contribute to the report. This includes a Director of Balance Sheet Management, Managing Director of Development & Analytics, an Analyst, and team members of theirs. The final quality assurance review will be completed by the Managing Director of Analytics & Development.
7. If needed, how are reruns of a period’s IRR analysis handled?

The Director of Advisory Services and the client will determine a mutually acceptable timeline in which a revised analysis that satisfies the re-run criteria will be provided.

8. Are there written operating guidelines for clients and vendor staff?

Yes

9. How are client questions or disputes remediated?

ALM First staff members that receive verbal or written client complaints forward the complaint to the ALM First Partners. If appropriate, the Partner will call the client directly as soon as possible or send an email within 10 business days acknowledging receipt of the complaint, indicating the matter is under review. The Partner will forward the complaint letter to the appropriate person(s) for research, review, and information needed in order to respond to the client.

E. CHART OF ACCOUNTS

1. Identify any special features and/or limitations of the model’s ability to address the balance sheet behaviors listed below

   • Limitations to the number of accounts/categories that can be modeled
     No limitations

   • Detailed re-pricing and maturing balances for categories without embedded options
     No limitations

   • Interest rate adjusted re-pricing and maturing balances for categories that have continuous and call/put embedded options
     No limitations

   • Re-pricing and maturing balances for unique categories (e.g., hybrid ARMs, teaser products, step-up/callable CD’s or FHLB advances)
     No limitations

   • Re-pricing and maturing balances for indeterminate behavior categories (e.g., core deposits, lines of credit, credit card outstandings)
     No limitations

2. Are there any limitations on automated control of pricing, re-pricing, embedded caps/floors, or teaser rates?

   No

3. Can the model effectively amortize discounts/premiums in any defined alternate interest rate scenario?

   Yes

4. Can the model effectively address unique balance sheet items (e.g. off-balance-sheet positions, mortgage servicing rights, loan pipelines, indirect lending)?

   Yes
F. PRICING, RE-PRICING, OPTION-RELATED CAPABILITIES, INTEREST RATE SCENARIOS AND MISCELLANEOUS

1. Who defines contractual inputs (e.g., pricing spreads, re-pricing limits)?
   Contractual data defines proper inputs. In the event of missing data, ALM First vets assumptions with client management.

2. How does the model obtain information on investments or FHLB advances with puts or calls in alternate interest rate scenarios?
   ALM First employs an Option-Adjusted Spread model such that the model employs the OAS in the base interest rate environment in the alternate scenarios.

3. Who defines re-pricing and decay rates (or similar inputs) to core deposits by interest rate scenario? Are there any limits on specifying assumptions (e.g. repricing lags, scenario specific decay rates)?
   Re-pricing and decay rates are based on a multivariable regression analysis over a statistically relevant time series and coupled with qualitative overlays centered on management guidance and market mechanisms. There are no limitations for specifying assumptions.

4. How does the model calculate core deposit present values? Can user-defined non-interest expense inputs be accurately applied in core deposit present value calculations?
   Yes.

   Calculating the fair value of non-maturity deposits requires that assumptions be made for the following attributes of the deposits: principal cash flows, servicing costs, sensitivity of the account rate to market rates, and discount rates with accounts stratified by product type, retail/commercial, and tier.

   ALM First accounts for principal cash flows by estimating an effective maturity and applying a decay rate. An effective maturity is estimated by performing a regression analysis on the spread between the account rate and the effective Fed funds rate versus the average customer account balance. The resulting R-squared value provides a measure of how well changes in average balances are explained by changes in the spread of the dividend rate to the effective fed funds rate.

   ALM First then determines an effective final maturity for the deposit account using the assumption that the maximum effective maturity for any non-maturity deposit is 10 years based largely on core deposit intangible amortization schedules observed in deposit franchise acquisitions. With this assumption in place, ALM First ascertains an effective maturity using an inverse linear relationship to the R-squared value. The effective final maturity indicates when the last cash flow for an account is projected to occur. However, the decay rate may result in a shorter effective final maturity.

   In the absence of an institution-specific study, decay rates, which represent the annual percentage decline in balances given a change in market rates, are ALM First’s own estimates for each account type since there is currently no established industry standard for decay rates in deposit accounts. ALM First applies figures that are based on independent observation and analysis of financial depository data. Generally, decay rates increase in higher market rate scenarios due to the increased likelihood of balance withdrawals as customers seek higher yields in alternative products. ALM First’s valuation model for non-maturity deposits includes non-interest cost, unless otherwise directed by the institution. Surge balances are also incorporated into the analysis largely
influenced by statistical measures and qualitative factors based on management guidance.

Typically, institutions pay a relatively low dividend rate for core deposit accounts (relative to certificates, for example). However, this does not necessarily encompass the total financing cost. For instance, an institution may pay a 0% interest rate for a checking account, but it may incur non-interest costs such as dedicated staffing, overtime, rent for convenient locations, ATMs, marketing, origination, and servicing costs, etc. These costs add up to some percentage of the outstanding balance in the checking account on an annual basis.

On the other hand, the institution may also have fee income from the checking account, which may fully or partially offset the service cost. ALM First employs non-interest costs that are based on historically reported values published by the former Office of Thrift Supervision for each account type.

Not all institutions choose to include non-interest cost due to the difficulty in obtaining accurate cost figures and to maintain consistency with other balance sheet items, such as certificates of deposit and some assets. However, ALM First recognizes that, though an exact cost is difficult to obtain, the cost is certainly greater than zero, and that including a cost errs on the side of conservatism.

ALM First discounts non-maturity deposits using FHLB fixed-rate term advances corresponding to the institution’s FHLB region as a proxy for funding costs.

Sensitivity of the account rate to market rates is estimated by performing a regression on the account rate versus the effective Fed funds rate. The resulting beta coefficient provides a measure of how sensitive the institution is to changing their dividend rates due to changes in market rates. In an effort to remain conservative, ALM First floors beta coefficients at 0.15 for regular shares, 0.10 for interest-bearing share drafts, and 0.25 for money market accounts.

This sensitivity is used in the base-case valuation to project the dividend rate according to 1-mo OIS implied forward rates. For the first month of the projected cash flow stream, the dividend rate plus non-interest cost equals the total cost of the account; however, beginning in the second month the coefficient multiplied by the change from the one to two month implied forward rates is added to dividend rate and non-interest cost for the total cost. The 1-mo LIBOR implied forward curve is bootstrapped using ZMFS’ interest rate model.

Prices for deposits are calculated in the interest rate scenarios in the same way that the base price is calculated except that the decay rates vary by interest rate environment and the coefficient determines the beginning dividend rate. For example, if a regular share account dividend rate pays 50 basis points in the base case and the calculated beta coefficient is 25 basis points then the beginning dividend rate before non-interest cost for the account would be 75 basis points in the up 100 scenario.

5. What standard IRR tests are provided? Can (and how) does the model define rate ramps (and/or rate shocks) that test for yield curve shape change basis risk?

Currently, down 300 through up 500 instantaneous, parallel, and sustained rate shocks, as well as rates ramped up and down 300 basis points with rates floored at 0. Additional non-parallel rate shocks are provided based on current yield curve shape and macroeconomic climate.
6. Describe the model’s analysis and reporting capabilities for standard IRR tests and other forecasts.

The model is industry-recognized, and ALM First dedicates a significant amount of resources to assumption development and maintenance. Please see sample reports.

7. Can the model export IRR inputs and outputs and report to spreadsheets or other financial information reporting products?

Yes

8. Can the model readily produce outcome analyses (e.g. back tests and retrocasts) of prior forecasts and behavior assumptions?

Yes

9. What internal liquidity analysis capabilities does the model have? Can the model interface with typical internal liquidity models and contingency funding plan spreadsheets?

Yes. The model can produce detailed cash flow information such as sources and uses of funds.

10. Does the model have stochastic forecasting capability? If so, describe it.

Yes, ALM First employs a short-rate model that is a modified version of Black, Derman, Toy term structure which allows for mean reversion. Monte Carlo simulation is based on ATM swap option volatility that can be manually calibrated for skew.

11. Can custom (institution-specific) equations for loan prepayments, core deposit behaviors, and CD options be embedded in the model to drive cash flow behaviors by interest rate scenario?

Yes

G. OPEN-ENDED COMMENTS

ALM First is a leading, trusted strategic partner for financial advisory services. Our expertise in asset liability management and investment portfolio management allows us to deliver deeper insights into your balance sheet and employ that knowledge to strengthen the financial performance of your institution.

As an SEC-registered investment advisor (not a broker/dealer), ALM First acts as an unbiased third party, offering commission-free, fee-based services.

- One of the nation’s leading financial advisory firms
- More than 200 clients representing over $220 billion in assets
- Approximately $18 billion in investments under management
- Comprehensive analytical software and risk reporting
- Access to the world’s largest brokerage firms
A. GENERAL INFORMATION
1. Vendor contact information
   Tom Hauck, Managing Director & Principal
   Austin Associates, LLC
   7205 West Central Avenue
   Toledo, OH 43617
   419-517-1770
   thauck@austinassociates.com
   www.austinassociates.com

2. Describe the general nature of the current client base (charters, asset range, business models)
   Clients include community banks, thrift and credit unions with assets ranging from $31 million to $2.2 billion.

3. Number of active outsource clients
   61

4. Describe any relevant special client characteristics addressed by the model (e.g. mortgage servicing rights, loan pipeline management, indirect lending)
   N.A.

B. MODEL USER SUPPORT PROGRAM
1. Toll-free, phone-based user support group (enter “yes” or “no”)
   No. Each consultant and support staff has a direct phone line.

2. Location(s) of the phone support group
   Toledo, OH

3. Hours during which phone support group operates
   Monday through Friday
   8:00 am to 5:00 pm Eastern Time

4. Number of phone support group staff normally available
   8

5. Typical time to resolve client inquiries by phone support group
   Within 24 hours and typically the same day as the inquiry.

6. Web-based user support function (enter “yes” or “no”)
   No.
7. If your response to question 6 is “yes”, typical time to resolve client inquiries by web-based user support function?

   N.A.

8. Other unique client support characteristics of special note (e.g. user training institute, annual user conference, local user groups)

   Each client is assigned a Principal Consultant who meets with the client’s ALCO and Board to review and discuss the reports and develop strategies to effectively manage the IRR and liquidity positions of the institution.

C. MODEL(S) USED IN OUTSOURCE ENGAGEMENT

1. Model(s) name(s)
   - Fiserv Asset/Liability System (A/L) – formerly IPS-Sendero
   - Fiserv Data Management System (DMS)

2. Current version(s) number(s)

   Release 3.5

3. Date(s) of last major model update(s)

   August 2014

4. Do you also offer the model(s) as an in-house solution?

   No

5. What other vendor-provided financial management products directly interface with the model?

   Austin Associates builds custom DataMaps that bridge the gap between our client’s core system information and the Fiserv risk products. Through this process, investment, loan, deposit, and borrowing information is efficiently and accurately imported into A/L and DMS

D. MECHANICS OF OUTSOURCE RELATIONSHIP

1. How are balance sheet data (G/L, maturity, repricing, and contractual options) and behavior assumptions (loan prepayments, core deposit behaviors, and CD options) transferred to you?

   Clients use either their own secure/encrypted file transfer service, or they may transfer data to us via our third party secure file transfer service by using our convenient web user interface.

2. At what point and by whom is the “run-ready” IRR model approved?

   Once our analysts have completed the report, it is reviewed and approved by a Managing Director. Should any anomalies be noted, the client is consulted and, if necessary, changes are made before the final report is distributed.

3. How fast are IRR analyses provided to the client after the final data is approved?

   The analyses can be completed within 48 hours if necessary. Our goal is to present our reports two business days prior to client ALCO meeting.
4. **How are completed IRR reports sent back to the institutions (e.g. Word, Excel, pdf)?**

Completed reports are sent in .pdf format via encrypted email.

5. **Describe the format and content of your standard IRR client report.**

Our standard IRR report contains the following:

- Economic and Market Update
- Balance sheet mix report
- Twenty-four month Earnings-at-Risk (simulation) report utilizing both static and dynamic balance sheets and 100 – 400 basis point rate shocks and ramps.
- Non-parallel rate change simulations over a twenty-four month period. May include steepening, flattening, twisted and inverted yield curves.
- Economic Value of Equity (EVE) report with +/- 100 - 400
- Repricing and maturity GAP reports
- Documentation of IRR assumptions
- Liquidity and Dependency ratios
- Liquidity stress test

We will additionally provide a detailed documentation report containing all of the balance sheets, income statements and rate reports for all IRR scenarios.

6. **Who is responsible for IRR analysis quality assurance?**

All of the members involved with the report, analyst or consultant have a responsibility to ensure our reports are accurate.

7. **If needed, how are reruns of a period’s IRR analysis handled?**

Any rerun of a report is performed within 24 hours of notification.

8. **Are there written operating guidelines for clients and vendor staff?**

Yes. Clients are provided with documentation of input data required to run the model.

9. **How are client questions or disputes remediated?**

Client questions or disputes are typically addressed and rectified within a 24 hour time period. The Managing Director(s) assigned to the account are in direct contact with the client to remedy any problems.

**E. CHART OF ACCOUNTS**

1. **Identify any special features and/or limitations of the model’s ability to address the balance sheet behaviors listed below**

   - **Limitations to the number of accounts/categories that can be modeled**
     - No limitations.
     - Special Feature: Each of our clients is set up with their unique chart of accounts.

   - **Detailed re-pricing and maturing balances for categories without embedded options**
     - No limitations or special features
• Interest rate adjusted re-pricing and maturing balances for categories that have continuous and call/put embedded options
  No limitations or special features

• Re-pricing and maturing balances for unique categories (e.g., hybrid ARMs, teaser products, step-up/callable CD's or FHLB advances)
  No limitations or special features

• Re-pricing and maturing balances for indeterminate behavior categories (e.g., core deposits, lines of credit, credit card outstandings)
  No limitations.

Special Features: Investments, loans, and deposits are imported into the model at the instrument level. The model is designed to handle everything from the simplest fixed rate instruments to the most complex adjustable rate instruments with various embedded options. The model allows for importing of maturity and re-pricing dates, payment information, re-pricing characteristics, call/put options, and many other data fields essential for proper analysis.

2. Are there any limitations on automated control of pricing, re-pricing, embedded caps/floors, or teaser rates?

   There are no limitations. All investments, loans, and deposits are imported at the instrument level. The pricing, re-pricing, lifetime and period cap/floor, and other vital information are imported with each instrument. Manual adjustments can be made in the model if the import data isn’t sufficient.

3. Can the model effectively amortize discounts/premiums in any defined alternate interest rate scenario?

   Yes. The amortization of discounts/premiums is calculated by the model in both flat rate and alternative interest rate scenarios.

4. Can the model effectively address unique balance sheet items (e.g. off-balance-sheet positions, mortgage servicing rights, loan pipelines, indirect lending)?

   Yes. We work closely with our clients to understand their unique circumstances and then configure their model accordingly.

F. PRICING, RE-PRICING, OPTION-RELATED CAPABILITIES, INTEREST RATE SCENARIOS AND MISCELLANEOUS

1. Who defines contractual inputs (e.g., pricing spreads, re-pricing limits)?

   Austin Associates will provide guidance as to appropriate inputs, but ultimately, the inputs and assumptions are determined by the client.

2. How does the model obtain information on investments or FHLB advances with puts or calls in alternate interest rate scenarios?

   Investment and FHLB advance data is imported into the model from client supplied inventory reports. The information imported includes call/put information. The model appropriately analyzes any call/put options in alternate rate scenarios.
3. Who defines re-pricing and decay rates (or similar inputs) to core deposits by interest rate scenario? Are there any limits on specifying assumptions (e.g. repricing lags, scenario specific decay rates)?

Austin Associates can run an historical deposit decay (includes beta analysis) and loan prepayment analysis to use in the model or we can use information supplied by the client. There are no limitations on specifying assumptions.

4. How does the model calculate core deposit present values? Can user-defined non-interest expense inputs be accurately applied in core deposit present value calculations?

Expected cash flows for deposit categories are each discounted against an alternative source of funding such as the FHLB yield curve. User-defined non-interest expense inputs can be applied in the model accordingly, but are not recommended for interest rate risk purposes.

5. What standard IRR tests are provided? Can (and how) does the model define rate ramps (and/or rate shocks) that test for yield curve shape change basis risk?

IRR is measured both in a short-term view (Earnings at Risk, EaR) and a long-term view (Economic Value of Equity, EVE). In regards to EaR, standard EaR reports include 100bp - 400bp parallel shocks over a two year time horizon and 100bp – 400bp parallel ramps over a two year time horizon. Both are analyzed on a dynamic and static balance sheet through net income. Non-parallel EaR impacts are also tested using the customer’s choice of 3 yield curve shapes. Time horizons can be expanded to 60 months. EVE reports reflect immediate rate movements from 100bp – 400bp.

6. Describe the model’s analysis and reporting capabilities for standard IRR tests and other forecasts.

IRR reports are accompanied by full documentation including proforma analytics. Balance sheets, income statements, rate analysis, detailed market value reports with duration analysis, as well as full documentation of all IRR assumptions. Repricing and Maturity gaps also support the IRR analytics.

7. Can the model export IRR inputs and outputs and report to spreadsheets or other financial information reporting products?

Yes.

8. Can the model readily produce outcome analyses (e.g. back tests and retrocasts) of prior forecasts and behavior assumptions?

Yes.

9. What internal liquidity analysis capabilities does the model have? Can the model interface with typical internal liquidity models and contingency funding plan spreadsheets?

Both liquidity and dependency ratios are provided in our standard reports. We also provide a liquidity stress test that will correspond with assumptions detailed in the CFP.

10. Does the model have stochastic forecasting capability? If so, describe it.

Yes. The model has a Linear Path Space (LPS) process that can create many forecasts from a single yield curve. This results in reports that give option adjusted valuations and probable values for a variety of key data elements including Stochastic rate scenarios and cash flows.
11. Can custom (institution-specific) equations for loan prepayments, core deposit behaviors, and CD options be embedded in the model to drive cash flow behaviors by interest rate scenario?

Yes.

G. OPEN-ENDED COMMENTS

Austin Associates provides a comprehensive, yet easy to understand, IRR and liquidity reporting package designed to meet and exceed regulatory expectations. We listen to client feedback from examiner comments and update our reports to address the latest regulatory hot issues. Our expert consultants meet with your designated staff to discuss the results of our analysis and provide strategic alternatives for managing risk and earnings.

We also provide education for your Board so that your members have a thorough understanding of IRR, how it is measured and how your institution is performing relative to expectations.

We strive to provide the highest level of service. Each of our trained staff members understands the importance of being available to our clients. No question or request goes unanswered. It is our goal to minimize the time and effort your staff spends on these complex issues and to be recognized as a member of your team.
A. GENERAL INFORMATION

1. Vendor contact information

Darling Consulting Group, Inc.
260 Merrimac Street
Newburyport, MA 01950
Phone: 978-463-0400
Fax: 978-465-6033
Web: www.darlingconsulting.com
Mark Haberland at mhaberland@darlingconsulting.com
Joe Kennerson at jkennerson@darlingconsulting.com

2. Describe the general nature of the current client base (charters, asset range, business models)

A large and highly diverse group of banks and credit unions entrust their asset/liability management and strategy development to Darling Consulting Group (DCG). Our current industry business partners include both single and multi-bank organizations of all charter types with asset sizes ranging from $46 million to $20 billion. We are actively engaged with institutions encompassing a broad range of business models, including all facets (simple and complex) of residential, commercial and consumer driven strategies.

3. Number of active outsource clients

DCG is currently engaged in this capacity with hundreds of banks and credit unions nationwide.

4. Describe any relevant special client characteristics addressed by the model (e.g. mortgage servicing rights, loan pipeline management, indirect lending)

The model can incorporate a wide array of “special client characteristics.” Our analysts discuss all special/unique characteristics with the client to ensure that all products are modeled appropriately.

B. MODEL USER SUPPORT PROGRAM

1. Toll-free, phone-based user support group (enter “yes” or “no”)

Yes

2. Location(s) of the phone support group

Newburyport, Massachusetts

3. Hours during which phone support group operates

Monday-Friday, 8:30AM-5:00PM Eastern Time. Also, client consultants are always available by cell phones when needed.
4. Number of phone support group staff normally available
   - 5 – software/technology support
   - 20 – analytical modeling support
   - 13 – strategic consulting support

5. Typical time to resolve client inquiries by phone support group
   Time varies by type of inquiry. All inquiries are addressed immediately and client is provided a timeline for resolution if further research is required.

6. Web-based user support function (enter “yes” or “no”)
   Yes

7. If your response to question 6 is “yes”, typical time to resolve client inquiries by web-based user support function?
   Time varies by type of inquiry. All inquiries are addressed immediately and client is provided a timeline for resolution if further research is required.

8. Other unique client support characteristics of special note (e.g. user training institute, annual user conference, local user groups)
   DCG hosts a long-standing annual Balance Sheet Management Conference the first week of June in Boston, MA. A variety of ALM issues are discussed through presentations, peer group sessions and product demonstrations: interest rate risk, liquidity, capital planning, assumptions support and stress testing, regulatory updates, operational and personnel management and an economic update and forecast to name a few.

   Our first meeting with new clients includes a ¾ day seminar to explain and discuss the balance sheet risk profile and potential strategies. We offer annual Board education sessions to all clients to continue to enhance the Board’s understanding of the ALCO process. We aid in the review and update of ALCO-related policies. We host a variety of webinars and write a monthly newsletter. We also have a client-only section of our website with access to a variety of educational materials and tools.

C. MODEL(S) USED IN OUTSOURCE ENGAGEMENT

1. Model(s) name(s)
   Balance Sheet Information System (BASIS), a DCG proprietary model that is validated annually.

2. Current version(s) number(s)
   9.334

3. Date(s) of last major model update(s)
   November 6, 2015

4. Do you also offer the model(s) as an in-house solution?
   Yes. Some of our advisory clients bring the system in-house to run interim simulations/strategies and reporting utilizing the quarterly ALM model our analysts build. The in-house model is also used for budget modeling in conjunction with the ALM model.
5. What other vendor-provided financial management products directly interface with the model?

The quarterly ALM model syncs with several other products to enhance the model accuracy and utility:

- **YieldBook** – CitiGroup’s investment analytics tool processes our clients’ investment portfolios and provides CUSIP-level cashflow projections for all rate scenarios we model as well as market values for the EVE analyses.

- **Black Knight Financial** – provides industry-leading loan prepayment projections for residential and consumer loan products for all rate scenarios we model for our clients.

- **Darling Data Warehouse** – houses all of our clients’ historical data for loans, deposits, investments and borrowings. Allows DCG to perform analysis for our clients to support the model assumptions and gain a better understanding of their client base through the utilization of our online data tools.

- **Atlas reporting** – presents model output in an easy-to-understand format that promotes effective discussion and decision making at ALCO meetings.

- **Deposits360°** – our deposit study and online data analytics tool provides business intelligence and strategic insight into our client’s customers’ behaviors and provides empirical support for the critical assumptions used for income simulation, economic valuation and funds management. Analysis includes:

  - Online access to meaningful strategic information embedded within our clients’ ALM-related non-maturity deposit data.
  - Quarterly updates of the following:
    - Historical trends in core deposits (i.e. price/rate sensitivity)
    - Price or rate sensitivity assumptions that can be used for income simulations and economic valuation measures
    - Estimates of core versus non-core balances
    - Estimates of non-maturity deposit retention/decay for use in economic valuation measures
    - Economic/fair value summary including average lives and durations based upon recommended assumptions

- **Prepayments360°** – using detailed historical account-level data, Prepayments360° provides our clients with the means to develop empirical information necessary to support the development and ongoing validation of the behavioral assumptions related to their loan customers (commercial, residential and consumer). In addition, Prepayments360° affords our clients the opportunity to gain an even greater degree of strategic insight into their loan activities. Through online access to DCG’s data warehouse, our clients have access to detailed analysis across multiple portfolio characteristics. This analysis includes:

  - Historical prepayment trends (i.e. trends compared to market rate movements)
  - Detailed analysis of refinancing activities (payoffs, curtailment and modifications)
  - Prepayment trends by various product characteristics (product type, term, repricing schedule, vintage, coupon band, etc.)
  - Estimates for prepayment speeds on all types of loan products

- **Liquidity360°** – DCG’s Liquidity360° is an interactive web-based tool that provides our clients access to the necessary resources for effective operating and contingency liquidity management. The suite of modeling, monitoring and reporting tools enables our clients to prepare pro forma cash flow forecasts, stress test their liquidity position with “what-if”
Choosing the Right ALM Modeling Solution: In-House and Outsourced Solutions and Risk Assessments

simulations, establish liquidity risk triggers and print a Board-ready liquidity monitoring report. Liquidity360 can be tailored to meet each client’s particular needs. Integrated with the quarterly interest rate risk simulation model that DCG maintains for our clients, the system will be pre-loaded with the appropriate liquidity-related cash flow and other data from the client’s most recent ALCO report.

Additionally, a robust contingency liquidity management policy and implementation plan is provided as the umbrella for this important part of the liquidity management process. This policy document is provided in Microsoft Word format and can be readily customized as necessary. It is complete with early warning risk triggers, risk assessment methodologies, required risk management response activities, a framework for liquidity stress testing and a discussion of potential contingency liquidity management strategies.

In summary, the key elements and related benefits of Liquidity360 include:

✓ Cash flow forecasting and liquidity needs assessment tool
✓ Multiple stress-testing scenario capabilities
✓ Customizable liquidity simulation assumptions
✓ Liquidity risk monitoring “scorecard”
✓ Institution-specific liquidity risk triggers
✓ Assumption documentation worksheets
✓ Contingency Liquidity Policy Statement
✓ Quarterly data updates based on your DCG simulation model
✓ Anytime online access

Credit Stress Testing – DCG has developed a best-in-class stress-testing solution. We have confirmed the soundness of our approach during our in-depth work helping larger banks, and effectively brought big-bank analytics to the community banking arena in a very pragmatic and cost-effective manner.

Our team of quantitative and strategic risk management experts has developed a stand-alone credit stress-test service that allows our clients to confidently assess the potential impact of adverse and severely adverse economic conditions (as defined by the Federal Reserve’s annual stress-test factors) on their loan losses and capital.

This forward-looking risk assessment provides immediate feedback regarding capital adequacy for current credit risk and provides insight regarding whether additional capital planning might be prudent. In addition to being understandable and practical, our documentation is thorough and designed to exceed growing regulatory expectations for stress testing.

DCG’s cost-effective credit stress-testing solution provides our clients with the following:

✓ A clear and concise executive summary that highlights results and key implications for capital, capital coverage and credit concentration impact
✓ Individual loan portfolio analysis that includes detailed institution-specific and national peer group expected loss projections for baseline, adverse and severely adverse economic scenarios
✓ Attribution analysis that indicates the relative impact various economic factors have on each portfolio’s loss estimates
✓ “Examiner-friendly” documentation that provides all key stakeholders with a clear explanation of the analyses, statistical methods employed and key assumptions
D. MECHANICS OF OUTSOURCE RELATIONSHIP

1. How are balance sheet data (G/L, maturity, repricing, and contractual options) and behavior assumptions (loan prepayments, core deposit behaviors, and CD options) transferred to you?

   All client data files are transferred to DCG via a secure FTP site or via encrypted email. If the clients have prepared their own study for behavioral assumptions, those can be transferred as mentioned. Should the clients engage DCG to perform a historical study, they would transmit the historical data files to us via the FTP/encrypted email as mentioned above.

2. At what point and by whom is the “run-ready” IRR model approved?

   Our financial analytics department has multiple levels of management review prior to the completion of the ALM model. The completed model is reviewed finally by the client’s dedicated business consultant as part of the strategic development process. Model results and potential strategies are discussed with client management prior to the ALCO meeting.

3. How fast are IRR analyses provided to the client after the final data is approved?

   For the initial engagement and first model, on average 6-8 weeks for the initial model build. Our analysts focus a great deal of time reviewing client data inputs to ensure the accuracy of the source files and providing the most beneficial model structure for each client. Our models are customized for each client’s balance sheet (we do not have a “standard” model structure), and our discussions with the client ensure the model structure is appropriate for that client. The development of the initial model structure and assumptions is critical to the reliability of model output, so we discuss assumptions for each model category with client personnel, including lending, retail, marketing, treasury/finance and senior management.

   Subsequent models are turned around within 3-5 weeks from receipt of all data, with delivery schedules driven by the date of the scheduled ALCO meeting. Each quarterly model update is subjected to a rigorous data scrub and entails a detailed assumption call with management as noted above.

4. How are completed IRR reports sent back to the institutions (e.g. Word, Excel, pdf)?

   Final ALM reporting is provided to each client in a PDF format and sent via the aforementioned secure FTP or encrypted email. For those clients who prefer hard copies, we will print, bind and ship via FedEx the client reports each quarter. Supporting analysis/detail for each model category in each scenario is provided to the client in PDF format and is also available in Excel upon request.

5. Describe the format and content of your standard IRR client report.

   Our quarterly ALCO reporting package is an in-depth and complete analysis of the entire balance sheet risk position: interest rate risk, liquidity risk and capital risk. It consists of analyses for a broad array of interest rate risk scenarios (5-year simulations for NII utilizing rate ramps, rate shocks, assumption stress testing, parallel and non-parallel movements to the yield curve), EVE/NEV analyses, operating and contingency liquidity, capital (inclusive of growth capacity and loss allowance capacity), funding source comparisons, gap report, core funding utilization, documentation for all model assumptions and culminating in a discussion of key strategic topics and inclusion of potential ALM strategies (documented with expected results and risk for each strategy).

   The ALCO reporting package is robust; however, it is laid out in a format which makes
understanding the contents of the reports very user-friendly. Our goal is to ensure that the users of this package can understand the results and effectively communicate them to regulators and the Board. The analyst will provide an initial education on the package and be available at all times to answer questions and elaborate on the results.

6. Who is responsible for IRR analysis quality assurance?
Each model is reviewed by an analytics supervisor and balance sheet consultant.

7. If needed, how are reruns of a period’s IRR analysis handled?
The client can contact either their financial analyst or consultant to discuss a rerun. The financial analyst is responsible for performing the rerun of the model.

8. Are there written operating guidelines for clients and vendor staff?
Operating guidelines are included within the contract each client signs and is also available in our standard Processes and Controls document that is available to each client upon request.

9. How are client questions or disputes remediated?
Client questions or disputes can be brought up to either the financial analyst or consultant. If necessary, the Chief Operating Officer or President would be available.

E. CHART OF ACCOUNTS

1. Identify any special features and/or limitations of the model’s ability to address the balance sheet behaviors listed below

- **Limitations to the number of accounts/categories that can be modeled**
  Unlimited. Each model is constructed to fit the balance sheet makeup and business plan of the client. There is no limit on the number of categories the model can include; however, care is taken to ensure the model breakout is not unnecessarily granular.

- **Detailed re-pricing and maturing balances for categories without embedded options**
  All data files are processed at the instrument level, and each account is modeled individually and reported at a more summary level. Repricing and maturity information is derived from client data files or through YieldBook for investment securities.

- **Interest rate adjusted re-pricing and maturing balances for categories that have continuous and call/put embedded options**
  All data files are processed at the instrument level, and each account is modeled individually and reported at a more summary level. Repricing and maturity information is derived from client data files, and those with embedded options are analyzed at each potential call to determine if option will be exercised. Investment securities are processed through YieldBook, which analyzes each instrument to determine if options will be exercised at every call date under each scenario we model.

- **Re-pricing and maturing balances for unique categories (e.g., hybrid ARMs, teaser products, step-up/callable CD’s or FHLB advances)**
  All data files are processed at the instrument level, and each account is modeled individually and reported at a more summary level. Repricing and maturity information is derived from client
data files, and the model is fully capable of incorporating teaser periods and step-up products. For those instruments with call options, the model determines the likelihood of exercising the call at each call date in each rate scenario modeled. Hybrid ARM products are modeled as “fixed” through the initial lockout period (adjusted for amortization and prepayments) and converted to adjustable products at first reprice date (as indicated in the loan file) and repriced accordingly based upon client-provided data.

- **Re-pricing and maturing balances for indeterminate behavior categories (e.g., core deposits, lines of credit, credit card outstandings)**

  For products with indeterminate characteristics, we discuss the assumptions with client personnel to determine whether “cashflow” or “decay” should be incorporated. These categories are generally modeled as long-term products that can “reprice” on demand. These assumptions can be included at the category level in the model and vary in rising/falling rate scenarios.

2. **Are there any limitations on automated control of pricing, re-pricing, embedded caps/floors, or teaser rates?**

   No limitations. This information should be included in the client provided data files and will be fed through the model. If the detail is not included in the file, we can apply these assumptions manually at the category level.

3. **Can the model effectively amortize discounts/premiums in any defined alternate interest rate scenario?**

   Yes. Discounts and premiums can be accreted and amortized differently in any rate scenario. The analyst has the ability to amortize/accrete in any number of ways depending upon client input.

4. **Can the model effectively address unique balance sheet items (e.g. off-balance-sheet positions, mortgage servicing rights, loan pipelines, indirect lending)?**

   The model has the flexibility to incorporate any “unique” items. Our analysts will discuss each with the client to determine the proper modeling of the products under different rate environments. The model is built to support the modeling of all off-balance sheet derivatives. In essence, so long as the client can provide details of the products, our analysts can incorporate them into the ALM model.

**F. PRICING, RE-PRICING, OPTION-RELATED CAPABILITIES, INTEREST RATE SCENARIOS AND MISCELLANEOUS**

1. **Who defines contractual inputs (e.g., pricing spreads, re-pricing limits)?**

   The model is populated by client data files for loans, investments, deposits and borrowings with contractual information. Should “off line” products need to be included in the model, the analyst will discuss contractual inputs with the client.

2. **How does the model obtain information on investments or FHLB advances with puts or calls in alternate interest rate scenarios?**

   Client investment portfolios are processed through YieldBook prior to the cashflows being read into the ALM model. YieldBook analyzes each security with embedded options to determine the likelihood of the option being exercised in every rate scenario we model. FHLB advances are processed through our data warehouse and the model analyzes potential calls/puts in all rate environments.
3. Who defines re-pricing and decay rates (or similar inputs) to core deposits by interest rate scenario? Are there any limits on specifying assumptions (e.g. repricing lags, scenario specific decay rates)?

Core deposits have a significant impact on model results and risk exposures. Repricing and decay assumptions are always discussed in depth with the client. If a historical study has been prepared, we will review the study methodology and results and, if reasonable, we can incorporate the results into the ALM model. DCG also has the ability to perform a non-maturity deposit study to derive the client-specific behavioral assumptions for the non-maturity deposits.

There are no limits on model assumptions; the model has the capability to incorporate lags and any other scenario-specific assumptions necessary to best capture the expected behavior of the deposit base. Additionally, our deposit assumptions are stress tested throughout the year to ensure ALCO has an understanding of the impact these assumptions have on risk exposures and results.

4. How does the model calculate core deposit present values? Can user-defined non-interest expense inputs be accurately applied in core deposit present value calculations?

Deposit “cash flows” are generated utilizing decay assumptions obtained from the study (or through discussion with the client of a “reasonable” lifing assumption for the deposits.) These cashflows can be discounted to a variety of user-defined market rates or term-structured yield curves (e.g. FHLB, Libor Swap, CD curve, etc.) utilizing present value of future cashflow discounting methodologies. Present value calculations can incorporate user-defined non-interest expense inputs.

5. What standard IRR tests are provided? Can (and how) does the model define rate ramps (and/or rate shocks) that test for yield curve shape change basis risk?

DCG runs a variety of rate scenarios each quarter for our clients. Interest rate shocks (+/- 100-400bp), ramps (+/- 100-400bp), parallel and non-parallel movements (flattening/steepestening) to the yield curve are simulated. Alternative scenarios are reviewed continuously to determine if current market conditions warrant additional scenarios to be examined or changes made to current scenarios.

6. Describe the model’s analysis and reporting capabilities for standard IRR tests and other forecasts.

The interest rate risk component will include Net Interest Income (NII) and Net Income (NI) simulations as well as Economic Value of Equity (EVE/NEV) analysis. The NII simulations include standard scenarios of Base, +/- 200bp parallel yield curve rate ramps over 12 months (currently do not run the -200bp scenario), 400bp parallel yield curve rate ramp over 24 months, and instantaneous shocks ranging from -100 to +400bp in 100bp increments. Other scenarios such as flattening/steepestening yield curves will be modeled depending upon current market rate levels and yield curve slope (e.g. currently prepare a +500bp scenario with the yield curve flattening over a 24-month horizon and a -100bp scenario over 12 months as well as a +200bp flattening over 12 and 24 months). The standard scenarios are subject to change depending upon changes in market conditions. Sensitivity will also be presented at the Net Income level for the standard scenarios (currently the flat rate, +200bp and -100bp scenarios).

Using a set of graphics and tables, DCG prepares a comprehensive reporting package that presents a clear picture of the client’s interest rate risk, liquidity and capital positions, including trend and comparisons to internal policy guidelines and limits. It will contain reports that outline optionality within the loan and investment portfolios, a comparison of deposit rates to wholesale costs, CD rollover and migration patterns and detail of the assumptions in place for every category.
This package will allow the users to review trends over the past year, determine where their current profile stands versus policy limits and will provide the tools for the client to effectively manage their ALM process.

An analysis of the client’s current liquidity profile will be prepared that reviews both on-balance sheet liquidity (e.g. liquid assets and security collateral) and off-balance sheet liquidity (e.g. FHLB, FRB and the brokered market).

The reporting package is designed to promote discussion and develop balance sheet strategies aimed at managing risk and maximizing earnings. Documented strategies and discussion points are included for client use and are a critical part of the consultant’s interaction with the Asset/Liability Management Committee (ALCO) and the ALM process. This helps organize the client’s ALCO meetings as well as aid in compliance with requirements of the recent Interagency Guidance.

The package also contains an Executive Risk Summary Report that clients utilize for Board-level reporting, policy compliance review and trend analysis.

7. Can the model export IRR inputs and outputs and report to spreadsheets or other financial information reporting products?

Yes. All reporting within the model can be exported to Excel or PDF.

8. Can the model readily produce outcome analyses (e.g. back tests and retrocasts) of prior forecasts and behavior assumptions?

Yes. Detailed variance analysis that allows for budget, actual and forecast comparatives including volume, rate, mix, accrual and day-count contributions.

9. What internal liquidity analysis capabilities does the model have? Can the model interface with typical internal liquidity models and contingency funding plan spreadsheets?

The model has internal liquidity capabilities to perform sources and uses analyses and can export the results to Excel or PDF.

The model syncs directly with our on-line liquidity management and contingency planning tool – Liquidity360° – an interactive web-based tool that provides our clients access to the necessary resources for effective operating and contingency liquidity management. The suite of modeling, monitoring and reporting tools enables our clients to prepare pro forma cash flow forecasts, stress test their liquidity position with “what-if” simulations, establish liquidity risk triggers, and print a Board-ready liquidity monitoring report.

10. Does the model have stochastic forecasting capability? If so, describe it.

No.

11. Can custom (institution-specific) equations for loan prepayments, core deposit behaviors, and CD options be embedded in the model to drive cash flow behaviors by interest rate scenario?

Yes, the model has the flexibility to include institution-specific assumptions for any categories and vary per rate scenario. The financial analyst will discuss the modeling with the client to ensure proper behavioral characteristics are modeled.
G. OPEN-ENDED COMMENTS

Darling Consulting Group specializes in empowering our client ALCOs with the means to make effective business decisions. As a result, ALCO becomes a profit center, not a cost center.

Importantly, all of our advice and counsel is completely independent. The only profit we realize from our ideas and your execution of strategies is the satisfaction of our clients making more money and improving their overall risk positions. We don’t have anything else to sell, and that is intentional.

By having a broad client base spread across 49 states plus Puerto Rico, our consultants bring a national perspective to each client relationship, providing insights on ideas and strategies from across the country.

We are engaged with all regulatory agencies and help our clients prepare for their next exam by understanding what the regulators are expecting before they arrive.

The ongoing success of our clients and our more than 30 years in the industry is testament to our knowledge, experience and expertise in developing and using the right risk management tools and resources. Our commitment to assisting clients in continuously enhancing their decision-making capabilities is at the foundation of all DCG services.

Institutions who have taken advantage of DCG’s Balance Sheet Management outsourcing solutions have realized many benefits, including:

✓ An efficient ALM modeling process that accurately reflects their IRR profile and stands up well to regulatory scrutiny
✓ Liquidity and IRR measurement and management techniques that reflect each client’s operating philosophies
✓ A reporting package that clearly outlines the client’s profile for IRR and Liquidity and exceeds the standards laid out in the Interagency Guidance
✓ A comprehensive review of current ALM policies
✓ A well-trained staff that maintains best practices
✓ A confident and more proactive ALCO and Board of Directors
✓ Greater confidence and respect from examiners
✓ A strong decision-making process that reviews and analyzes a variety of strategic options to determine the best fit for the institution

The increased regulatory pressure on financial institutions to maintain a finely tuned ALCO process makes DCG the perfect partner to have in your corner.
A. GENERAL INFORMATION

1. Vendor contact information
   Farin and Associates
   5951 McKee Road Suite 201
   Fitchburg, WI 53719
   800.236.3724
   info@farin.com
   www.farin.com

2. Describe the general nature of the current client base (charters, asset range, business models)
   FARIN ALM clients include community-based financial institutions, commercial banks, state
government economic development authorities, consultants, specialty lenders, thrifts and
credit union charters.
   Client Asset Ranges: $30 million to $10 billion

3. Number of active outsource clients
   55

4. Describe any relevant special client characteristics addressed by the model (e.g. mortgage servicing rights, loan pipeline management, indirect lending)
   The model’s capabilities include static and dynamic modeling, budgeting, forecasting,
incorporating mortgage servicing values, complex investment structures, stress testing, liquidity
analysis and holding company analysis.

B. MODEL USER SUPPORT PROGRAM

1. Toll-free, phone-based user support group (enter “yes” or “no”)
   Yes – 1.800.236.3724

2. Location(s) of the phone support group
   Fitchburg, WI and Seattle, WA

3. Hours during which phone support group operates
   8:00 am – 6:00 pm Central

4. Number of phone support group staff normally available
   7

5. Typical time to resolve client inquiries by phone support group
   Calls are answered as received. Resolution of the issue depends on the complexity and the
experience of the user. Generally 5 to 10 minutes.
6. **Web-based user support function (enter “yes” or “no”)**
   
   Yes.

7. **If your response to question 6 is “yes”, typical time to resolve client inquiries by web-based user support function?**
   
   Inquiries are answered as received. Resolution of the issue depends on the complexity and the experience of the user. Generally 5 to 10 minutes.

8. **Other unique client support characteristics of special note (e.g. user training institute, annual user conference, local user groups)**
   
   FARIN offers an on-line support site with FAQs, instructional videos, key assumption downloads and model upgrade links. We also provide both real-time and recorded education/support sessions for use in diagnosing common problems during off-hours.

   For complex problems, we offer remote desktop control services that will allow our support staff to take control of the user’s desktop to resolve and train on the situation or issue.

   Our user help system and knowledge base are Web-based and updated in real-time, allowing user’s access to the most up-to-date information and answers to issues.

   In addition to the initial user training, FARIN offers client directed, face to face training sessions.

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**C. MODEL(S) USED IN OUTSOURCE ENGAGEMENT**

1. **Model(s) name(s)**
   
   Insight

2. **Current version(s) number(s)**
   
   5.2.17.21

3. **Date(s) of last major model update(s)**
   
   May 2015

4. **Do you also offer the model(s) as an in-house solution?**
   
   Yes

5. **What other vendor-provided financial management products directly interface with the model?**
   
   FARIN’s iPrice Loan and LoanEDGE pricing systems share many elements. Using our export function, clients link to other programs such as cost accounting applications, management reporting systems, mortgage servicing rights, credit risk assessment systems and more.

   FARIN’s Core Analytics (non-maturity core deposit study) results are loaded directly into the model.
D. MECHANICS OF OUTSOURCE RELATIONSHIP

1. How are balance sheet data (G/L, maturity, repricing, and contractual options) and behavior assumptions (loan prepayments, core deposit behaviors, and CD options) transferred to you?

   Via a secured website

2. At what point and by whom is the “run-ready” IRR model approved?

   The “run-ready” decision is made jointly between the FARIN Analyst and the client.

3. How fast are IRR analyses provided to the client after the final data is approved?

   The turnaround time is 10 – 14 business days

4. How are completed IRR reports sent back to the institutions (e.g. Word, Excel, pdf)?

   The client accesses the PDF report set via a secured website.

5. Describe the format and content of your standard IRR client report.

   The comprehensive report package contains:
   - Executive Review – outlining in tables and graphs the high level results
   - Interest Rate Forecast and Economic Report
   - Multiple pages of detailed analysis
     - 90 Day Look Back
     - IRR Profile
     - 3 Year Base Forecast Reports
     - Liquidity Profile
     - Static Forecast Reports
     - Account Growth Projections
     - Current Reports
     - Market Value Assumptions
     - Account Settings

6. Who is responsible for IRR analysis quality assurance?

   The primary responsibility for quality assurance is the Senior Vice President of Client Services

7. If needed, how are reruns of a period’s IRR analysis handled?

   The FARIN Financial Analyst responsible for the client relationship completes the task.

8. Are there written operating guidelines for clients and vendor staff?

   Yes, guidelines are contained within the contract. In addition, clients are provided a document outlining the processes
9. How are client questions or disputes remediated?

In case of a dispute the client’s Financial Analyst is initially charged with resolving the dispute. If needed, the issue is escalated to the Senior Vice President of Client Care.

E. CHART OF ACCOUNTS

1. Identify any special features and/or limitations of the model’s ability to address the balance sheet behaviors listed below

FARIN’s outsourced model runs on the same platform as FARIN’s in-house model (described earlier in this publication). So the capabilities are similar.

- Limitations to the number of accounts/categories that can be modeled

The model allows an unlimited number of chart-of-account categories, nested as deep as necessary. Categories can have child categories and accounts, and those child categories can also have child categories and/or individual accounts.

Categories function like summary accounts. They will inherit many of the properties of typical accounts and some properties, like balance and budget values, will be available at the category level. Accounts holding more detailed data and modeling will be done at the account level.

Each institution’s chart maintains a list of special accounts that are used for model balancing and built-in ratios or features. These special accounts, with the exception of the balance sheet and income statement accounts, can be used by the institution as can any account in the model’s chart of accounts.

- Detailed re-pricing and maturing balances for categories without embedded options

No limitations in modeling the most basic of instruments. These instruments have no options, therefore they reprice as cash flows occur or as contracts allow. Data provided on repricing from core systems will drive the specific future rate.

- Interest rate adjusted re-pricing and maturing balances for categories that have continuous and call/put embedded options

Continuously callable instruments can be modeled using FARIN Foresight as a repricing instrument based upon contractual provisions, with a separate final maturity date. The call function can be set to a specific strike price related to an index, curve or rates where the model will review the remaining final maturity of the instrument using current rates and determine if, based on the curve, the option has triggered a call event. Repricing, maturity and call events are separate items in FARIN Foresight and can be combined on any instrument as needed.

- Re-pricing and maturing balances for unique categories (e.g., hybrid ARMs, teaser products, step-up/callable CD’s or FHLB advances)

In FARIN Foresight, existing data has its own repricing information such as next reprice date, subsequent reprice, frequency, rate index, margin and caps. This information is used on existing positions to determine rates. For planned purchases, the overall account characteristics define the basic structure and then assumptions on current rates, repricing rates, calls, etc. are handled as an assumption within the plan.
• Re-pricing and maturing balances for indeterminate behavior categories (e.g., core deposits, lines of credit, credit card outstandings)

For the purposes of modeling indeterminate accounts, the client may elect to apply decay rates to create assumed “maturity structures” for valuing cash flows. However, repricing is a function that is controlled via assumptions on offer rates and will be applied to the entire balance in the period being analyzed. We have separated the assumed core deposit run-off from the projections of balance levels and allowed the user to control expected outcomes when forecasting income at risk and future balance levels.

2. Are there any limitations on automated control of pricing, re-pricing, embedded caps/floors, or teaser rates?

No

3. Can the model effectively amortize discounts/premia in any defined alternate interest rate scenario?

Yes, users have the ability to define the amortization of discounts or premiums on a straight line basis, level yield basis or with the projected cash flows of the associated balances. If the institution has a specific schedule to write down, the model accepts a “cash-flow definition” for the projected write-down by rate environment.

4. Can the model effectively address unique balance sheet items (e.g. off-balance-sheet positions, mortgage servicing rights, loan pipelines, indirect lending)?

Yes

F. PRICING, RE-PRICING, OPTION-RELATED CAPABILITIES, INTEREST RATE SCENARIOS AND MISCELLANEOUS

1. Who defines contractual inputs (e.g., pricing spreads, re-pricing limits)?

The client

2. How does the model obtain information on investments or FHLB advances with puts or calls in alternate interest rate scenarios?

This information is supplied by the client via the data upload process.

FARIN Foresight stores each investment or bond as a separate event with specifics on the put, call or comparison in that contract. These conditions are kept within the database so periodic updates can be done without having to re-enter these conditions, one simply updates the balances.

3. Who defines re-pricing and decay rates (or similar inputs) to core deposits by interest rate scenario? Are there any limits on specifying assumptions (e.g. repricing lags, scenario specific decay rates)?

The client controls the decay assumptions. There are no limits.

4. How does the model calculate core deposit present values? Can user-defined non-interest expense inputs be accurately applied in core deposit present value calculations?

Both pricing and decay are specified by interest rate scenario. Cash flows are generated and they are present valued back using a discount rate function. Costs can be inserted as a negative cash flow into the cash flows that are generated and they also will be present valued back.
5. What standard IRR tests are provided? Can (and how) does the model define rate ramps (and/or rate shocks) that test for yield curve shape change basis risk?

- Net Interest Income Volatility – Earnings At Risk (year 1) static and dynamic (Flat rates, Global Insight rate forecast, I & P -100bp, I & P +100bp, +200bp, +300bp, +400bp)
- Net Interest Income Volatility – Earnings At Risk (year 2) static and dynamic (Flat rates, Global Insight rate forecast, I & P -100bp, I & P +100bp, +200bp, +300bp, +400bp)
- Current, 1 year and 2 year Forecast EVE Results (Book, -300bp, -200bp, -100bp, 0, +100bp, +200bp, +300bp, +400bp)
- Non-maturity deposits Macaulay duration (with the same interest rate shocks)
- Liquidity Risk Analysis Results (Previous quarter, Current, Year 1, Year 2)
- Any Treasury yield curve that existed in the last 15 years can be tested against, plus the different parallel and non-parallel rate shock that can be run, including Global Insight Rate environments.

6. Describe the model's analysis and reporting capabilities for standard IRR tests and other forecasts.

FARIN Foresight uses standard income simulation techniques to project the amount and timing of cash flows on all instruments, replacing runoff balances with client-controlled projections for future activities. The analysis horizon can be as short as 1 month and as long as 72 months. Results can be examined under any combination of interest rate projections or forecasts over the selected horizon, and various reports showing earnings at risk levels can be run to report risk levels.

In addition to the earnings at risk, Foresight calculates value at risk using discounted cash flow analysis. This analysis can be run on current, past or projected future balance sheet positions. When running under a projected scenario, the model allows users to run a series of baseline interest rate projections that would occur during the forecast, then stresses those new rate levels to create a lattice of projected value-at-risk possibilities based upon possible interest rate movements. This process is called dynamic value at risk; it must be considered under multiple interest rate forecasts during the projection period to accurately assess all potential risks.

7. Can the model export IRR inputs and outputs and report to spreadsheets or other financial information reporting products?

Yes - all reports in the model can be exported to CSV files for use in any other application. In addition, reports can be directly exported individually, or as a group, to Adobe PDF format for ease of report packet production.

8. Can the model readily produce outcome analyses (e.g. back tests and retrocasts) of prior forecasts and behavior assumptions?

Yes – this is a standard part of the reporting package

9. What internal liquidity analysis capabilities does the model have? Can the model interface with typical internal liquidity models and contingency funding plan spreadsheets?

FARIN Foresight contains a liquidity report that is based on the projected sources and uses of funds in a plan. This approach helps identify key assumptions in managing liquidity levels and plan for stress tests on these assumptions to understand the implications of a missed projection. This reporting can include dynamic projections of external funding sources, stress test key assumptions such as deposit run-off or prepayment speed changes. These are typical adjustments and tests found in many contingency funding plans. Of course all outputs can be saved to
10. Does the model have stochastic forecasting capability? If so, describe it.

Yes - The user selects the forecast and set of output parameters desired. The user may also define the number of rate paths to run. Output is saved to a CSV file to make the output file results easy to manipulate in Excel.

As a part of the Monte Carlo engine, users may elect to run forecast market value calculations at the end of the forecast to test the long-term interest rate risk in the resulting strategies. This option helps to more fully assess the trade-off between income and value at risk in the different what-if scenarios.

To calculate market rate paths, the user selects a base Yield Curve. FARIN Foresight displays the estimated historical volatility for the selected Yield Curve over the selected number of historical periods. This is purely for informational purposes to help explain how history may or may not impact future volatility. The user is asked to supply a volatility level for the curve in the analysis.

Output from the model can display any information requested in the output metrics.

11. Can custom (institution-specific) equations for loan prepayments, core deposit behaviors, and CD options be embedded in the model to drive cash flow behaviors by interest rate scenario?

Yes - FARIN Foresight has the ability to use formulas to drive future projected balances and offering rates. These assumptions can be written to adjust levels based upon many different factors, including market interest rate levels.

G. OPEN-ENDED COMMENTS

The FARIN Insight (outsourced solution) Asset/Liability Management model utilizes the same platform as FARIN’s time tested and robust Foresight model, which in-house clients use.

The Insight solution is accessible to clients in a number of different formats. The client can have FARIN complete all of the IRR modeling and reporting, or the client can take on some of the responsibilities themselves. The solution also allows the client to access the model to generate reports or run forecasts if they desire.

Since FARIN’s in-house and outsourced model operate using the same platform, the client can easily move between how they utilize the model. This is particularly advantageous when the clients resources change or when the client wants to take on more responsibilities regarding IRR modeling.

The model is independently certified to fully and accurately perform mandated regulatory analyses and reporting of interest rate risk for both income-at-risk and value-at-risk metrics. FARIN Foresight provides industry best practice functionality for institutions that aspire to use their ALM solution for more than basic regulatory compliance—for example, as a strategic business tool to optimize net interest margin, assess risk exposure and develop appropriate contingency funding plans for various forecasted economic environments.

FARIN Foresight provides tremendous flexibility in tailoring a system to fit the client’s unique needs. An unlimited, intuitive and highly adaptive chart of accounts can be maintained, thus
supporting a variety of important financial management activities such as forecasting, budgeting and regulatory analysis. FARIN Foresight’s extensive features substantially improve productivity and decision processes.

The model allows institutions to meet specific ALCO objectives by providing:

- Income and Market Value (NEV) calculations
- Simulation of interest rate shocks, ramps and yield curve twists
- Complete, meaningful and understandable reports that are supported by thorough, in-depth analytics and communicate all risks in the ALCO process
- Cash flow projections at detailed or summary level for easy updating
- Branch or entity-level reporting for accountability and performance
- Numerous options for use of historical data in projections and reporting of financial performance trends
- Full IRR analysis supporting both current and future views of your risk position
- Comprehensive budgeting features
- Integrated liquidity analysis and testing
- Graphing capabilities to help you quickly transform outputs into actionable decisions

FARIN Foresight provides a framework to test countless interest rate scenarios and strategy combinations, showing the institution the impact of individual components as well as the entire balance sheet and income statement. In addition to the Asset/Liability components, FARIN Foresight offers full budgeting and planning support as budgets are typically a sub-set of the income forecasts used for ALM and liquidity analysis.

FARIN is committed to ensuring that an investment in FARIN Foresight earns a real return for an institution in its compliance, knowledge and decision-making processes.

When you partner with FARIN, you benefit not only from a quality product, but also from the experience of our people. An ALM model is only as good as the company and the staff supporting the solution. FARIN has been serving the financial analysis needs of community based institutions for over 30 years. Our focus is solely on financial analysis, we are not distracted by offering a core data processing model, brokerage or investment services. This means our clients receive the highest level of service, a cutting edge product and the ability to act swiftly to changes in regulations.

FARIN staff is composed of former CEOs, ALCO members, controllers and financial analysts who understand both our products and your business. Routinely FARIN staff is asked to lead education sessions for regulators, national industry groups such as CUNA, FMS, Graduate School of Banking in Madison, WI and Federal Home Loan Banks. In other words, FARIN understands the needs and pressures of your work life, and we are here to make certain that FARIN Foresight becomes a valuable, indispensable asset for you and your team.
A. GENERAL INFORMATION

1. Vendor contact information
   sales@fimacsolutions.com or dial 877-789-5905, Ext. 1

2. Describe the general nature of the current client base (charters, asset range, business models)
   We service banks, thrifts, and credit unions nationally and off shore clients through our Cloud based format offered by FIMACMountainSM – A/L© solution that is a member of our integrated suite of solutions on FIMACMountainSM.

3. Number of active outsource clients
   Many hundreds of clients utilize FIMAC Solutions for their ALM/IRR modeling needs.

4. Describe any relevant special client characteristics addressed by the model (e.g. mortgage servicing rights, loan pipeline management, indirect lending)
   The solution has unlimited capabilities to define and manage any on or off-balance sheet account type or cash flow or notional cash flows while allocating non-interest income or expense against production volumes.

B. MODEL USER SUPPORT PROGRAM

1. Toll-free, phone-based user support group (enter “yes” or “no”)
   Yes

2. Location(s) of the phone support group
   Denver, Milwaukee, and Minneapolis

3. Hours during which phone support group operates
   9:00 am to 7:00 pm Eastern time.

4. Number of phone support group staff normally available
   3-5

5. Typical time to resolve client inquiries by phone support group
   Less than 1 hour

6. Web-based user support function (enter “yes” or “no”)
   Yes, through on-line model wiki and on-line user group
7. If your response to question 6 is “yes”, typical time to resolve client inquiries by web-based user support function?

Unknown

8. Other unique client support characteristics of special note (e.g. user training institute, annual user conference, local user groups)

Monthly educational opportunities on-line, monthly on-line webinars, user conference, specifically assigned assistance specialist, direct client visits.

C. MODEL(S) USED IN OUTSOURCE ENGAGEMENT

1. Model(s) name(s)

   FIMACMountainSM – A/L®

2. Current version(s) number(s)

   V 1.0

3. Date(s) of last major model update(s)

   V 1.0 is the current release

4. Do you also offer the model(s) as an in-house solution?

   Cloud based. Supports all browsers and recent browser versions.

5. What other vendor-provided financial management products directly interface with the model?

   Balance Sheet Manager®, Cash Sources & Uses®, and Risk Analytics® ALM Model®, Fixed Income Accounting®

D. MECHANICS OF OUTSOURCE RELATIONSHIP

1. How are balance sheet data (G/L, maturity, repricing, and contractual options) and behavior assumptions (loan prepayments, core deposit behaviors, and CD options) transferred to you?

   Through secure transfer of uploaded data extract file.

2. At what point and by whom is the “run-ready” IRR model approved?

   At user’s choice and determination.

3. How fast are IRR analyses provided to the client after the final data is approved?

   Generally within one hour.

4. How are completed IRR reports sent back to the institutions (e.g. Word, Excel, pdf)?

   Retrieved on-line through secure connection with user name and password.

5. Describe the format and content of your standard IRR client report.

   A report set utilizing immediate and parallel rate shocks with a static balance sheet is delivered along with 2 other agreed upon rate environments with any dynamic balance sheet changes.
requested. Stress testing reports are delivered on an agreed upon schedule. See our In-House model description for a fuller description of reports generated.

6. **Who is responsible for IRR analysis quality assurance?**
   
   Internally the ALM Specialists assigned to the account are ultimately responsible for our work product, while the client identifies their own individually, generally internal audit.

7. **If needed, how are reruns of a period’s IRR analysis handled?**
   
   As quickly as possible, generally within 24 hours, though any modified written analysis of the results will likely be longer.

8. **Are there written operating guidelines for clients and vendor staff?**
   
   Yes along with policies and procedures to follow.

9. **How are client questions or disputes remediated?**
   
   The assigned ALM/IRR specialist responds initially to any questions or concerns. If a resolution is not achieved, then the issue is taken to the head of consulting who will work with the client to reach a satisfactory resolution for both parties.

**E. CHART OF ACCOUNTS**

1. Identify any special features and/or limitations of the model’s ability to address the balance sheet behaviors listed below

   - **Limitations to the number of accounts/categories that can be modeled**
     
     Unlimited

   - **Detailed re-pricing and maturing balances for categories without embedded options**
     
     Full capabilities utilizing the capture of delivered sub-ledger detail or client entered detail, or both.

   - **Interest rate adjusted re-pricing and maturing balances for categories that have continuous and call/put embedded options**
     
     The solution handles all American, Bermuda, and European option types.

   - **Re-pricing and maturing balances for unique categories (e.g., hybrid ARMs, teaser products, step-up/callable CD’s or FHLB advances)**
     
     Full capability and functionality through user provided optionality of non-contractual and from sub-ledger detail or CUSIP level detail (as automatically imported from independent providers as an included function of the solution).

   - **Re-pricing and maturing balances for indeterminate behavior categories (e.g., core deposits, lines of credit, credit card outstandings)**
     
     User directed modeling as to balances, rates, behavioral characteristics, discount rates, decay rates, etc. User can direct maturing or new balances into any maturity, rate, or account type of their choice. Balances are not required to return to the same category.
2. Are there any limitations on automated control of pricing, re-pricing, embedded caps/floors, or teaser rates?

No. Such items are retained until changed, but may be changed or modified at any time and under any dynamic balance(s) or rate scenario(s) that may be built.

3. Can the model effectively amortize discounts/premiums in any defined alternate interest rate scenario?

Not currently, but to be implemented.

4. Can the model effectively address unique balance sheet items (e.g. off-balance-sheet positions, mortgage servicing rights, loan pipelines, indirect lending)?

Yes, and with inclusion of any non-interest income or expense generated through such activities.

F. PRICING, RE-PRICING, OPTION-RELATED CAPABILITIES, INTEREST RATE SCENARIOS AND MISCELLANEOUS

1. Who defines contractual inputs (e.g., pricing spreads, re-pricing limits)?

The client may dictate or FIMAC will calculate annually (or more frequently as needed) utilizing the clients’ current and historical data.

2. How does the model obtain information on investments or FHLB advances with puts or calls in alternate interest rate scenarios?

Investments are culled from external data bases. If not available, then the model conducts estimated valuations. OAS methodology is utilized for projecting likely behavior, and hence translated into likely pricing under alternative rate environments when data is not available.

3. Who defines re-pricing and decay rates (or similar inputs) to core deposits by interest rate scenario? Are there any limits on specifying assumptions (e.g. repricing lags, scenario specific decay rates)?

All subjective type assumptions are calculated by FIMAC annually (or more frequently as needed) from current and historical data or, at the client’s direction, assumptions they prefer to utilize.

No limits to assumptions by rate environment or by modeled scenario.

4. How does the model calculate core deposit present values? Can user-defined non-interest expense inputs be accurately applied in core deposit present value calculations?

Core deposit present values are calculated using the cash flows generated by the assigned decay rates and then discounted at a specifically agreed upon discount rate by expected cash flow date, generally an externally available rate source/curve. Thus, each expected cash flow is discounted at a rate appropriate to the timing of the cash flow.

Non-interest expenses can be applied in core deposit present value calculations.

5. What standard IRR tests are provided? Can (and how) does the model define rate ramps (and/or rate shocks) that test for yield curve shape change basis risk?

We can conduct any IRR test(s) that a client may ask for since any alternative rate curve or rate environment may be utilized. Account behavioral characteristics may be assigned by rate environment, by scenario or both.
6. Describe the model's analysis and reporting capabilities for standard IRR tests and other forecasts.

The model produces expected NII, NI, and NEV/EVE under all scenarios modeled along with an analysis of capital, liquidity, the investment portfolio, comparative analysis from the previous model run, duration under all scenarios, and a breakdown of the components of NII, NI, and EVE/NEV along with 2 types of Gap reports. Also delivered are Variance Report, Back Testing Report, Sources of Risk Report and Cash Sources and Uses packets.

Further, users may develop an unlimited number of user defined report sets from any available data modeled from the capabilities of the model. All source and modeled data is available for user defined reporting over a virtually unlimited time horizon.

7. Can the model export IRR inputs and outputs and report to spreadsheets or other financial information reporting products?

FIMACMountain A/L can export for the client any source or modeled data held in the data base.

8. Can the model readily produce outcome analyses (e.g. back tests and retrocasts) of prior forecasts and behavior assumptions?

Yes. Standard and routine.

9. What internal liquidity analysis capabilities does the model have? Can the model interface with typical internal liquidity models and contingency funding plan spreadsheets?

The model produces multiple liquidity analyses and can produce others by user defined modeling. Any data may be imported or exported from or to any source whether an externally developed software model or a client’s internal spreadsheet, though under Outsourcing, those analytics are produced depending upon the level of service contracted.

10. Does the model have stochastic forecasting capability? If so, describe it.

Yes. Hull White derivative formula in v1. Subsequent versions will offer a choice of approaches.

11. Can custom (institution-specific) equations for loan prepayments, core deposit behaviors, and CD options be embedded in the model to drive cash flow behaviors by interest rate scenario?

Not as a standard format. User specific behavioral characteristics may be built into the process, but are not offered as standard. If any characteristics that modify potential behavior and forecasting needs are embedded in record level detail, then it will be captured and modeled.

G. OPEN-ENDED COMMENTS

Our outsourced services can be utilized from simple data entry and model operation to a total and complete ALM/IRR, liquidity, and balance sheet management solution that eliminates any internal need for expertise or significant time commitments. We bring the knowledge of a professional ALM/IRR practitioner to you.

We offer four standard levels of service –

Foothills
Sierra
High Country
Peak Performance
Each subsequent level adds additional services and advice up to and including attendance at ALCO and/or Board meetings, planning sessions, and providing education to non-financial members of ALCO. Some levels of service also include annual analytics conducted to correctly estimate subjective assumptions required for modeling. Liquidity work and stress testing is included in most service levels.

All levels of service include a written analysis and explanation of the current position, a review of all information required for the Board and ALCO, an economic outlook from rotating sources, a discussion of any systemic trends or issues of importance, and a discussion of strategies to accomplish the institution’s goals while maximizing income, and managing IRR, capital and liquidity, all within each client’s defined risk profile.

Our outsourcing utilizes the Cloud based FIMACMountain® - A/L® which is the newest fully compliant advanced solution available today. A very powerful dynamic as to rates and balances model that is affordable and scalable from the small institution upward to the highest levels of sophisticated modeling needs. Clients may choose those features that are right for their organization, and add or remove them at will. It unites with our Budget® and Fixed Income Accounting® solutions as yet another integrated solution in our FIMACMountain suite available to clients.

All data, source data or modeled data and results are available for export. The standard output pages may be utilized, or we will design specific output, charts, and graphs as desired. A large number of industry standard Key Performance Indicators are provided as well as unique KPI’s as requested. The solution is designed to provide any measurements and analytics needed by any institution for standard ALM/IRR modeling and stress testing, including liquidity modeling.

Global rates and rate curves traditionally utilized by institutions are available in the solution and are updated daily, with the ability to pick the date of choice and to look back in time to rates and rate curves chosen for comparative analysis to allow for unparalleled back testing, or one may simply utilize the standardized back testing built in. Model various curves for comparative results if desired. Any or varying rate lags desired for any account may be deployed under any scenario built.

FIMACMountain – A/L uses each client’s GL account numbers and names and calculates at the instrument level from the imported sub-ledger information. Pricing and issue structure information and detail for CUSIP holdings are automatically embedded from independent nationally recognized data bases. Prepayment and other non-contractual cash flows are built and modeled in our multi-factor models. Exercise of any option, be it American, Bermuda, or European may be calculated utilizing recognized lattice based OAS methodologies with Monte Carlo simulation also available.

Standard report sets include:

- EVE/NEV under any rate environment or balance scenario with 8 automatic levels of user defined shock from the base levels included
- Forecasted NII and NI to any horizon
- Full report sets for all assumptions
- Standard and beta adjusted gap reports for cash flows only and a separate set for total repricing volumes
- Stress test reports based on user defined settings that can be modified at any time
- Full report sets disclosing all assumptions and rates
- Executive summary for ease of reading and understanding by all participants
• General model solution features and benefits include:
  - User defined modeling. Choose your level of sophistication
  - Embedded “global” rates such as yield curves, indexes, money market rates, etc. received daily from the FRED data base maintained by the Federal Reserve Bank of St. Louis
  - Automatic CUSIP pricing and underlying terms and conditions embedded from recognized national providers
  - No mapping to another GL form. Utilizes each client’s own GL numbers and names
  - Operates and calculates utilizing specific sub-ledger data from each contract for exacting results
  - Stochastic or non-stochastic modeling choices
  - Choose from multiple standard OAS models for optionality determination and correct valuation
  - Standard report outputs and unlimited user defined outputs
  - Full reporting of Key Performance Indicators along with ability to design others
  - Built in graphics for creating specific user defined graphic presentations
  - All data received and modeled results are available for export. Standardized or on the fly creations are possible
  - Utilizes static, growing, or shrinking balances as needed. Sets any balance considerations by the month or longer
  - Future balances may be added at will to new or existing instrument types. Create new instruments
  - Ability to readily conduct stress testing from user defined scenarios, modify them, or create additional new stress scenarios
  - Shock or stress multiple yield curves for comparative analysis
  - Full disclosure of the resulting duration of all assets, liabilities, and capital to allow readers to understand the price volatility of each
  - True dynamic income simulation modeling for NII and expected cash flows
  - Easy data import utilizing our invisible data wizard. Add new account types or structures at any import
  - Capability to structure any on or off-balance sheet position and expected performance
  - A fully scalable model responding to the needs of users of all sizes and complexities with associated scaled pricing
  - Secure log-ins and security features built in. Multi-user capabilities as managed by a designated internal administrator
  - FIMACMountain is hosted by Zoya, a managed data center and co-location for SaaS delivered solutions that comply with all federal banking laws, rules, and regulations
  - SaaS format architecture allows for rapid response to regulatory or technological changes utilizing a relational data base separately partitioned for each user
  - Follows FIMAC Solutions’ hallmark of ease of front end operation and easy to read output
  - All commonly utilized browsers and versions are supported

Contact us today to learn which level of service is right for your institution
Outsource Model Providers

Financial Institutions Management Associates Corp
www.fimacsolutions.com

Model: Risk Analytics® ALM Model®

A. GENERAL INFORMATION

1. Vendor contact information
   www.fimacsolutions.com
   877-789-5905, Ext. 1

2. Describe the general nature of the current client base (charters, asset range, business models)
   The Risk Analytics ALM Model has clients across all charter types who range in asset size from very small to multi-billion.

3. Number of active outsource clients
   Hundreds

4. Describe any relevant special client characteristics addressed by the model (e.g. mortgage servicing rights, loan pipeline management, indirect lending)
   The model has limited off balance sheet capabilities

B. MODEL USER SUPPORT PROGRAM

1. Toll-free, phone-based user support group (enter “yes” or “no”)
   Yes

2. Location(s) of the phone support group
   Denver, Minneapolis, Milwaukee

3. Hours during which phone support group operates
   9:00 am – 7:00 pm Eastern time

4. Number of phone support group staff normally available
   3-5

5. Typical time to resolve client inquiries by phone support group
   Less than 30 minutes

6. Web-based user support function (enter “yes” or “no”)
   Yes

7. If your response to question 6 is “yes”, typical time to resolve client inquiries by web-based user support function?
   Unknown as support can be “self-service” or through our LinkedIn user group.
8. Other unique client support characteristics of special note (e.g. user training institute, annual user conference, local user groups)

Continual on-line training/refresher classes, user conference, available webinars, and “on demand” customer support through each client's assigned specialist.

C. MODEL(S) USED IN OUTSOURCE ENGAGEMENT

1. Model(s) name(s)
   - Risk Analytics® ALM Model®

2. Current version(s) number(s)
   - Rev 17232

3. Date(s) of last major model update(s)
   - 2007

4. Do you also offer the model(s) as an in-house solution?
   - Windows operating system required and a current version of a commonly used web browser.

5. What other vendor-provided financial management products directly interface with the model?
   - Balance Sheet Manager®, Cash Sources & Uses®, and FIMACMountain® – Fixed Income Accounting®.

D. MECHANICS OF OUTSOURCE RELATIONSHIP

1. How are balance sheet data (G/L, maturity, repricing, and contractual options) and behavior assumptions (loan prepayments, core deposit behaviors, and CD options) transferred to you?

   Through secure transfer of uploaded data extract file.

2. At what point and by whom is the “run-ready” IRR model approved?

   At user’s choice and determination.

3. How fast are IRR analyses provided to the client after the final data is approved?

   Generally within one hour.

4. How are completed IRR reports sent back to the institutions (e.g. Word, Excel, pdf)?

   Retrieved on-line through secure connection with user name and password. Written analytic reports are delivered direct to the client by the ALM practitioner assigned to the account.

5. Describe the format and content of your standard IRR client report.

   A report set utilizing immediate and parallel rate shocks with a static balance sheet is delivered. See our In-House model description earlier in this publication for a fuller description of reports generated.
6. Who is responsible for IRR analysis quality assurance?
   Internally the ALM practitioner assigned to the account is ultimately responsible for our work
   product, while the client identifies their own individual, generally internal audit.

7. If needed, how are reruns of a period’s IRR analysis handled?
   As quickly as possible, generally within hours of discovery of need, though any modified written
   analysis of the results will likely be longer.

8. Are there written operating guidelines for clients and vendor staff?
   Yes along with policies and procedures to follow.

9. How are client questions or disputes remediated?
   The assigned ALM/IRR specialist responds initially to any questions or concerns. If a resolution
   is not achieved, then the issue is taken to the head of consulting who will work with the client to
   reach a satisfactory resolution for both parties.

E. CHART OF ACCOUNTS

1. Identify any special features and/or limitations of the model’s ability to address the balance
   sheet behaviors listed below
   - Limitations to the number of accounts/categories that can be modeled
     Unlimited
   - Detailed re-pricing and maturing balances for categories without embedded options
     Full capabilities utilizing the capture of delivered sub-ledger detail or client entered detail, or both.
   - Interest rate adjusted re-pricing and maturing balances for categories that have
     continuous and call/put embedded options
     The solution handles all defined options
   - Re-pricing and maturing balances for unique categories (e.g., hybrid ARMs, teaser products,
     step-up/callable CD’s or FHLB advances)
     Capability and functionality through user provided optionality of non-contractual options and from
     sub-ledger detail or CUSIP level detail (as automatically imported from independent providers as
     an included function of the solution).
   - Re-pricing and maturing balances for indeterminate behavior categories (e.g., core deposits,
     lines of credit, credit card outstandings)
     User directed modeling as to balances, rates, behavioral characteristics, discount rates, decay
     rates, etc. Balances are required to return to the same category.

2. Are there any limitations on automated control of pricing, re-pricing, embedded caps/floors,
   or teaser rates?
   Characteristics within Risk Analytics are modeled as static regardless of rate shock level, though
   all characteristics can be defined.
3. Can the model effectively amortize discounts/premiums in any defined alternate interest rate scenario?
   No

4. Can the model effectively address unique balance sheet items (e.g. off-balance-sheet positions, mortgage servicing rights, loan pipelines, indirect lending)?
   No. Data to be utilized must be aggregated into a single net position and input to handle off-balance sheet positions at the base level. No ability within the model to vary the net position under rate shock levels.

F. PRICING, RE-PRICING, OPTION-RELATED CAPABILITIES, INTEREST RATE SCENARIOS AND MISCELLANEOUS

1. Who defines contractual inputs (e.g., pricing spreads, re-pricing limits)?
   The client may dictate or FIMAC will calculate annually (or more frequently as needed) utilizing the clients’ current and historical data.

2. How does the model obtain information on investments or FHLB advances with puts or calls in alternate interest rate scenarios?
   The model does not conduct alternative rate scenarios.

3. Who defines re-pricing and decay rates (or similar inputs) to core deposits by interest rate scenario? Are there any limits on specifying assumptions (e.g. repricing lags, scenario specific decay rates)?
   All subjective type assumptions are calculated by FIMAC annually (or more frequently as needed) from current and historical data or, at the client’s direction, assumptions they prefer to utilize.
   Limited capability.

4. How does the model calculate core deposit present values? Can user-defined non-interest expense inputs be accurately applied in core deposit present value calculations?
   Core deposit present values are calculated using the cash flows generated by the assigned decay rates and then discounted at an agreed upon discount rate, generally an external rate. The Risk Analytics model does not utilize non-interest expense inputs.

5. What standard IRR tests are provided? Can (and how) does the model define rate ramps (and/or rate shocks) that test for yield curve shape change basis risk?
   The Risk Analytics model conducts only immediate and parallel rates shocks under a static balance sheet assumption, though the Balance Sheet Manager module is utilized to conduct ramps and curve changes, but does not back test the results.

6. Describe the model's analysis and reporting capabilities for standard IRR tests and other forecasts.
   The model produces expected NII, NI, and NEV/EVE under all scenarios modeled along with an analysis of capital, liquidity, the investment portfolio, comparative analysis from the previous model run, duration under all scenarios, and a breakdown of the components of NII, NI, and EVE/NEV along with 2 types of Gap reports.
   Also delivered are a Variance Report, Back Testing Report, Sources of Risk Report and Cash Sources and Uses packets.
7. Can the model export IRR inputs and outputs and report to spreadsheets or other financial information reporting products?
   Yes, though limited.

8. Can the model readily produce outcome analyses (e.g. back tests and retrocasts) of prior forecasts and behavior assumptions?
   Yes. See #6.

9. What internal liquidity analysis capabilities does the model have? Can the model interface with typical internal liquidity models and contingency funding plan spreadsheets?
   It does not.

10. Does the model have stochastic forecasting capability? If so, describe it.
    No.

11. Can custom (institution-specific) equations for loan prepayments, core deposit behaviors, and CD options be embedded in the model to drive cash flow behaviors by interest rate scenario?
    Limited capacity

G. OPEN-ENDED COMMENTS

Our outsourced services can be utilized from simple data entry and model operation to a total and complete ALM/IRR, liquidity, and balance sheet management solution that eliminates any internal need for expertise or significant time commitments. We bring the knowledge of a professional ALM/IRR practitioner to you.

We offer four standard levels of service:
   Foothills
   Sierra
   High Country
   Peak Performance

Each subsequent level adds additional services and advice up to and including attendance at ALCO and/or Board meetings, planning sessions, and providing education to non-financial members of ALCO. Some levels of service also include annual analytics conducted to correctly estimate subjective assumptions required for modeling. Liquidity work and stress testing is included in most service levels.

All levels of service include a written analysis and explanation of the current position, review of all information required for Board and ALCO, economic outlook from rotating sources, a discussion of any systemic trends or issues of importance, and a discussion of strategies to accomplish the institution’s goals while maximizing income, and managing IRR, capital and liquidity, all within each clients defined risk profile.

Contact us today to learn which level of professional service is right for your institution.
A. GENERAL INFORMATION

1. Vendor contact information
   Greg Garcia
   Managing Director
   FinPro, Inc.
   158 Route 206
   Gladstone, NJ 07934
   ggarcia@finpro.us
   908-604-9336
   www.finpro.us

2. Describe the general nature of the current client base (charters, asset range, business models)
   Community banks and credit unions with asset sizes ranging from $50mm to $10billion in total assets and a wide range of balance sheet structures and complexity. Our client base spans all primary regulatory agencies.

3. Number of active outsource clients
   70

4. Describe any relevant special client characteristics addressed by the model (e.g. mortgage servicing rights, loan pipeline management, indirect lending)
   Off-balance sheet derivatives, forecasting of CD early withdrawals, integration with budgeting, deposit retention analysis, mortgage servicing rights, purchased accounting, multiple-bank holding companies, hedging activities, detailed cash-flow projections, cost center level detail, integrated asset migration, and strategic planning.

B. MODEL USER SUPPORT PROGRAM

1. Toll-free, phone-based user support group (enter “yes” or “no”)
   Yes

2. Location(s) of the phone support group
   Gladstone, NJ and Buffalo, NY

3. Hours during which phone support group operates
   8:00 am – 5:00 pm EST

4. Number of phone support group staff normally available
   12

5. Typical time to resolve client inquiries by phone support group
   Several minutes
6. Web-based user support function (enter “yes” or “no”)
   No

7. If your response to question 6 is “yes”, typical time to resolve client inquiries by web-based user support function?
   N/A

8. Other unique client support characteristics of special note (e.g. user training institute, annual user conference, local user groups)
   Quarterly Economic and Interest Rate Outlook Webinars included with all ALCO services. FinPro works directly with all major core system providers to ensure easy and accurate transfer of data. Additional webinars, management training, board training and annual conferences also provided.

C. MODEL(S) USED IN OUTSOURCE ENGAGEMENT
   1. Model(s) name(s)
      FinPro Asset Liability Management Model

   2. Current version(s) number(s)
      Version 1509

   3. Date(s) of last major model update(s)
      March 2015

   4. Do you also offer the model(s) as an in-house solution?
      No

   5. What other vendor-provided financial management products directly interface with the model?
      Strategic planning, budgeting, capital planning, enterprise risk management, investment advisory, deposit analysis, and asset migration.

D. MECHANICS OF OUTSOURCE RELATIONSHIP
   1. How are balance sheet data (G/L, maturity, repricing, and contractual options) and behavior assumptions (loan prepayments, core deposit behaviors, and CD options) transferred to you?

      Balance sheet data is transferred through a series of data extract files that are provided by the client through a secure server. The data extract files are created through the client’s data processor and bond accounting provider; we work with all major EDPs and accountants. These files contain all pertinent cash flow characteristic data based on FinPro’s required data format. This data includes balance, rate, amortization, re-pricing data, cap/floors, optionality, balloon maturity, interest only, nonaccrual status, loan grading, risk-weighting, etc.

      Behavior assumptions such as prepayment speeds on loans and MBS, beta values, decay rates, time lags, and future yields/costs are developed in consultation with the client and are unique to each institution using their own data. FinPro assists in the analysis and development of the
assumptions. Behavior assumptions are discussed and revised before each reporting period and FinPro also provides periodic stress-testing of behavioral assumptions.

We also assist in validating prepayment speed assumptions on loans as well as developing/validating deposit decay and beta value assumptions.

2. At what point and by whom is the “run-ready” IRR model approved?

Each client is assigned a personal FinPro client manager who is responsible for the approval of the “run-ready” IRR model only after consulting with the client on behavioral assumptions.

3. How fast are IRR analyses provided to the client after the final data is approved?

Variable based on the client, but typically within one week after behavioral assumptions have been finalized.

4. How are completed IRR reports sent back to the institutions (e.g. Word, Excel, pdf)?

A report in .pdf format and exhibits in excel format are uploaded to each client via a secure website that is unique to each institution.

5. Describe the format and content of your standard IRR client report.

Asset liability reports are delivered in either Powerpoint or PDF format. The report includes a detailed Executive Summary section that is specifically tailored to each institution and addresses all key areas of interest rate risk, including performance to policy limits, in a summary fashion.

The Executive Summary is followed by a more detailed Appendix section that has in-depth analytics on each area of interest rate risk. The Appendix also includes back testing results, IRR performance comparison to FinPro’s client universe, policy limit comparison to FinPro’s client universe, quarterly peer comparison trends, historical balance sheet and income statement trends, liquidity analysis, contingency funding stress testing, and detailed assumptions.

6. Who is responsible for IRR analysis quality assurance?

The FinPro client manager is responsible for quality assurance.

7. If needed, how are reruns of a period’s IRR analysis handled?

Ideally, a unique scenario requested by the client is determined prior to initial run. However, changes to financial statements or unique circumstances may require reruns. All reruns are handled by the FinPro client manager in a timely manner that is agreed upon by the client.

8. Are there written operating guidelines for clients and vendor staff?

Yes. There is a set of operating guidelines and checklists for FinPro staff.

9. How are client questions or disputes remediated?

The FinPro client manager is responsible for answering any client related question or dispute. Questions or disputes are remediated through verbal communication and are followed up with written communication.
E. CHART OF ACCOUNTS

1. Identify any special features and/or limitations of the model’s ability to address the balance sheet behaviors listed below

- **Limitations to the number of accounts/categories that can be modeled**
  
  FinPro models at the account level. There are no limits on the number of accounts that can be modeled.

- **Detailed re-pricing and maturing balances for categories without embedded options**
  
  Each unique asset and liability account is modeled at the instrument level based on the unique re-pricing, amortization and maturity characteristics assigned to each account that is provided by the data extract file.

- **Interest rate adjusted re-pricing and maturing balances for categories that have continuous and call/put embedded options**
  
  Each unique asset and liability account is modeled at the instrument level based on the unique re-pricing, amortization and maturity characteristics assigned to each account that is provided by the data extract file.

  The required data extract file contains the appropriate fields necessary to properly model embedded options, step-up coupons, adjustable or floating rate products, balloon, floors, caps, interest only payments, etc.

- **Re-pricing and maturing balances for unique categories (e.g., hybrid ARMs, teaser products, step-up/callable CD’s or FHLB advances)**
  
  Each unique asset and liability account is modeled at the instrument level based on the unique re-pricing, amortization and maturity characteristics assigned to each account that is provided by the data extract file.

  The required data extract file will have the appropriate fields necessary to properly model embedded options, step-up coupons, adjustable or floating rate products, balloon and interest only payments, etc.

- **Re-pricing and maturing balances for indeterminate behavior categories (e.g., core deposits, lines of credit, credit card outstandings)**
  
  Each unique asset and liability account is modeled at the instrument level based on the unique re-pricing, amortization and maturity characteristics assigned to each account that is provided by the data extract file.

  Non-maturity deposit re-pricing behaviors are modeled based on beta value and time lag assumptions provided by the client after consultation with the FinPro client manager. Lines of credit and credit card outstandings are based on book balance at the time of the analysis and re-price and/or mature based on their unique cash flow characteristics.

2. Are there any limitations on automated control of pricing, re-pricing, embedded caps/floors, or teaser rates?

No, FinPro’s model is comprehensive.
3. Can the model effectively amortize discounts/premiums in any defined alternate interest rate scenario?
   Yes. The model adjusts discounts/premiums based on changing cash flow created from alternate interest rate scenarios.

4. Can the model effectively address unique balance sheet items (e.g. off-balance-sheet positions, mortgage servicing rights, loan pipelines, indirect lending)?
   Yes.

**F. PRICING, RE-PRICING, OPTION-RELATED CAPABILITIES, INTEREST RATE SCENARIOS AND MISCELLANEOUS**

1. Who defines contractual inputs (e.g., pricing spreads, re-pricing limits)?
   The fields within the data extract files will define the contractual inputs on an account level basis for current cash flows. Future cash flow inputs are defined by the client after consultation with a FinPro client manager.

2. How does the model obtain information on investments or FHLB advances with puts or calls in alternate interest rate scenarios?
   The FinPro data extract template has all of the pertinent information necessary for the model to calculate puts or calls in alternative rate scenarios.

3. Who defines re-pricing and decay rates (or similar inputs) to core deposits by interest rate scenario? Are there any limits on specifying assumptions (e.g. repricing lags, scenario specific decay rates)?
   The client defines beta values, time lags and decay rates to non-maturity deposits for each of the interest rate scenarios. These assumptions are determined after consultation with a FinPro client manager and are based on historical behavior of each client’s deposit base. Beta values and decay rates can be scenario specific.

4. How does the model calculate core deposit present values? Can user-defined non-interest expense inputs be accurately applied in core deposit present value calculations?
   All interest bearing non-maturity core deposit present values are determined based on discounted cash flow (DCF) calculations.

   The model has the capability to apply noninterest expenses to core deposits when calculating present values.

5. What standard IRR tests are provided? Can (and how) does the model define rate ramps (and/or rate shocks) that test for yield curve shape change basis risk?
   The standard IRR tests provided are Economic Value of Equity (EVE), Net Interest Income Sensitivity (NII) and Gap. The model also has the capability to do dynamic modeling of net interest income sensitivity based on dynamic changes to the balance sheet.

   The model has standardized rate shock and rate ramp capability that accounts for the changing shape of the yield curve. The rate shocks are based on 100 bps increments but can be modified by the client as needed. FinPro provides several rate ramp scenarios that are reviewed and revised on a quarterly basis based on future economic and interest rate forecasts. Many clients also define unique rate scenarios to be run within the model.
6. Describe the model’s analysis and reporting capabilities for standard IRR tests and other forecasts.

All regulatory required analyses and scenarios are contained within the model and report. Additionally, the client can, and most often, includes dynamic changes to the Bank’s balance sheet and alternative interest rate and economic scenarios.

Clients can either select the standard “static” balance sheet report that is required by regulation or the “dynamic” report that incorporates the more realistic dynamic balance sheet modeling (shift in product mix, growth, etc.) and budgeting.

7. Can the model export IRR inputs and outputs and report to spreadsheets or other financial information reporting products?

Yes. Output and assumption exhibits are provided to clients in electronic spreadsheet format.

8. Can the model readily produce outcome analyses (e.g. back tests and retrocasts) of prior forecasts and behavior assumptions?

Yes, back testing of the previous reporting period’s forecast is part of all ALM reports. Any material model variances are researched and discussed with the client.

In addition, we have the ability to conduct historical non-maturity deposit decay, beta value and depositor loyalty studies to verify that the modeling assumptions being utilized reflect actual behavior at the financial institution.

9. What internal liquidity analysis capabilities does the model have? Can the model interface with typical internal liquidity models and contingency funding plan spreadsheets?

The ALM Report analyzes an institution’s liquidity position and stress tests its contingency funding plan. Yes, the model and report can incorporate internal liquidity and contingency funding limits and internal analyses as needed.

10. Does the model have stochastic forecasting capability? If so, describe it.

No.

11. Can custom (institution-specific) equations for loan prepayments, core deposit behaviors, and CD options be embedded in the model to drive cash flow behaviors by interest rate scenario?

Yes, but only after sufficient review and documentation of the customization has been verified with FinPro.

G. OPEN-ENDED COMMENTS

FinPro’s Asset Liability Management Service utilizes FinPro’s proprietary ALM model to provide the analytics necessary to define, measure, monitor, and manage interest rate risk.

Managing interest rate risk is not just a regulatory requirement but an essential element to the overall success of your institution. With FinPro, you’ll receive the most accurate analytics possible, in a format that is easy to comprehend, so you can make informed decisions more efficiently. Our service will analyze the key elements to managing interest rate risk including GAP and Economic Value of Equity (EVE) analyses, as well as a Net Interest Income Simulation over a 24 month time...
period. We also incorporate internal policy limits and compare each of these ratios against those limits.

Reliable and accurate information is the key to managing interest rate risk. Our independently audited model empowers you to make accurate decisions by:

- Measuring interest rate risk in account-by-account detail for all investments, loans, deposits, and borrowings
- Incorporating specific product details including call options, prepayment speeds, deposit decay rates, beta values, and actual repricing information
- Producing customized interest rate scenarios to capture "realistic" rising and falling interest rate environments, as well as instantaneous rate shock scenarios

By outsourcing the ALM process, management can focus on implementing the strategies necessary to manage interest rate risk while maximizing value of their institution. The FinPro ALM process includes:

- Data collection and manipulation
- Consultation with the institution to customize analysis and reports
- ALM modeling and analysis
- Report presentation

Once the data is compiled, a FinPro consultant will analyze the data and produce a report with commentary in a format that is easy to comprehend. Our interest rate risk report includes:

- Current and projected interest rate risk analysis including Gap, NPV, and Net Interest Income analysis
- Historical trend analysis of investments, loans, deposits and borrowings in account level detail
- In-depth analysis of the time deposit portfolio including remaining maturity balance and repricing of maturing time deposit balances
- Peer comparisons
- External interest rate environment reports
- Threats, opportunities, and strategies

At FinPro, we're tied to the overall success of your institution. We frequently facilitate presentations to the Board and Management to discuss interest rate risk, as well as any other banking topics. At the client's request, we can also provide investment advice, balance sheet restructuring recommendations, IRR and ALM training, and interest rate risk and ALCO policy review.
A. GENERAL INFORMATION

1. Vendor contact information
   Mark H. Smith, Inc.
   2860 W 4700 South, Suite D
   Salt Lake City, UT 84129
   800.268.7795
   Mark H. Smith, Owner E-mail: mark@markhsmith.com
   Cynthia Walker, CEO E-mail: cynthia@markhsmith.com
   www.markhsmith.com

2. Describe the general nature of the current client base (charters, asset range, business models)
   Federal and State Chartered Credit Union clients. Asset range $20 million to $1 billion.

3. Number of active outsource clients
   Combined ALMPro Products 340

4. Describe any relevant special client characteristics addressed by the model (e.g. mortgage servicing rights, loan pipeline management, indirect lending)
   --

B. MODEL USER SUPPORT PROGRAM

1. Toll-free, phone-based user support group (enter “yes” or “no”)
   Yes

2. Location(s) of the phone support group
   Salt Lake City, Utah

3. Hours during which phone support group operates
   7:00 am to 6:00 pm Mountain Time

4. Number of phone support group staff normally available
   5

5. Typical time to resolve client inquiries by phone support group
   1 hour or less.

6. Web-based user support function (enter “yes” or “no”)
   Yes
7. If your response to question 6 is “yes”, typical time to resolve client inquiries by web-based user support function?
   1 hour or less.

8. Other unique client support characteristics of special note (e.g. user training institute, annual user conference, local user groups)
   The professional and knowledgeable staff at Mark H. Smith, Inc. offer comprehensive and ongoing support. This includes staff training, ALCO training and participation in meetings as needed, board training, analysis, balance sheet management and liquidity consulting.

C. MODEL(S) USED IN OUTSOURCE ENGAGEMENT

1. Model(s) name(s)
   - In-house developed ALMPro and ALMPro PLUS rev20150630
   - ALMPro Premier (Licensed Farin Foresight 5.2.17.21) (Re-brand of the Farin Foresight Model for larger outsource clients that need instrument level analytics)

2. Current version(s) number(s)
   see above

3. Date(s) of last major model update(s)
   - ALMPro and ALMPro PLUS last updated June 2015
   - Farin Foresight last updated September 2015

4. Do you also offer the model(s) as an in-house solution?
   No

5. What other vendor-provided financial management products directly interface with the model?
   Liquidity analysis and budgeting models.

D. MECHANICS OF OUTSOURCE RELATIONSHIP

1. How are balance sheet data (G/L, maturity, repricing, and contractual options) and behavior assumptions (loan prepayments, core deposit behaviors, and CD options) transferred to you?
   We strive to make the transfer of data as easy as possible for our clients. Data can be submitted via email, fax or uploaded to our secure FTP site. We can accept many file layouts and try to use reports and data extracts already available. We do not require a special data extraction. We will work with the client’s DP vendor to have data sent directly to us if requested.

2. At what point and by whom is the “run-ready” IRR model approved?
   Model assumptions are developed at the beginning of the setup process based on data available, combined with industry and experience knowledge. Draft reports will be run and then management and a senior analyst will review and work together to adjust assumptions. Once the setup is complete, the client may work with an IRR professional quarterly or as needed to incorporate revisions, review assumptions, have a consultation, discuss strategies, or prepare alternative scenarios.
3. How fast are IRR analyses provided to the client after the final data is approved?
   Same Day.

4. How are completed IRR reports sent back to the institutions (e.g. Word, Excel, pdf)?
   PDF

5. Describe the format and content of your standard IRR client report.
   All reports, regardless of the model platform, have an executive management dashboard page with Income Simulation, NEV, Liquidity, current net worth ratios, and earnings summary combined with a comparison to policy limits. The remainder of the report provides:
   - Assumptions details
   - Policy limits
   - Description of analysis for end users
   - Detailed income simulation comparing base case to shock scenarios for year 1, year 2 and year 3, and 3 year cumulative.
   - Income simulation historical trend graphs
   - Forecasted Net Worth, Net income, Net Interest margin, and ROA graphs
   - Forecasted yields by quarter for loans, investments and deposits
   - NEV analysis with market value changes by category
   - Net Economic Value historical trend graphs
   - Net Economic Value with NMS at Par
   - Liquidity ratios and trends
   - Liquidity coverage ratio
   - Likely, moderate and severe stress 12 month cash flow forecast
   - Net worth ratio historical recap and graphs
   - Income statement and balance sheet historical recap and graphs
   - Customized reports can be provided

6. Who is responsible for IRR analysis quality assurance?
   MHSI senior analyst reviews all reports and established internal check figures. Financial institution will also designate an internal person or ALCO member to double check inputs and assumptions.

7. If needed, how are reruns of a period’s IRR analysis handled?
   The client can email or call us. Problems or reruns are handled quickly and a revised report will be sent as quickly as possible, but at the very latest it will be in the same day.

8. Are there written operating guidelines for clients and vendor staff?
   Yes

9. How are client questions or disputes remediated?
   Clients can call or email the CEO or the analyst they are most comfortable with. We will do everything possible to answer their questions in a friendly and timely manner. If a dispute arises, which is very rare, we will make every effort the make the client happy or issue a full refund.
E. CHART OF ACCOUNTS
1. Identify any special features and/or limitations of the model’s ability to address the balance sheet behaviors listed below

- **Limitations to the number of accounts/categories that can be modeled**
  
<table>
<thead>
<tr>
<th>ALMPro Models</th>
<th>ALMPro Premier</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 loan categories</td>
<td>Unlimited loan categories</td>
</tr>
<tr>
<td>12 Investment categories</td>
<td>Unlimited investment categories</td>
</tr>
<tr>
<td>13 Deposit types</td>
<td>Unlimited deposit categories</td>
</tr>
</tbody>
</table>

- **Detailed re-pricing and maturing balances for categories without embedded options**
  
  **ALMPro Model**

  Loan repricing aggregated by account type based on average maturity or repricing characteristics for each loan category. Investments re-pricing by instrument. Model incorporates unique maturity, steps, calls and other reset dates. NMD deposits modeled with user defined cash flows, rate sensitivities, and maturities based on credit union specific data or industry index. Repricing based on actual maturity schedule for time deposits.

  **ALMPro Premier Model**

  No limitations in modeling the most basic of instruments. These instruments have no options, therefore they reprice as cash flows occur or as contracts allow. Data provided on repricing from core systems will drive the specific future rate.

- **Interest rate adjusted re-pricing and maturing balances for categories that have continuous and call/put embedded options**
  
  **ALMPro Model**

  Continuously callable investments can be modeled at instrument level based on contractual provisions. Limitation on index and rate curve variables.

  **ALMPro Premier Model**

  Continuously callable instruments can be modeled at instrument level based upon contractual provisions, with a separate final maturity date. The call function can be set to a specific strike price related to an index, curve or rates where the model will review the remaining final maturity of the instrument using current rates and determine if, based on the curve, the option has triggered a call event.

- **Re-pricing and maturing balances for unique categories (e.g., hybrid ARMs, teaser products, step-up/callable CD’s or FHLB advances)**
  
  **ALMPro Models**

  Repricing information for unique categories will be modeled as close as possible to the terms of the product, but may be aggregated. In instances where terms on investments such as steps-up/callable features are defined, these are modeled by instrument.

  **ALMPro Premier Model**

  Existing data has its own repricing information such as next reprice date, subsequent reprice, frequency, rate index, margin and caps. This information is used on existing positions to determine rates. For planned purchases, the overall account characteristics define the basic structure and then assumptions on current rates, repricing rates, calls, etc. are handled as an assumption within the plan.
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- Re-pricing and maturing balances for indeterminate behavior categories (e.g., core deposits, lines of credit, credit card outstandings)

  **ALMPro Model**
  Decay rates and cash flows can be defined by the end user or an industry index. Decay rates can be customized for each account type which can be expanded up to 13 categories. Decay, lags, and rate sensitivities can be customized for each category. Lines of credit and outstanding credit card behavior may be manually customized.

  **ALMPro Premier Model**
  For the purposes of modeling indeterminate accounts, the client may elect to apply decay rates to create assumed “maturity structures” for valuing cash flows. However, repricing is a function that is controlled via assumptions on offer rates and will be applied to the entire balance in the period being analyzed. We have separated the assumed core deposit run-off from the projections of balance levels and allowed the user to control expected outcomes when forecasting income at risk and future balance levels.

2. Are there any limitations on automated control of pricing, re-pricing, embedded caps/floors, or teaser rates?

   **ALMPro Model** – Partial and manual customization aggregated balance.
   **ALMPro Premier** - No

3. Can the model effectively amortize discounts/premiums in any defined alternate interest rate scenario?

   **ALMPro Model** – No. Some manual customization optional if material.

   **ALMPro Premier** - Yes, users have the ability to define the amortization of discounts or premiums on a straight line basis, level yield basis or with the projected cash flows of the associated balances. If the institution has a specific schedule to write down, the model accepts a “cash-flow definition” for the projected write-down by rate environment.

4. Can the model effectively address unique balance sheet items (e.g. off-balance-sheet positions, mortgage servicing rights, loan pipelines, indirect lending)?

   **ALMPro Model** – No, unless manually customized.
   **ALMPro Premier** – Yes

F. PRICING, RE-PRICING, OPTION-RELATED CAPABILITIES, INTEREST RATE SCENARIOS AND MISCELLANEOUS

1. Who defines contractual inputs (e.g., pricing spreads, re-pricing limits)?

   Inputs for both model platforms are data dependent, with customization jointly with IRR professional and end user. Data received via downloads, spreadsheets or manually.

2. How does the model obtain information on investments or FHLB advances with puts or calls in alternate interest rate scenarios?

   **ALMPro Model** – assumptions can be customized for different rate scenarios based on data available.

   **ALMPro Premier** incorporates supplied external rate drivers (over 150 driver rates) are automatically updated. User-defined rates may be communicated by client to the analyst.
3. Who defines re-pricing and decay rates (or similar inputs) to core deposits by interest rate scenario? Are there any limits on specifying assumptions (e.g. repricing lags, scenario specific decay rates)?

**ALMPro Model**
Re-pricing on adjustable-rate loans are aggregated with floors, caps, ceiling rates, and dates and frequency of repricing by product type based on client input. Industry re-pricing and decay rates on core deposits by interest rate scenario are available for client use if deposit information not available. Client customized decay rates may be incorporated with no limits.

**ALMPro Premier**
Existing contracts such as adjustable-rate loans offer two options. The data can be received on the loans during the import function or the client can use “default” data in lieu of specifics from the processor. The specifics on the loans can be imported from the core system with specific repricing information on each loan regarding the index, spread, floor, cap, ceiling rates and dates or frequency of repricing.

As for non-maturity accounts, and for all new balances that are booked in a forecast, the relationships on the offer rate can be set using a traditional spread/index relationship, or the analyst can apply a formula using multiple factors to calculate a rate, or a specific rate may be entered. Additionally, trends/regressions on offer rates can be built with enough historical information.

4. How does the model calculate core deposit present values? Can user-defined non-interest expense inputs be accurately applied in core deposit present value calculations?

**ALMPro Model** calculates present value based on projected cash flow for each rate scenario. Cash flows can also be customized by quarter for up to 10 years. The present value calculation accounts for rate sensitivities and repricing lags. User defined non-interest expense or industry non-industry expense is included in the calculation.

**ALMPro Premier** allows for both pricing and decay specified by interest rate scenario. Cash flows are generated and they are present valued back using a discount rate function. Costs can be inserted as a (negative cash flow) into the cash flows that are generated and they also will be present valued back.

5. What standard IRR tests are provided? Can (and how) does the model define rate ramps (and/or rate shocks) that test for yield curve shape change basis risk?

**ALMPro Model** NII simulation and NEV, GAP, NMS at par analysis are standard tests. Shock scenarios are assumed to be instantaneous and parallel in user defined increments of typically 100 basis points.

**ALMPro Premier** NII simulation and NEV, GAP, NMS at par analysis are standard tests. The model can also import rate ramps or the user can define their own. In addition, the model supplies external rate drivers (over 150 driver rates) that are updated via a Web interface.

6. Describe the model’s analysis and reporting capabilities for standard IRR tests and other forecasts.

**ALMPro Model** uses standard income simulation to project the amount and timing of cash flows at aggregated account levels, replacing runoff balances with similar products and terms. Cash flows are customized for investments products. The time horizon is 36 months. A static balance sheet and limited growth is assumed. Growth in deposits may be customized. Value at risk (NEV) is discounted cash flows for each balance sheet category and will include a base case or current
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market valuation compared to each shock scenario. The model can present up to 6 different scenarios at one time.

**ALMPro Premier** uses standard income simulation techniques to project the amount and timing of cash flows on all instruments, replacing runoff balances with client-controlled projections for future activities. The analysis horizon can be as short as 1 month and as long as 72 months. Results can be examined under any combination of interest rate projections or forecasts over the selected horizon, and various reports showing earnings at risk levels can be run to report risk levels.

In addition to the earnings at risk, ALMPro Premier calculates value at risk using discounted cash flow analysis. This analysis can be run on current, past or projected future balance sheet positions. When running under a projected scenario, the model allows users to run a series of baseline interest rate projections that would occur during the forecast, then stresses those new rate levels to create a lattice of projected value-at-risk possibilities based upon possible interest rate movements. This process is called dynamic value at risk and must be considered under multiple interest rate forecasts during the projection period to accurately assess all potential risks.

7. Can the model export IRR inputs and outputs and report to spreadsheets or other financial information reporting products?

All **ALMPro and ALMPro Premier** reports can be exported to CSV files for use in any other application. In addition, reports can be directly exported individually, or as a group, to Adobe PDF format for ease of report packet production.

8. Can the model readily produce outcome analyses (e.g. back tests and retrocasts) of prior forecasts and behavior assumptions?

**ALMPro and ALMPro Premier** Yes

9. What internal liquidity analysis capabilities does the model have? Can the model interface with typical internal liquidity models and contingency funding plan spreadsheets?

**ALMPro Model** contains static liquidity indicators. A 12 month liquidity report is based on projected sources and uses of funds, customized with management input. Three liquidity scenarios: likely, moderate and severe stress to identify potential shortfalls. Liquidity coverage ratio included.

**ALMPro Premier** contains a liquidity report that is based on the projected sources and uses of funds in a plan. This approach helps identify key assumptions in managing liquidity levels and plan for stress tests on these assumptions to understand the implications of a missed projection. This reporting can include dynamic projections of external funding sources, stress test key assumptions such as deposit run-off or prepayment speed changes. These are typical adjustments and tests found in many contingency funding plans. Of course, all outputs can be saved to formats compatible with external spreadsheets should the client prefer to use a different format or methodology.

10. Does the model have stochastic forecasting capability? If so, describe it.

**ALMPro Model** No

**ALMPro Premier** Yes - The user selects the forecast and set of output parameters desired. The user may also define the number of rate paths to run. Output is saved to a CSV file to make the output file results easy to manipulate in Excel.

As a part of the Monte Carlo engine, users may elect to run forecast market value calculations at
the end of the forecast to test the long-term interest rate risk in the resulting strategies. This option helps to more fully assess the trade-off between income and value at risk in the different what-if scenarios.

11. Can custom (institution-specific) equations for loan prepayments, core deposit behaviors, and CD options be embedded in the model to drive cash flow behaviors by interest rate scenario?

   **ALMPro Model** – All loan prepayment assumptions, deposit assumptions and CD option inputs can be customized to reflect institution specific behaviors in different rate scenarios.

   **ALMPro Premier** has the ability to use formulas to drive future projected balances and offering rates. These assumptions can be written to adjust levels based upon many different factors, including market interest rate levels.

**G. OPEN-ENDED COMMENTS**

Mark H. Smith, Inc. offers three levels or analysis to fit your credit union’s asset size and balance sheet complexity. The ALMPro Classic and ALMPro PLUS are reputable, and time-tested IRR models which include income simulation, NEV analysis, cash flow forecasting, stress testing and ratio analysis. They are designed to be user friendly and cater to smaller or less complex credit unions searching for a cost effective solution. These ALMPro models provide reliable analysis and results with easy to understand reports and data inputs. When compared to other industry models, the outcomes are very similar.

The ALMPro Premier is a solution for credit unions that needs a more comprehensive IRR analysis due to a complex investment portfolio or large variable rate or balloon loan portfolios. This model is sophisticated, and incorporates instrument level analytics, variable cash flows, multiple rate paths, and different rate indexes.

Mark H. Smith, Inc. has been in business for more than 25 years and all our clients can capitalize on our broad and objective expertise accumulated from assisting over 400 credit unions across the country. Our expert advisors support you with vital industry experience and understanding. We are an outsource solution that saves you time and takes the burden of assessing your credit union’s interest rate risk out of your workload. When working with us there will not be a conflict of interest that may arise when your investment broker or advisor provides the IRR analysis. Clients benefit from dedicated support throughout the entire process, which includes the following: comprehensive phone support, training for staff, training for ALCO and boards, participation in meetings, assumption reviews, help during regulatory exams, assistance with regulator concerns and responses, consulting, and planning. We strive to provide outstanding, helpful and friendly service.
A. GENERAL INFORMATION
   1. Vendor contact information
      McQueen Financial Advisors, Inc.
      26676 Woodward Avenue
      Royal Oak, MI 48067
      Phone 248-548-8400
      Web address: www.m-f-a.com
      Email: info@m-f-a.com

   2. Describe the general nature of the current client base (charters, asset range, business models)
      McQueen Financial Advisors provides an outsourced ALM solution. Our process ensures accuracy and limits the time consuming tasks associated with desk-top models. This allows management to focus on other strategic priorities and growth.

      McQueen Financial supports clients from $10 million in assets to over $3 billion.

      Clients include credit unions and community banks.

      We have clients in 18 states.

   3. Number of active outsource clients
      143

   4. Describe any relevant special client characteristics addressed by the model (e.g. mortgage servicing rights, loan pipeline management, indirect lending)
      The Model captures the reset characteristics of a variety of unique holdings, including:
      - High yield / discounted loan products
      - Merger purchase accounting including loans, investments and deposits
      - Mortgage Servicing Rights
      - Rate sensitive non-interest income and expense
      - Callable step up bonds
      - Client-specific deposit retention, beta and prepay speed assumptions
      - Variable rate loans locked out in rising rate scenarios

B. MODEL USER SUPPORT PROGRAM
   1. Toll-free, phone-based user support group (enter “yes” or “no”)
      Phone based support, 248-548-8400 (not toll free)

   2. Location(s) of the phone support group
      Royal Oak, MI
3. Hours during which phone support group operates
   8:00 AM to 6:00 PM EST

4. Number of phone support group staff normally available
   Six

5. Typical time to resolve client inquiries by phone support group
   Fifteen to twenty minutes

6. Web-based user support function (enter “yes” or “no”)
   Support is offered via phone calls and email to our staff.

7. If your response to question 6 is “yes”, typical time to resolve client inquiries by web-based user support function?
   E-mail inquiries are normally resolved before the close of business on the day received.

8. Other unique client support characteristics of special note (e.g. user training institute, annual user conference, local user groups)
   McQueen Financial provides on-site ALM training for all clients. We hold regional user conferences. Additionally, we provide economic projections for each local region.

C. MODEL(S) USED IN OUTSOURCE ENGAGEMENT

1. Model(s) name(s)
   McQueen Financial Asset Liability Management Model

2. Current version(s) number(s)
   7.1.14.2

3. Date(s) of last major model update(s)
   June 2014

4. Do you also offer the model(s) as an in-house solution?
   No

5. What other vendor-provided financial management products directly interface with the model?
   Several McQueen models interface with the ALM model. The output from the models is incorporated into future ALM model runs:
   • McQueen Mortgage Servicing Rights Valuation: Value is measured in the base case and a variety of scenarios.
   • McQueen Financial Investment Reporting: The report includes cash flow and value over a wide range of scenarios.
   • McQueen Prepayment Speed Analysis: The report measures client-specific prepay speeds for each ALM category.
   • McQueen Core Deposit Study: The study measures non-maturity deposit retention and
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In addition to standard ALM reports the optional reports include:

- **McQueen Liquidity Stress Testing**: Report includes ratio analysis and forward-looking liquidity stress assuming a wide range of possible events.
- **McQueen Assumption Sensitivity Analysis**: The report is a re-run of the ALM model using different and less-favorable assumptions. Test results are compared to a standard ALM report. The goal is to understand the importance of model assumptions and how the client’s risk profile may change if future conditions differ from what was assumed in a standard ALM report.
- **Growth Reports**: Clients are free to request as many growth reports as needed to measure the impact of budgeted growth or other planned activities (new branches, mergers, or other). A Growth Comparison Analysis reports the impact of growth on the client’s risk profile.
- **McQueen Budget Model**

The following 3rd party data may be used in the ALM model:

- Bloomberg
- Client-supplied bond accounting

**D. MECHANICS OF OUTSOURCE RELATIONSHIP**

1. **How are balance sheet data (G/L, maturity, repricing, and contractual options) and behavior assumptions (loan prepayments, core deposit behaviors, and CD options) transferred to you?**

   - All data is transmitted to McQueen Financial via our secure upload system.
   - All assumptions are client-specific and based on the unique institution and local market. Assumptions are carefully reviewed quarterly and tested to ensure appropriateness.
     - Loan prepayment assumptions are based on a mix of historical prepayments (as outlined in their prepayment study) and forecasted industry prepayments for each unique loan type, maturity term and interest rate.
     - Loan repricing is based on an analysis of the client’s unique product types, pricing strategy and competitive market place.
     - Treatment of non-maturity deposits is based on a historical core deposit study and historical deposit rate pricing analysis. Additionally, we look at each client’s unique setting and competitive environment to ensure accurate repricing assumptions.
     - Term deposits are analyzed individually for each client and recommendations are provided based on each unique situation.

2. **At what point and by whom is the “run-ready” IRR model approved?**

   A run ready IRR model is approved by the head of modeling. The approval is made only after full testing and an independent 3rd party review is complete.

3. **How fast are IRR analyses provided to the client after the final data is approved?**

   Our normal turn-around time is 3 to 6 business days.
4. How are completed IRR reports sent back to the institutions (e.g. Word, Excel, pdf)?

Reports are sent in a PDF format. Additionally, data or excel formats are available. Quarterly reports are followed up with a conference call and/or on-site client visit.

5. Describe the format and content of your standard IRR client report.

Each report is prepared using detailed loan, investment and deposit files. No summary data is used. There are three standard quarterly reports:

- **ALM Executive Summary** – This four page report provides the board and non-ALM professionals with a clear concise picture of the client’s risk profile, trends and projections. The report includes a yield and volume trend analysis for loans, investments, funding, income and margin. Income and NEVE sensitivity is presented over multiple gradual and shock scenarios. Three non-parallel scenarios are also included. Several performance and condition ratios are tracked against policy limits over time. The source of key model assumptions is also reported.

  McQueen’s Executive ALM Summary provides users with a useful condensed trend analysis of financial performance and interest rate risk. It includes condition ratios, performance measures and interest rates for the current period, the past several quarters, and one year forward. Unfavorable trends (if any) are quickly identified. The report enables management and the board to monitor interest rate risk and develop growth and/or risk mitigation strategies.

- **Full ALM Report** - This detailed report expands upon the ALM Executive Summary. It includes all risk, performance and condition ratios, policy limits and model assumptions. The report displays the following:
  - Executive Summary: 3 page narrative which describes McQueen’s model, our process and key assumption sources.
  - Overview of ALM Ratios: Performance and condition ratios are tracked over time and against policy limits. Out-of-policy conditions are clearly identified. This page can be customized to meet the unique needs of each client.
  - Liquidity Analysis: Normal and On-Hand liquidity is measured over one year.
  - Overview of Interest Rate Risk: The report includes parallel, gradual, and shock risk to net interest income and net income over one and two years. NEVE sensitivity is also shown. The pages can display up to 11 scenarios for net income, net interest income and NEVE (base case and +/- 100, 200, 300, 400 & 500 basis points). Test results are compared to policy limits with a ‘pass’ or ‘fail’ indicator.
  - 17/4 Test (Credit Unions Only): The 17/4 Test is a simple model used by examiners to assist in setting the scope of their ALM review. Failing the 17/4 test is not an indicator of severe interest rate risk, it simply means that the examiner may expand the scope of their exam. Our analysis compares the NCUA 17/4 test to McQueen’s calculated value sensitivity. The comparison is useful to show that risk to value is typically not nearly as severe as what the NCUA test would suggest.
  - Gap Analysis: Repricing gap is displayed over a variety of terms and compared to policy limits (if any).
  - Historical Balances and Yields: Volume and yield trends are displayed over time for each detailed loan, investment and funding category.
  - Volume and Rate Variance (Assets & Liabilities): Volume and yield trends are shown over time. A narrative section describes historical and projected results.
  - Net Interest Spread & Margin: Ratios are shown over time. A narrative section describes
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6. Who is responsible for IRR analysis quality assurance?

   Ultimately the President of McQueen Financial is responsible. The ALM manager is responsible for the accuracy of all reports. The head of modeling is responsible for accuracy of all modeling reports.

7. If needed, how are reruns of a period's IRR analysis handled?

   Model re-runs are available with a short turn-around time upon request. There is no cost for a re-run.

8. Are there written operating guidelines for clients and vendor staff?

   Yes, all operations and procedures are documented and shared with all parties.

9. How are client questions or disputes remediated?

   Measurement of interest rate risk requires significant data input and assumptions. Disputes or questions may be related to a variety of factors. We carefully determine if the inquiry is related to data or assumptions. Depending on the path, we either update model inputs or clarify model output. The resolution process ensures timely and accurate reporting.
E. CHART OF ACCOUNTS

1. Identify any special features and/or limitations of the model's ability to address the balance sheet behaviors listed below

- **Limitations to the number of accounts/categories that can be modeled**
  No Limitations. The chart of accounts can be customized to meet the unique needs of each client and repricing characteristics that impact risk. The chart of accounts is ‘mapped’ based on detailed client files. As an example, 30 year fixed real estate loans are typically split in multiple categories based on loan age and/or borrower rate. Each category may be assigned a different prepay speed assumption related to loan age or borrower refinance incentive.

- **Detailed re-pricing and maturing balances for categories without embedded options**
  No limitations. The model captures re-pricing characteristics using a detailed method.

- **Interest rate adjusted re-pricing and maturing balances for categories that have continuous and call/put embedded options**
  No limitations. Call and put options typically relate to investment securities. We use a variety of methods to capture potential calls across different rate scenarios. The analysis uses CUSIP-level detail. If available, clients provide us with this information from their bond accounting software.

- **Re-pricing and maturing balances for unique categories (e.g., hybrid ARMs, teaser products, step-up/callable CD’s or FHLB advances)**
  No limitations. The analysis uses CUSIP-level investment detail. We have also developed a proprietary ‘Step-Up Calculator’ for use in the rising rate scenarios. As needed, FHLB provides scenario values for each advance with a put feature (not common).

- **Re-pricing and maturing balances for indeterminate behavior categories (e.g., core deposits, lines of credit, credit card outstandings)**
  Model choices vary by product type. Calculations include:
  - Decay Rates
  - Beta
  - Average life
  - Duration

2. Are there any limitations on automated control of pricing, re-pricing, embedded caps/floors, or teaser rates?
   No limitation. The model captures repricing characteristics due to timing as well as caps, floors and teaser rates.

3. Can the model effectively amortize discounts/premiums in any defined alternate interest rate scenario?
   Yes, as defined by institution-specific schedules.

4. Can the model effectively address unique balance sheet items (e.g. off-balance-sheet positions, mortgage servicing rights, loan pipelines, indirect lending)?
   Yes.
F. PRICING, RE-PRICING, OPTION-RELATED CAPABILITIES, INTEREST RATE SCENARIO AND MISCELLANEOUS

1. Who defines contractual inputs (e.g., pricing spreads, re-pricing limits)?
   Inputs are client-specific and generally supplied by our clients. As needed, our analysts work with the client to determine appropriate inputs. A thorough testing process ensures that assumptions are reasonable and supported.

2. How does the model obtain information on investments or FHLB advances with puts or calls in alternate interest rate scenarios?
   Complex securities and borrowings are carefully reviewed on a line-level basis. CUSIP level analysis ensures that all unique investments are modeled correctly. We integrate our investment advisory team to analyze all complex securities to ensure proper modeling. Additionally, we employ internal modeling to ensure FHLB advances are properly modeled. As needed, value and sensitivity of FHLB Advances with put features may be obtained from the issuer.

3. Who defines re-pricing and decay rates (or similar inputs) to core deposits by interest rate scenario? Are there any limits on specifying assumptions (e.g., repricing lags, scenario specific decay rates)?
   Inputs are client-specific and may be derived from a variety of sources including historical analysis or a core deposit study. In other cases, a McQueen analyst works with the client to establish reasonable and appropriate model inputs. When a client-specific study is not available, inputs may be sourced from McQueen’s analysis of a broad range of institutions across multiple states. We obtain client approval for all model inputs and key assumptions.

4. How does the model calculate core deposit present values? Can user-defined non-interest expense inputs be accurately applied in core deposit present value calculations?
   Core non-maturity deposits are valued using present value analysis. The calculations consider expected retention and cost in relation to alternative funding sources. Non-interest expense inputs are optional.

5. What standard IRR tests are provided? Can (and how) does the model define rate ramps (and/or rate shocks) that test for yield curve shape change basis risk?
   The McQueen Financial Advisors model provides the following standard scenarios:
   - Net Interest Income and Net Income
     - Gradual and Shock Scenarios with rate changes of up to +/- 100, 200, 300, 400 & 500 basis points (2 years)
   - NEVE Sensitivity with rate changes of up to +/- 100, 200, 300, 400 & 500 basis points
   - Shock tests assume immediate and full change to all rates. Gradual tests assume 1/12 of the scenario increase each month for 12 months
   - Each report includes six non-parallel scenarios that measure impact to income and value assuming steeper, flatter and twist scenarios

6. Describe the model’s analysis and reporting capabilities for standard IRR tests and other forecasts.
   Income sensitivity is based on repricing characteristics of all assets and liabilities. NEVE (value) is based on discount cash flow analysis. For each rate scenario, calculations include amortization
schedules, payment and reset frequency, prepay speed assumptions, repricing (beta) and likely puts or calls. The model accommodates static and growth versions as well as a ‘what-if’ analysis which may include a shift from term to non-maturity deposits (or any other balance sheet shift). Parallel income sensitivity is reported at +/- 100, 200, 300, 400 & 500 basis points and covers two years. Each quarterly report also includes income and NEVE sensitivity for six non-parallel scenarios.

7. Can the model export IRR inputs and outputs and report to spreadsheets or other financial information reporting products?
Yes. All reports can be exported to Excel or a data file.

8. Can the model readily produce outcome analyses (e.g. back tests and retrocasts) of prior forecasts and behavior assumptions?
Yes. The model provides back testing analysis which compares a prior period projection to actual results. McQueen’s back testing analysis identifies the variance between projected and actual results and reports the reason for each variance. The back testing analysis is a useful tool that allows users to tweak future model inputs and assumptions to enhance ALM results.

9. What internal liquidity analysis capabilities does the model have? Can the model interface with typical internal liquidity models and contingency funding plan spreadsheets?
The model includes two liquidity options, and data can be exported to support a client’s unique liquidity reporting. Liquidity reports we provide:

- Basic Liquidity and On-Hand Liquidity Report
- Detailed Liquidity Stress Testing includes a base (non-stressed scenario), trend analysis, moderate stress and severe stress. Liquidity stress is measured using two methods:
  - Short-term event driven analysis measures stressed liquidity over 30, 60 and 90 days.
  - Long-term market driven analysis measures stressed liquidity at 180 and 365 days.
  - McQueen’s Liquidity Stress Testing report includes a narrative section about the importance of liquidity stress testing and use of the report. Liquidity stress is measured using a ratio trend and forward-looking pro-forma balance sheet analysis. Liquidity stress is measured over a wide range of time periods. Potential stress factors include lower income, deposit run-off, slower loan prepayments, loan growth, unanticipated borrower draws, falling investment values and reduced access to wholesale funding.

10. Does the model have stochastic forecasting capability? If so, describe it.
Yes. The model can generate Earnings and NEVE outcomes based on common risk drivers and statistical distributions. Multiple simulations and ‘what-if’ analyses are easily created. As one simple example, the change to a client’s risk profile can be measured assuming a simultaneous shift in funding, loan growth, lower non-maturity deposit retention, wider betas and increasing interest rates. Nearly any concurrent scenario and balance sheet shift can be modeled.

11. Can custom (institution-specific) equations for loan prepayments, core deposit behaviors, and CD options be embedded in the model to drive cash flow behaviors by interest rate scenario?
Yes, we encourage unique client assumptions.

G. OPEN-ENDED COMMENTS
Over the past several years, the McQueen team has engaged extensively with clients, boards,
examiners and regulators on the importance of presenting clear and concise interest rate risk profiles. We have done so in response to a growing need to make sense of complex balance sheets so that management may plan for growth and uncertainty. These needs originate from a number of sources: increased regulatory focus, a sustained low rate environment, an uneven economic recovery and growing balance sheet complexity. In addition to presenting results clearly, one of our primary goals is to remove all of the time consuming tasks that surround report preparation. McQueen loads detailed files into the model and handles all model updates. We also assist with key model assumptions.

Each quarter, we meet on-site or hold a conference call with each client. These meetings cover economic conditions, our interest rate outlook, our client’s risk profile, trends, growth opportunities, risk mitigation and examiner expectations. The McQueen model is an effective interest rate risk tool that eliminates substantially all of the time consuming tasks associated with desk-top models. In addition to presenting results clearly, we analyze and interpret results and follow up with in-depth discussions. These activities provide management a deeper understanding of interest rate risk and the opportunity to plan for growth.
A. GENERAL INFORMATION
1. Vendor contact information
   R2Metrics, Inc.
   6930 Cahaba Valley Road
   Suite 201
   Birmingham, AL 35242
   analytics@r2metrics.com
   205-991-9415
   www.r2metrics.com

2. Describe the general nature of the current client base (charters, asset range, business models)
   Commercial banks and credit unions, $50 million to $3 billion in asset size

3. Number of active outsource clients
   Greater than 600 banks and credit unions monthly through the calculation engine provided
   through BondRisk/SwapRisk; about 20 banks and credit unions use ALM on a quarterly basis.

4. Describe any relevant special client characteristics addressed by the model (e.g.
   mortgage servicing rights, loan pipeline management, indirect lending)
   None

B. MODEL USER SUPPORT PROGRAM
1. Toll-free, phone-based user support group (enter “yes” or “no”)
   Yes

2. Location(s) of the phone support group
   Birmingham, AL

3. Hours during which phone support group operates
   8:00 am to 5:00 pm Central Time

4. Number of phone support group staff normally available
   4

5. Typical time to resolve client inquiries by phone support group
   1 hour

6. Web-based user support function (enter “yes” or “no”)
   Yes
7. If your response to question 6 is “yes”, typical time to resolve client inquiries by web-based user support function?
   1 hour

8. Other unique client support characteristics of special note (e.g. user training institute, annual user conference, local user groups)
   Email and iPhone support

C. MODEL(S) USED IN OUTSOURCE ENGAGEMENT

1. Model(s) name(s)
   Proprietary in house models including BondRisk, BankRisk, SwapRisk, Comparative Sensitivity Analysis, Liquidity Stress Testing, etc.

2. Current version(s) number(s)
   BankRisk – 7.0
   BondRisk/SwapRisk – 6.0

3. Date(s) of last major model update(s)
   All models are continuously updated and enhanced.

4. Do you also offer the model(s) as an in-house solution?
   Yes, it is delivered via the web

5. What other vendor-provided financial management products directly interface with the model?
   --

D. MECHANICS OF OUTSOURCE RELATIONSHIP

1. How are balance sheet data (G/L, maturity, repricing, and contractual options) and behavior assumptions (loan prepayments, core deposit behaviors, and CD options) transferred to you?
   Via email, ShareFile, or uploaded onto the R2Metrics website

2. At what point and by whom is the “run-ready” IRR model approved?
   CEO Dan Matheson or Vice President Andrew Stein

3. How fast are IRR analyses provided to the client after the final data is approved?
   Depends on the product – BondRisk/SwapRisk 5-15 minutes, BankRisk 1-2 hours

4. How are completed IRR reports sent back to the institutions (e.g. Word, Excel, pdf)?
   Excel or PDF as desired by client via email, ShareFile or downloaded from the R2Metrics website

5. Describe the format and content of your standard IRR client report.
6. Who is responsible for IRR analysis quality assurance?
   All employees are responsible but primarily the CEO and Vice President

7. If needed, how are reruns of a period's IRR analysis handled?
   As many as are needed to get accurate answers at no additional charge

8. Are there written operating guidelines for clients and vendor staff?
   Yes

9. How are client questions or disputes remediated?
   We will always do what the client wishes. If the client is unhappy with the analysis, they will not have to pay for it.

E. CHART OF ACCOUNTS

1. Identify any special features and/or limitations of the model's ability to address the balance sheet behaviors listed below

   • Limitations to the number of accounts/categories that can be modeled
     We can model 50 asset categories and 50 liability categories and they can have any name the bank or credit union chooses.

   • Detailed re-pricing and maturing balances for categories without embedded options
     All of the assumptions/inputs are customizable so we have the ability to custom model all categories

   • Interest rate adjusted re-pricing and maturing balances for categories that have continuous and call/put embedded options
     All of the assumptions/inputs are customizable

   • Re-pricing and maturing balances for unique categories (e.g., hybrid ARMs, teaser products, step-up/callable CD’s or FHLB advances)
     We regularly model unique categories in BondRisk which allows us to custom model any type of financial item

   • Re-pricing and maturing balances for indeterminate behavior categories (e.g., core deposits, lines of credit, credit card outstandings)
     All of the assumptions/inputs are customizable

2. Are there any limitations on automated control of pricing, re-pricing, embedded caps/floors, or teaser rates?
   No

3. Can the model effectively amortize discounts/premiums in any defined alternate interest rate scenario?
   Yes

4. Can the model effectively address unique balance sheet items (e.g. off-balance-sheet
positions, mortgage servicing rights, loan pipelines, indirect lending)?

Yes

F. PRICING, RE-PRICING, OPTION-RELATED CAPABILITIES, INTEREST RATE SCENARIOS AND MISCELLANEOUS

1. Who defines contractual inputs (e.g., pricing spreads, re-pricing limits)?

The client has the ability to customize all aspects of the model but R2Metrics personnel will assist as needed in setting assumptions.

2. How does the model obtain information on investments or FHLB advances with puts or calls in alternate interest rate scenarios?

The model works with BondRisk for investments and FHLB advances are modeled using OAS or manual overrides.

3. Who defines re-pricing and decay rates (or similar inputs) to core deposits by interest rate scenario? Are there any limits on specifying assumptions (e.g. repricing lags, scenario specific decay rates)?

The client has the ability to customize all aspects of the model but R2Metrics personnel will assist as needed in setting assumptions. There are no limits on scenario specific decay rates but we do limit re-pricing lags to 3.

4. How does the model calculate core deposit present values? Can user-defined non-interest expense inputs be accurately applied in core deposit present value calculations?

The model uses betas, decay rates, and applicable risk free rates to determine the base case market value. The model also allows the user to apply a servicing cost to each category to adjust ending market values.

5. What standard IRR tests are provided? Can (and how) does the model define rate ramps (and/or rate shocks) that test for yield curve shape change basis risk?

Our ALM model has the ability to stress test all key modeling assumptions, such as decay rates and betas, as well as export the cashflows to run a Liquidity Stress Test. We also have the ability to perform dynamic growth modeling and perform non-parallel shocks by using ramped, vectored, or forward rates, which includes flattening or steepening the yield curve as specified.

6. Describe the model’s analysis and reporting capabilities for standard IRR tests and other forecasts.

- Important Assumptions and Ratios
- Executive Summary - Income at Risk
- Change from Previous Report
- Executive Summary - Market Value of Equity
- Interest Rate Risk Management Policies
- Net Interest Margin Projections
- Change in Net Interest Margin Forecast from Level Rates
- Forecasted Net Interest Margin Charts
- Change in Asset Yields, Liability Costs & Net Interest Margin from Level Rates
- Long Term Interest Rate Risk
- Risk Management Solutions
- Income Statement Analysis
- Automated Backtesting
- Loan, Investment & Funding Details

7. Can the model export IRR inputs and outputs and report to spreadsheets or other financial information reporting products?
   Yes

8. Can the model readily produce outcome analyses (e.g. back tests and retrocasts) of prior forecasts and behavior assumptions?
   Yes

9. What internal liquidity analysis capabilities does the model have? Can the model interface with typical internal liquidity models and contingency funding plan spreadsheets?
   The model exports cashflows into a Liquidity Stress Testing analysis, and generates a separate 3 page report which includes loan, investment, and deposit growth and runoff assumptions. The model can interface as needed.

10. Does the model have stochastic forecasting capability? If so, describe it.
    We use OAS and option pricing methodology for certain balance sheet items to estimate values and cashflows. Several bond categories rely upon stochastic forecasting such as callable and step agencies. Many loan categories with embedded options also utilize OAS.

11. Can custom (institution-specific) equations for loan prepayments, core deposit behaviors, and CD options be embedded in the model to drive cash flow behaviors by interest rate scenario?
    Our model uses specific loan prepayment speeds provided by the client and this can be applied to individual loans if desired. CD early redemption assumptions and core deposit behaviors also vary by interest rate scenario.

G. OPEN-ENDED COMMENTS

Our model is extremely flexible as literally all aspects of the model can be customized. R2Metrics personnel are heavily and routinely involved on a day to day basis with modeling new and unusual financial structures, primarily in the BondRisk space. This experience makes it highly likely that any modeling challenges on loans, deposits, advances etc, can be addressed so that outcomes are at least reasonably accurate, when often there is no precisely accurate solution. R2Metrics personnel are also routinely involved in explaining and defending methodologies to bank management, boards, regulators, and other appropriate parties.

R2Metrics personnel also provide ALM and IRRM consulting services, and not only measure interest rate risk but also craft independent market based hedging solutions to reduce or eliminate unwanted long or short term interest rate risk. We believe we are a “low cost” provider of IRRM modeling services, and we believe our turnaround times are extremely fast once all data has been gathered. We will rerun reports based on changes in assumptions until the client is completely satisfied with the results.
Velligan-Blaxall Consultants, LLC
www.VelliganBlaxall.com

A. GENERAL INFORMATION

1. Vendor contact information
   - Hugh Blaxall, President
     215.822.9097
     HBlaxall@VelliganBlaxall.com
   - Brian A. Velligan, CEO
     610.526.1869
     BVelligan@VelliganBlaxall.com
   - Velligan-Blaxall Consultants, LLC
     721 Millbrook Lane
     Haverford, PA 19041-1210
     www.VelliganBlaxall.com

2. Describe the general nature of the current client base (charters, asset range, business models)
   VBC, LLC has a national reach and works with Banks and Credit Unions ranging from de-novo to multi-billion dollars in total assets. We work with a large variety of institutions with different charters, ranging from strong earnings and low risk to others under financial stress or regulatory scrutiny.

3. Number of active outsource clients
   About 100

4. Describe any relevant special client characteristics addressed by the model (e.g. mortgage servicing rights, loan pipeline management, indirect lending)
   For institutions that are looking to outsource their ALM reporting and consulting, our services are very attractive. These clients are looking to benefit from our wide experience and broad perspective as we bring an outside perspective and simultaneously help them manage their costs by avoiding hiring expensive experts on as full-time staff or even license an ALM model. We customize each client's model to their specific needs and can model a variety of unique instruments, including mortgage servicing and off-balance sheet positions.

B. MODEL USER SUPPORT PROGRAM

1. Toll-free, phone-based user support group (enter “yes” or “no”)
   Yes.

2. Location(s) of the phone support group
   Pennsylvania.

3. Hours during which phone support group operates
   M-F 9:00 am – 7:00 pm Eastern Time.
4. Number of phone support group staff normally available
   8.

5. Typical time to resolve client inquiries by phone support group
   Within 24 hours.

6. Web-based user support function (enter “yes” or “no”)
   No.

7. If your response to question 6 is “yes”, typical time to resolve client inquiries by web-based
   user support function?
   --

8. Other unique client support characteristics of special note (e.g. user training institute,
   annual user conference, local user groups)
   VBC prides itself in that we provide customized service to each of our clients. We don’t require
   your data or process to fit our mold; we tailor our service to meet the needs of your institution.
   This philosophy is part of our motto.

C. MODEL(S) USED IN OUTSOURCE ENGAGEMENT

1. Model(s) name(s)
   Fiserv ALM (Formerly IPS-Sendero).
   onlineALM (from ZM Financial Systems).

2. Current version(s) number(s)
   3.5 (Fiserv/Sendero).
   4.30 (OnlineALM ZMFS)

3. Date(s) of last major model update(s)
   November 2014

4. Do you also offer the model(s) as an in-house solution?
   No.

5. What other vendor-provided financial management products directly interface with the model?
   Depending on the model selected, ADCO prepays, Intex Investment cash flows, IDC or Moody’s/
   Markit data for investments.

D. MECHANICS OF OUTSOURCE RELATIONSHIP

1. How are balance sheet data (G/L, maturity, repricing, and contractual options) and behavior
   assumptions (loan prepayments, core deposit behaviors, and CD options) transferred to you?
   VBC maintains a secure SSL FTP website to upload client data files.
2. At what point and by whom is the “run-ready” IRR model approved?
   The client is provided with a draft run of the reports and, after review, there is an iterative process that incorporates any changes discussed in order to produce a final copy.

3. How fast are IRR analyses provided to the client after the final data is approved?
   There is a turnaround for the client’s results of within two weeks.

4. How are completed IRR reports sent back to the institutions (e.g. Word, Excel, pdf)?
   VBC maintains a secure SSL FTP website to download reports and information. All reports are sent as pdf files or Excel files.

5. Describe the format and content of your standard IRR client report.
   Typically, a report package includes two files in pdf format. One report is generally 20-30 pages and contains higher level reports for review by committees and boards. The other report contains supporting detail and can run 200-300 pages.

6. Who is responsible for IRR analysis quality assurance?
   On VBC’s end, several staff cooperate on the modeling process for each client. As expected by the regulators, the client is fully-involved in the production process, including a full telephone review of the final draft of each report. This includes a quality control process to ensure that changes and new assumptions are implemented as expected.

7. If needed, how are reruns of a period’s IRR analysis handled?
   If a client requests a re-run, it can usually be handled very quickly once the request is made. Then, the re-run is provided to the client for further review.

8. Are there written operating guidelines for clients and vendor staff?
   Yes. For each client, VBC maintains guidelines and agreed upon procedures for review by the client, their auditor, other VBC staff, or regulatory bodies.

9. How are client questions or disputes remediated?
   VBC does not allow discussions to grow into disputes. Any questions or concerns are of utmost importance to us and are discussed together until a satisfactory resolution is achieved.

E. CHART OF ACCOUNTS

1. Identify any special features and/or limitations of the model’s ability to address the balance sheet behaviors listed below
   - Limitations to the number of accounts/categories that can be modeled
     The limit on number of accounts is 2,600.
   - Detailed re-pricing and maturing balances for categories without embedded options
     Repricing and maturities can go out 50 years.
• Interest rate adjusted re-pricing and maturing balances for categories that have continuous and call/put embedded options
  These can also go out 50 years.

• Re-pricing and maturing balances for unique categories (e.g., hybrid ARMs, teaser products, step-up/callable CD’s or FHLB advances)
  These can also go out 50 years.

• Re-pricing and maturing balances for indeterminate behavior categories (e.g., core deposits, lines of credit, credit card outstandings)
  These can also go out 50 years.

2. Are there any limitations on automated control of pricing, re-pricing, embedded caps/floors, or teaser rates?
   There are no limitations.

3. Can the model effectively amortize discounts/premiums in any defined alternate interest rate scenario?
   Yes. The discount method has to be defined/chosen.

4. Can the model effectively address unique balance sheet items (e.g. off-balance-sheet positions, mortgage servicing rights, loan pipelines, indirect lending)?
   Yes, all of these items can be effectively addressed.

F. PRICING, RE-PRICING, OPTION-RELATED CAPABILITIES, INTEREST RATE SCENARIOS AND MISCELLANEOUS

1. Who defines contractual inputs (e.g., pricing spreads, re-pricing limits)?
   These are defined by the core system files and the client.

2. How does the model obtain information on investments or FHLB advances with puts or calls in alternate interest rate scenarios?
   Depending on model selected, investment options are obtained from Bloomberg, IDC or Moody’s/Markit and borrowing reports are either inputted directly into the model or inputted through an upload.

3. Who defines re-pricing and decay rates (or similar inputs) to core deposits by interest rate scenario? Are there any limits on specifying assumptions (e.g. repricing lags, scenario specific decay rates)?
   Core deposit assumptions are defined by the client (usually from core deposit studies) and the model does not have limits on these assumptions.

4. How does the model calculate core deposit present values? Can user-defined non-interest expense inputs be accurately applied in core deposit present value calculations?
   Core deposit values are calculated using discount rates/curves with the option of using spreads. The non-interest expense can be applied by the use of spreads over the rates/curves.
5. **What standard IRR tests are provided? Can (and how) does the model define rate ramps (and/or rate shocks) that test for yield curve shape change basis risk?**

   The model allows for the building of shocks, ramps and twists, with choices of time periods and pivot points and individually defined curves that can be directly inputted.

6. **Describe the model’s analysis and reporting capabilities for standard IRR tests and other forecasts.**

   The model supplies many standard options for reporting all aspects of the forecasting and IRR. These can be further specified for time periods and detail level as well as supplying comparative reporting options.

7. **Can the model export IRR inputs and outputs and report to spreadsheets or other financial information reporting products?**

   Yes, you can export any report to a spreadsheet.

8. **Can the model readily produce outcome analyses (e.g. back tests and retrocasts) of prior forecasts and behavior assumptions?**

   The model can give comparisons between any saved results.

9. **What internal liquidity analysis capabilities does the model have? Can the model interface with typical internal liquidity models and contingency funding plan spreadsheets?**

   The model produces cash flow forecast results that can be utilized for liquidity reporting.

10. **Does the model have stochastic forecasting capability? If so, describe it.**

    The model can be used for stochastic forecasting. It uses linear path space with user defined iterations rather than Monte Carlo simulations.

11. **Can custom (institution-specific) equations for loan prepayments, core deposit behaviors, and CD options be embedded in the model to drive cash flow behaviors by interest rate scenario?**

    --

**G. OPEN-ENDED COMMENTS**

Our mission is to deliver the highest level of personalized service. We provide the best quality insights and analysis to position you for the future. Our aim is to be a long-term extension of your internal team and integral to your success.
Choosing the right ALM model or Outsourced IRR analysis solution is just the start of your modeling related commitment. There is also the need to maintain the IRR analyses obtained (produced in-house or Outsourced) at a high level of forecast accuracy. Doing so requires a periodic assessment of the model and its forecast accuracy. This is both good business practice (and often mandated in ALM policies) and required by regulatory guidance. The discussion below examines salient features of this need.

ALM models are complex software systems that require a significant level of data and institution-specific (and ever-changing) contractual inputs and behavior assumptions. Because of their ongoing upkeep requirements, ALM models tend to collect errors and omissions over time. It is even possible that the original model installation was not completed correctly, or that users have made inappropriate changes to category setup definitions or other technical specifications after the installation. Thus, for many reasons, ALM models can drift into a state of low forecast precision that creates model risk, which is defined as making an incorrect decisions based on inaccurate model outputs.

Model risk is a business concern because it can lead to lost earnings and unforeseen risks. It is also a regulatory concern since poor financial decisions can lead to impaired capital.

The OCC (Office of the Comptroller of the Currency) and FED (Federal Reserve) have the strongest recent statement of model risk assessment needs, in Bulletin 2011–11/SR 11-7. This guidance provides extensive discussions of the issues involved and requires that an annual ALM model validation (audit) be conducted by an independent third party. Directly relevant for credit unions is the NCUA Interest Rate Risk Policy and Program. Other earlier agency statements have similar, if less specific, directives:

Model Risk Concepts
Business and regulatory mandates are clear: Assess and control ALM model risk. To achieve this goal, ALM models and IRR analysis applications must be independently assessed on a periodic basis. Such a review in its broadest form has four components:

1. **Model Certification.** The fundamental capability of the model to correctly address balance sheet data and produce accurate projections – the “model math” – must be affirmed by an independent third party expert. This certification of excellence is your assurance that the model is an accurate analysis tool.

2. **Model Verification.** To prove the model has the basic technical capacity to produce accurate values and forecasts, the model must be verified. This includes a detailed assessment of model data, setup attributes, contractual inputs, behavior assumptions and reports.

3. **Model Validation.** Confirmation of model forecasts compared to expected category behaviors given their contract terms and embedded options is required to prove that the model actually produces accurate forecasts of earnings and value.

4. **Model Governance.** Finally, the model must be supported by an appropriate set of user controls, policies and procedures. The model control environment and policy directives must be formally assessed.

Many suppliers offer ALM model risk assessments (a.k.a. model verification or model validation). Below are discussions of underlying issues and key criteria to consider in evaluating potential solutions, centered around the key sources of model risk.
The ALM Model Itself as a Risk Source
ALM models are complex software programs. In vendor-provided models, prerelease analyses, independent third party certification, ongoing internal reviews and day-to-day experiences of large numbers of users attest to the efficacy of the underlying code and the accuracy of its results. Assuming a current version of the model is employed, shortfalls in the fundamental forecast accuracy of a vendor-provided ALM model are rare. Thus, this area of model risk is normally minimal.

Such a statement, however, does not apply to ALM models developed in-house or non-vendor supported models. In those cases, testing and precision certification by a third party must be completed and fully documented on a periodic basis.

ALM Model Components as Risk Sources
Model risk arises from multiple sources. Consider each model risk source in turn.

Data-related risks are obvious. They arise from using wrong data or data that does not foot across the model. In most cases, however, model data is comprehensively assessed in reviews of feeds from underlying core systems or managed as part of user procedures that require balancing tests each time the model is run. Data-related risks are not typically a key model risk area, but ALM model risk assessments must evaluate data-related model risk issues at a basic level.

A point to note here — the integrity of record level data needs to be affirmed by periodic micro-level data audits. These are normally conducted by internal audit.

Category setup definitions tell the model how to interpret incoming record-level data. Because these specifications define the categories analyzed in the model, the attributes are crucial to the success of all subsequent model applications. As such, they are a source of fundamental model risk that can arise from their initial installation specifications and any ongoing changes over time. A key point here is that category specifications are often changed by line of business managers, so an active dialog needs to be maintained.

Contractual inputs are behavior definitions that can be read directly from underlying asset and liability contracts. Pricing spreads, teaser rates, balloon term points and re-pricing limits (caps and floors) are common examples, as are call and put features (in investments and wholesale funding sources). These inputs are a source of model risk that arises from initial specifications and continual evolution.

Option inputs and indeterminate behavior assumptions are weak links in many model implementations and as such need to be monitored very carefully. These sources of model risk include prepayment inputs for contractual maturity loans of all types (not just first mortgages) and pay down rates for indeterminate maturity loans. Loan behavior inputs also need to specify the interrelationships among loan types (e.g., second mortgage prepayments or HELOC pay downs linked to 1–4 family mortgage prepayments).

Inputs defining core deposit supply, re-pricing, decay (defines average life), present value-related behaviors, embedded CD options (e.g. bump-up CDs) and CD early withdrawal inputs are also important. Accuracy is of the utmost importance as these inputs are key determinates of IRR positions.

Reporting that originates directly from a vendor-provided ALM model is normally error free and rarely a source of model risk. Custom-produced model reports, however, and especially reports created from model outputs imported into external spreadsheets, are often risk concerns. Ample evidence of spreadsheet errors is available in the business literature, yet model implementations normally have few controls over them. Address this issue in an uncompromising manner, preferably by treating each model
output-related spreadsheet as a “model” itself and focusing on its own embedded risk potential.

The model governance solution provides the surrounding support for an ALM model. It rounds out the technical elements of the model with the processes needed to employ it as a financial management decision-making tool.

The model control environment is defined by user process documentation, verification of user modeling activities, and model change controls. A best practice solution includes a comprehensive user manual (with an inventory of files that interface with the model), a simple user checklist to document completion of all modeling steps in each period, and model inputs change control documents. Model risk typically arises when the model control environment is weak, raising the probability that user errors will occur or changes to model specifications will go undocumented.

The institution’s ALM process solution (a.k.a. its model governance) revolves around the asset/liability management committee (ALCO) and its functions, along with Board involvement. A best practice solution embodies the center and lower elements of the data-to-decisions framework described earlier. Model risk often stems from an incomplete ALCO function, poor IRR exposure limits, or a lack of Board involvement and/or oversight.

Controlling ALM Model Risk
The two discussion areas that immediately follow separately address controlling model risk for in-house ALM models and Outsourced IRR analysis services. There are stand-alone treatments of each so that readers can focus on what is applicable to their institution. The third discussion area following in this section outlines guidance for choosing a model risk assessment supplier. The same choice criteria apply to in-house ALM models and out-source provided IRR analyses.

Controlling In-House ALM Model Risk
The goal of an ALM model is to produce accurate forecasts. This requires a multifaceted solution, given the many possible sources of risk. An outline of the steps required to comprehensively control model risk follows.

Correct installation of the model is the key first step in controlling model risk. For many implementations, installation is distant history and its quality is not now directly relevant. However, for new models, the best defense is to address and document the treatments used for every element of model risk at installation. The vendor should have comprehensive installation policies, data tests, category setup, contractual input and behavior assumption controls, and reporting tests. Documentation of these activities mitigates all dimensions of model risk at this beginning step.

Periodic assessment of model risk is the next step in controlling model risk. Use of a competent and independent source is essential. As noted, model risk assessment first includes a detailed technical review of each model element. This establishes the model’s potential to accurately value and forecast. The assessment then needs to validate that model forecasts are actually accurate.

Model risk assessment must go far beyond just affirming that the model is constructed in such a way that it could forecast correctly. The model risk assessment must also prove that the model actually does forecast correctly. That is, as noted above, the model must be validated as well as verified.

Validation of your model’s forecast accuracy needs to include reviews of a constant interest rate (Base Case) scenario and a range of rate ramp or shock scenarios. Testing across a range of interest rates assesses whether interest rate sensitivity forecasts correctly capture all balance sheet behaviors.
Many special diagnostic systems can be employed. Ensure that both “as forecasted” values at the category level and outcomes accuracy are reviewed. A model’s validity can also be demonstrated through comparisons of first month margin forecasts vis-à-vis actual prior month values and by comparing model forecasts of NII IRR direction against recent actual margin sensitivity data.

Two important notes apply to the validation of ALM model-produced forecasts:

1. ALM model accuracy cannot be adequately judged by producing parallel forecasts in another ALM model run. Running your exact current model through another separate model (which is necessary for comparability) tests little beyond the ability of the two models to compute balances and sums. None of the underlying elements in your model (e.g., data, category setup, inputs, assumptions or outputs) are assessed. The result is that a poor quality model is not recognized.

   Also, the “model math” capabilities of your ALM model need to be certified by the vendor, not you, using an independent third-party expert. Having every user affirm the model’s basic calculation accuracy has no purpose when it can be proven once and for all in a formal model certification.

2. ALM model accuracy cannot always be adequately judged by running “outcome back tests” of prior model forecasts against subsequent actual outcomes. Back tests are by nature rearward looking while model risk is future oriented. Also, information on a model’s ability to forecast option influences in extreme scenarios is minimal as such conditions are rarely encountered. Finally, a back test only assesses the model’s computational capabilities. Again, that is best done via an independent model certification.

   There are, however, instances where outcome back tests have value. Pre-testing a new ALM model installation or when an empirical touchstone is desired to measure model forecasts against are examples. There is also a degree of regulatory preference for periodic back testing, thus there may be times when it is advisable to do. Back tests of 90 days (one quarter) are generally the norm in such cases.

Implementation of a comprehensive model control environment is the third step in controlling model risk. This includes the previously discussed documentation, checklist, and change controls. It extends, however, to include user cross training and backup users to provide production depth. The model control environment also encompasses directions that stipulate how often and by whom model specifications, inputs, and assumptions must be examined and updated, acceptable sources of any new information, and documentation of data adjustments.

Implementation of a comprehensive ALM process solution surrounding the model is the final step in controlling model risk. While the ALM process solution encompasses all ALCO activities, certain elements bear more directly on model risk.

1. An annual formal review of the model must be done by ALCO. This internal function is a complement to the policy-mandated periodic independent model verification.

2. IRR limits must be defined correctly for all rate test scenarios reviewed by ALCO and the Board. Best practice IRR limits expand nonlinearly across rate scenarios to accommodate the adverse implications of increasing option influences.

3. The model and its implementation specifications must be described in the institution’s policy guidance. This is most commonly done in an appendix that documents the full “implicit contract” between the Board and ALCO with regard to model application.

**Controlling Outsourced IRR Analysis Model Risk**
The ALM model used in outsourced IRR analysis can be as complex as an in-house ALM models.
Because of their extensive ongoing upkeep requirements, ALM models and IRR projections tend to collect errors and omissions over time. As a result, accuracy can drift lower and create model risk, defined as making a wrong decision based on inaccurate model outputs. Model risk is a business concern because it can cause lost earnings and unforeseen risks. In addition, model risk is a regulatory concern because poor financial decisions can potentially create conditions that impair capital. The mandate is thus clear: Control Outsourced IRR analysis related ALM model risk. The following are significant review points:

**Correct installation of the model by the Outsourced IRR analysis service** is the first step in controlling model risk. Ensure that your institution’s balance sheet is properly represented in model definitions and that all contractual inputs and behavior assumptions are correctly specified.

**Periodic assessment of model risk** is the second step in controlling risk. A competent and fully independent supplier is essential as model risk assessment includes a detailed technical review of each model element to establish the model’s potential to accurately value and forecast. The assessment then needs to validate that model forecasts are actually accurate. Many special diagnostic tests can be employed. Ensure that both as forecasted values at the category level and outcomes accuracy are reviewed.

Two important notes apply to the validation of ALM model-produced forecasts:

1. **ALM model accuracy cannot be adequately judged by producing parallel forecasts in another ALM model run.** Running your exact current model through another separate model (which is necessary for comparability) tests little beyond the ability of the two models to compute balances and sums. None of the underlying elements in your model (e.g., data, category setup, inputs, assumptions or outputs) are assessed. The result is that a poor quality model is not recognized.

2. **ALM model accuracy cannot always be adequately judged by running “outcome back tests” of prior model forecasts against subsequent actual outcomes.** Back tests are by nature rearward looking while model risk is future oriented. Also, information on a model’s ability to forecast option influences in extreme scenarios is minimal as such conditions are rarely encountered. Finally, a back test only assesses the model’s computational capabilities. Again, that is best done via an independent model certification.

There are, however, instances where outcome back tests have value. Pre-testing a new ALM model installation or when an empirical touchstone is desired to measure model forecasts against are examples. There is also a degree of regulatory preference for periodic back testing, thus there may be times when it is advisable to do. Back tests of 90 days (one quarter) are generally the norm in such cases.

**Implementation of a comprehensive model control environment** is another step in controlling model risk. This includes a model control environment for both the out-source IRR analysis provider and the institution’s staff, documentation at all levels, and policy guidance. Ensure also that user cross training is completed to provide production depth. The model control environment also encompasses directions that stipulate how often and by whom model specifications, inputs, and assumptions must be examined and updated, acceptable sources of any new information, and documentation of data adjustments.

**Implementation of a comprehensive ALM process solution** surrounding the model is the final step in controlling model risk. An ALM process solution encompasses all ALCO activities and it must be described in the institution’s policy guidance. Use an appendix that documents the full “implicit contract” between the Board and ALCO with regard to the Outsourced IRR analysis solution implemented.
Fundamental Concepts to Consider
There are multiple dimensions of assessing the institution specific model risk embedded in an in-house ALM model or Outsourced IRR analysis service. As a result, model risk assessments must be detailed and comprehensive, with content matched to the specific complexity of the model to the out-source service.

Checklist type reviews of only data and basic model definitions and inputs are rarely sufficient. Thus, beyond that approach, how does one ensure that a proposed model risk assessment is adequate? The underlying issues and associated choice criteria to consider in evaluating potential solutions are outlined below.

Assess the Supplier’s Independence
Regulators hold the independence of a model risk assessment supplier as an essential qualifying point, and so should you. Questions to ask the provider are:

1. Is the supplier connected in any way with, or does it receive payments from the ALM model vendor or IRR analysis provider? If yes, this potentially compromises independence – is this important to your institution?
2. Is the supplier connected in any way with, or does it receive payments of any kind from a securities broker your institution uses? If yes, this potentially compromises independence – is this important to your institution?
3. Does the supplier offer an outsource IRR analysis solution that competes with your Outsourced IRR analysis provider? If yes, this is a potential compromise of supplier independence – is this important to your institution?

Evaluate the Supplier’s Model Experience and Expertise
Value added content in an ALM model risk assessment comes from qualifications and broad industry experience and expertise. Questions to ask the supplier here are:

1. What is the supplier’s level of technical knowledge with respect to details, nuances and limitations of your in-house ALM model or the model used in your Outsourced IRR analyses?
2. How many staff members will contribute to your report? What level(s) are they in the organization? Who will perform the final quality assurance review?
3. In the last 12 months, how many comprehensive risk assessments of ALM models like yours has the supplier provided? What models have they assessed?

Review the Supplier’s Model Risk Assessment Process
ALM models are multi-faceted, and as such, model verifications need to address all dimensions of model risk. Questions to ask the supplier are:

1. Why is the supplier’s model risk assessment process defined as it is?
2. What specific model technical verification techniques are used and why?
3. What specific model value/forecast validation techniques are used and why?
4. What are the specific model verification and validation deliverables?
5. What quality assurance processes does the supplier's production process use?
6. Are benchmark industry standard and best practices defined in the deliverable?

Consider the Supplier’s Model Risk Assessment Deliverable
An ALM model risk assessment is a consultative process. Thus, the deliverable needs to not only assess model risk, but also to recommend responses to model areas in need of upgrade. Questions to ask the supplier are:

1. What is the conceptual or theoretical reason each report element is included?
2. Does the report include prioritized recommendations for model enhancements and refinements? If yes, what are some examples?
3. Can the supplier assist your institution in implementing the model enhancements and refinements from the verification report?

Determine Regulatory Acceptance of Supplier’s Model Risk Assessments
The business related aspects of an ALM model verification should be its primary value, but there is no question that regulatory compliance needs to be a vital element in the final deliverable. Questions to ask the provider are:

1. Have examiners in the field reviewed the supplier's model risk assessment report? If yes, from which regulatory agencies?
2. What feedback have examiners provided on the supplier’s reports?
3. Does the supplier offer assistance if regulators challenge the report? What type of specific support is provided?

Obtain References from Recent Model Risk Assessment Clients
The ALM model verification supplier needs to be your partner through the project, and references are your best way to gauge the degree to which this will happen. Questions to ask the supplier are:

1. Can the supplier provide references from recent clients with your institution’s asset size, charter type and general operating characteristics?
2. Ask the references about report quality and content, delivery timing and the quantity and quality of staff. Finally, ask the supplier to share any internal audit or regulatory responses to the report.
Risk Assessment Suppliers

ALM First Financial Advisors, LLC
Alpha-Numeric Consulting, LLC
Darling Consulting Group
Financial Institutions Management Associates Corp
FinPro, Inc
R2Metrics
Velligan-Blaxall Consultants, LLC
A. GENERAL INFORMATION

1. Vendor contact information
   ALM First Financial Advisors, LLC
   2911 Turtle Creek Blvd., Ste. 500
   Dallas, Texas 75219
   800.752.4628
   info@almfirst.com
   www.almfirst.com

2. Describe the general nature of the current client base (charters, asset range, business models)
   Client charters include:
   • Federal Savings Bank
   • Federal Savings Association
   • National Bank
   • Savings Bank
   • Credit Union
   Assets range from $39M - $55B with the majority between $150M - $5B.

3. Number of IRR model risk assessment reports delivered in the past three years
   Approximately 20 per year

4. Describe any special business activities commonly engaged in by your IRR model risk assessment clients (e.g. mortgage servicing rights, loan pipeline management, indirect lending)
   Like all other balance sheet instruments, ALM First evaluates mortgage servicing rights during IRR model risk assessments. As separate services from the IRR model risk assessment, ALM First can analyze and opine on residential mortgage pipeline management and indirect lending profitability.

B. ALM MODEL(S) ON WHICH YOU HAVE PERFORMED IRR MODEL RISK ASSESSMENTS

1. ALM model name(s), level(s) and version(s)
   ZMdesk 4.3
   Fiserv AL 3.4 (formerly IPS Sendero)
   PROFITstar
   Brick & Associates ALM Software
   ALM Software employed by First Empire, Baker Group, DCG, FTN, and Catalyst Strategic Solutions
   QRM
   Sungard Ambit 4.0-6.0 (formerly BancWare)
2. For each ALM model named above, how many IRR model risk assessments have you conducted in the past three years?

For a majority of model validations, ALM First performs a parallel analysis for a client without knowing their model level and version. ALM First only knows the model level and version when we are contracted to opine on the model.

3. Provide any relevant comments regarding your expertise and experience with particular ALM models and types of IRR analysis

ALM First is intimately familiar with a wide variety of ALM software solutions, and has performed evaluations on the following models: Ambit, QRM, Misys, PolyPaths, ZMdesk, Algorithmics, Kamakura, Fiserv AL, c.Myers, Brick and Profitstar to name a few.

However, as it relates to modeling, the software is almost irrelevant. The assumptions employed in the model are far more important. Tunings on term structure model, Monte Carlo paths, and volatility surface and how they inform projected prepayment speeds, NMD betas, and discount curves are irrespective of software.

C. TYPES OF RISK ASSESSMENTS PERFORMED

- Model Verification: A detailed assessment of model data, chart of accounts setup, attributes, contractual inputs, behavior assumptions and reports.

- Model Validation: Confirmation of category model forecasts compared to expected category behaviors given their contractual terms and embedded options.

- Model Governance Review: Assessment of an institution’s model control environment, policy directives, modeling procedures, and IRR analysis scope and quality.

D. VENDOR INDEPENDENCE

1. Are you connected in any way with, or do you receive any payments from, the ALM vendor(s) whose model(s) you assess? If so, please describe the relationship.

   No

2. Are you connected in any way with, or do you receive any payments from, any securities brokers? If so, please describe the relationship.

   No

3. Do you offer an in-house ALM model or outsourced IRR analysis service? If so, please describe any potential influence of these on your IRR model risk assessments.

   Vendor software:
   ZMdesk 4.3
   Fiserv AL 3.4

E. IRR MODEL RISK ASSESSMENT PROCESS

1. Describe your IRR model risk assessment process?

   Patterned after guidelines described in regulatory bulletins, ALM First’s risk assessment process provides a sophisticated analysis of a depository institution’s interest rate risk by applying
rigorously developed methodologies from experienced financial professionals to some of the most technologically advanced analytical models.

2. **Do you take physical possession of the ALM model for the IRR model assessment?**
   
   No

3. **What specific model technical verification techniques do you use, and why?**
   
   ALM First performs a thorough data scrub at the instrument level in order to identify, note, and offer suggestions for incomplete, missing, and inconsistent data. Furthermore, ALM First analyzes the model setup, inputs, and assumptions at the account level in order to opine on best practices. From a reporting perspective, ALM First ensures that the ALCO and board receive the appropriate amount of analyses while also vetting that the risk modelers adequately document and test assumptions and are separated from the risk takers at the firm based on industry best practices, regulatory guidance, and cost/benefit.

4. **What specific model forecast validation techniques do you use, and why?**
   
   ALM First performs a parallel ALM analysis in order to determine how much the client’s forecasted balance sheet instrument behaviors differ from market expectations from behavioral gap, earnings at risk, and economic value perspectives. Through the parallel analysis, ALM First can identify anomalies in projected income and value in order to drill down to the assumptions or model limitations causing the issue.

5. **What specific model governance review techniques do you use, and why?**
   
   In order to abide by regulatory recommendations and industry best practices, ALM First ensures that there is adequate documentation related to model maintenance procedures, assumptions sourcing and change logs, methodology (including limitations), procedural cross-training, ongoing conceptual training, separation of duties, electronic security, and electronic model back-ups.

6. **What internal quality assurance processes do you use?**
   
   With respect to quality assurance, in conjunction with each ALM analysis, the analysts update a procedural checklist along with a summary report that includes items like, but not limited to, incomplete data, modeling assumption modifications, account stratification changes, and sources for non-interest items. The ALM reports are reviewed by, at a minimum, a Senior Analyst, Associate, and Director or Managing Director. The Valuation Manager maintains the centralized assumptions to be employed in the ALM analyses along with all relevant market data that were utilized to derive the assumptions while the Director of Development and Analytics reviews the assumptions and their source data monthly for reasonableness.

   Additionally, from a quality control perspective, analysts meet weekly to discuss ALM methodology. Regular training sessions for analysts are held on ALM topics such as modeling, assumptions, and banking products. The Valuation Manager audits ALM reports on a monthly basis and provides modeling and data handling suggestions to the analysts. Most centralized templates are password protected to prevent accidental manipulation. Moreover, most folders are password protected so that only analysts on the team can access the data and reporting tools.

7. **Are industry standard and best practice references defined in your deliverable?**
   
   Yes. ALM First follows industry best practices from an ALM perspective. ALM First’s approach and software are industry-recognized and above standard in nature.
F. IRR MODEL RISK ASSESSMENT REPORT DELIVERABLE

1. Describe the general format and content of your IRR model risk assessment report?

In a password-protected Portable Document Format, the parallel analysis includes summary information for key IRR metrics and then drills down to detail pages by account type. Additionally, there are executive summary narratives, numerical assumptions, a methodology document including data limitations, selected peer comparisons, an economic commentary, and a comparison report describing variances between ALM First’s and the client’s results.

2. What is the conceptual or theoretical reason each component is included in your IRR model risk assessment report?

It is imperative to provide both high-level summaries in numerical and narrative form as well as more granular detail in order to support the audience and to improve the efficiency of analyzing the reports. Moreover, it is critical to include methodology documentation in order to highlight key variables assumed in the model to produce the results. Economic commentary and peer comparisons work to provide current snapshot and time series perspective on the global and local markets.

3. Does your IRR model risk assessment report provide prioritized recommendations for model corrections, upgrades, and advanced refinements? If yes, what are some recent examples?

Yes. Some sample comments:

1. No re-price dates are provided for any of the unsecured lines of credit loans, adjustable home equity loans, and adjustable mortgage loans. It is recommended that the re-price dates be provided to get more accurate cash flows.

2. Structures for adjustable loans are not provided. It is recommended that period caps, floors, lookbacks, and re-price spreads are included in the model to capture the true structure of the loans and therefore produce more accurate results.

3. Original terms and remaining number of payments are not provided for adjustable rate accounts. It is suggested the original term or the number of payments remaining is included in the loan file for proper calculation of maturity dates and to ensure cash flows are being placed in the correct time periods.

4. The lifetime floor for HELOCs listed in the rate file is higher than the book rate. It is recommended the lifetime floor be more correctly aligned with the average rate of the account.

5. Based on the client attribute report, the financial institution does not use prepayment speeds for auto, student, SBA, and home equity loans, ALM First recommends that the financial institution use prepayment speeds for these accounts based on empirical data.

6. Based on the attribute report provided by the financial institution, there is a disconnect between the account type and the secondary market spread being applied. It is recommended the financial institution reassess and be more consistent when applying secondary market spreads. For example, no secondary market spreads are used for the majority of new and used auto loans but a secondary market spread is used for indirect lending new vehicles.

7. A few mortgage loans are incorrectly grouped based on the term and product code provided in the loan file. Also, the original terms for some mortgages do not correlate with the payment frequency provided in the loan file. For example, a 15 year fixed mortgage that pays bi-weekly should not have the same original term as a 15 year fixed mortgage that pays monthly. It is recommended the original terms of bi-weekly mortgages be correctly assigned.
8. The payment frequency for all investments is set to monthly. The payment frequencies for agency fixed, agency callables, foreign bonds, and treasuries should be set to semi-annually. ALM First recommends the client retrieve prices from a direct pricing source if possible.

9. Bump-up certificates should be modeled to account for individuals taking advantage of the one-time rate increase.

10. It is recommended that, where possible, the financial institution discount loans according to a term structure of interest rates (yield curve) rather than at a single rate. Discounting along a curve assigns a unique rate to each cash flow based on that cash flow's remaining term, while using a single rate applies that specific rate to all cash flows. A yield-curve discounting approach is more accurate, especially for instruments such as mortgages, whose cash flows are sensitive to interest rate changes. Along with asset accounts, this yield-curve discounting would also apply to non-maturity deposits and certificates of deposits, which could utilize the appropriate FHLB curve.

11. Running the model in different rate environments (ramped scenarios, twisted scenarios, different shock scenarios etc.) on occasion can highlight areas of balance sheet risk and income risk not captured in the normal, parallel shocks.

12. The Client should incorporate LTV ratios, property type, loan purpose, subordinate financing, and debt-to-income ratios into the model to get a more precise sense of the institution’s fair value. ALM First suggests incorporating credit into the valuation, specifically with respect to first lien residential mortgage discounting. With the application of credit, the property's state should be considered in order to model the estimated recovery lags in foreclosure proceedings. FHLMC post-settlement delivery fees or FNMA loan level pricing adjustments should be taken into account to reflect the pricing guidelines of both FHLMC and FNMA. This will give additional impact to the credit quality and will consider the potential liquidity risk of selling various mortgage products.

13. ALM First suggests that the client bifurcate credit cards into transactors and revolvers based on the past year’s performance and assume an average life for the revolvers based on WAL expectations at origination of credit card ABS issues. In order to bifurcate the credit card portfolio, the client will need offer rates by credit card product in addition to credit score.

14. ALM First counsels the client to model loans flagged as non-performing as though no income will be received. Along with the assumption of a zero coupon, non-performing loans should have cash flows shortened to mimic foreclosure timelines given the collateral’s geographic location.

15. ALM First advises the client to incorporate early withdrawal assumptions on certificates of deposit (CD) based on moneyness and burnout since historical analysis will not lend itself to the current rate environment and relatively low withdrawal penalties that exist now. Burnout on first lien residential mortgage loans can be loosely equated to burnout on CD withdrawals. For out-of-the-money (OTM) CDs, ALM First recommends assuming early withdrawal based on institution-specific empirical data. Similarly, ALM First recommends that investment CDs be modeled as putable bonds with a put price equal to par less the early withdrawal penalty. Moreover, it could be helpful to stratify dormant accounts and estimate immediate withdrawals. Given the relatively short nature of the CD portfolio, this modification will not radically adjust the NEV conclusion.

16. The client should differentiate commercial real estate by property type with each property type receiving unique discounting assumptions. Secondary market spreads can deviate significantly between general CRE and more specialized CRE like warehouses, medical offices, and the like. Data should be collected frequently to capture each loan’s debt service coverage ratio (DSCR). When modeling with credit, loans should be tiered by DSCR. Low DSCR loans should be given more punitive default assumptions.
17. Net non-interest costs represent cash flow from the non-maturity portfolio and should be considered. The non-interest costs, as a proportion of deposit yield, can be significant. Further, ALM First recommends using the swap forward rate curve to project future NMD dividends. Non-maturity deposits are assumed to be variable rate products rather than fixed rate products. Best practice within the industry is to project rates over the life of a variable rate product using a forward curve.

4. Do you assist clients in implementing any IRR model enhancements or refinements recommended by your report?
   Yes.

5. Do you help clients implement enhancements to their model governance solution?
   Yes.

G. IRR MODEL RISK ASSESSMENT REPORT REGULATORY ACCEPTANCE

1. Have examiners in the field reviewed your IRR model risk assessment report? If yes, which agencies?
   Yes. NCUA, FDIC, and OCC.

2. What feedback have examiners generally provided with respect to the methodological approach, content/scope, and findings of your reports?
   No issues – exceeds regulatory requirements.

3. Do you offer assistance to your clients if regulators challenge your report? Specifically, what types of support do you provide?
   Yes, we support our clients’ education about our methodology and the analysis before, during, and after the completion of the risk assessment. We are available for conference calls and on-site visits in order to serve our clients.

H. OPEN-ENDED COMMENTS

ALM First is a leading, trusted strategic partner for financial advisory services. Our expertise in asset liability management and investment portfolio management allows us to deliver deeper insights into your balance sheet and employ that knowledge to strengthen the financial performance of your institution.

As an SEC-registered investment advisor (not a broker/dealer), ALM First acts as an unbiased third party, offering commission-free, fee-based services.

- One of the nation’s leading financial advisory firms
- More than 200 clients representing over $220 billion in assets
- Approximately $18 billion in investments under management
- Comprehensive analytical software and risk reporting
- Access to the world’s largest brokerage firms
A. GENERAL INFORMATION

1. Vendor contact information
   Deborah Donaldson, President & CEO
   Alpha-Numeric Consulting, LLC
   464 Quail Run
   Hoschton, GA 30548
   ddonaldson@alphanumericconsulting.com
   www.alphanumericconsulting.com
   706.824.1902

2. Describe the general nature of the current client base (charters, asset range, business models)
   • Banks and Credit Unions, with an asset range of $50 million to $14 billion
   • Non-complex to moderate balance sheet structures
   • Regulated by the OCC, FDIC, Federal Reserve, NCUA, as well as various state regulatory agencies
   • Broad geographical base with clients in more than 30 states

3. Number of IRR model risk assessment reports delivered in the past three years
   Approximately 143

4. Describe any special business activities commonly engaged in by your IRR model risk assessment clients (e.g. mortgage servicing rights, loan pipeline management, indirect lending)
   Current clients are not engaged in any special business activities.

B. ALM MODEL(S) ON WHICH YOU HAVE PERFORMED IRR MODEL RISK ASSESSMENTS

1. ALM model name(s), level(s) and version(s)
   Fiserv, Farin Foresight, Farin Insight, Darling Consulting Group BASIS, Vantage, FTN, Risk Analytics (FIMAC), First Empire, ProfitStars, Album, BudSyn, BPS, Sendero SVAL, Sendero Plan80, Bancware 4.x, Bancware 5.x, Vining Sparks, Echo, FiCast, Darling Consulting Group L360, RzMetrics, HNC/FTI, Olsen, Baker, Plansmith Compass, QRM, Wisdom, FinPro, SRI VTEN and several others.

2. For each ALM model named above, how many IRR model risk assessments have you conducted in the past three years?
   117 validations performed on the Fiserv, Darling, Farin, and FIMAC models.
   26 validations performed on the other models.

3. Provide any relevant comments regarding your expertise and experience with particular ALM models and types of IRR analysis
   I have specialized knowledge and technical skills backed by more than 27 years of experience.
Choosing the Right ALM Modeling Solution: In-House and Outsourced Solutions and Risk Assessments

in banking, financial applications, software models, and consulting services with an emphasis on asset-liability management, internal audit, investments, operations, profitability analysis and risk, and vendor oversight management. I am a recently retired FMS Board of Directors member, past Chair of the Financial Managers Society Internal Audit/Risk Management Council, past FMS Audit Committee member, national speaker for ALM and IRR webinars and seminars, frequent contributor to industry newsletters and magazines, BALM contributor, Georgia Bankers Association member, and Editorial Advisor for the Internal Audit Alert newsletter. I am a published author of both fiction and nonfiction, and have written the 2nd edition of The Internal Audit Desk Reference for FMS, as well as Auditing and Validating Asset/Liability Management Models (published Oct 2009).

C. TYPES OF RISK ASSESSMENTS PERFORMED

- **Model Verification**: A detailed assessment of model data, chart of accounts setup, attributes, contractual inputs, behavior assumptions and reports.

- **Model Validation**: Confirmation of category model forecasts compared to expected category behaviors given their contractual terms and embedded options.

- **Model Governance Review**: Assessment of an institution’s model control environment, policy directives, modeling procedures, and IRR analysis scope and quality.

D. VENDOR INDEPENDENCE

1. Are you connected in any way with, or do you receive any payments from, the ALM vendor(s) whose model(s) you assess? If so, please describe the relationship.

   No payments are received from the vendors in conjunction with any of the validations performed. However, I have been hired to perform the software certifications, independent of any client validations and verifications, for Darling BASIS, Darling L360, Farin Foresight, ZMFS, Farin Foresight, SRI VTEN, ALMeter, and R2Metrics.

2. Are you connected in any way with, or do you receive any payments from, any securities brokers? If so, please describe the relationship.

   No

3. Do you offer an in-house ALM model or outsourced IRR analysis service? If so, please describe any potential influence of these on your IRR model risk assessments.

   No

E. IRR MODEL RISK ASSESSMENT PROCESS

1. Describe your IRR model risk assessment process?

   The validation process is fairly straight-forward. A proposal is sent that provides background for the due diligence, scope, timing, sample table of contents, pricing, data & document request list as well as a mutual non-disclosure agreement. If accepted, the signed proposal becomes the executed contract, eliminating the need to compare documents.

   Data requested from the institution includes the as-of date general ledger, ALCO reports, ALCO minutes, investment trial balance and all applicable policies. Data requested from the model,
provided by the institution and/or the vendor, is documented in the proposal and is comprehensive with respect to the inputs, assumptions, and outputs for EVE/NEV/NII IRR rate shocks and rate ramps. When applicable, a back-up of the database is requested.

The independent validation follows the Interagency regulatory guidelines and requirements. The process includes a review of the policies and procedures, model data/inputs/assumptions/outputs, and exposure limits as well as an historical analysis that compares the direction and volatility of the model’s forecasts compared to the actual institution performance during the various rate cycles (March 2006-present).

Throughout the review process, questions and concerns are emailed regularly with all clients. This frequent communication allows a clear understanding to both parties of the potential issues as well as the project status. Once the validation is completed, a comprehensive Draft report is emailed. After the client has had the time to review the Draft report, we’ll schedule an exit call to discuss the findings and recommendations. Any changes that need to be made to the report will be made at that time. Once the changes have been incorporated into the report, two final reports will be issued. One final report is the comprehensive report, and the other is a summary report that contains only the cover, scope, and summary of findings. A customized Management Response template is provided to enable the client to more easily prepare management responses to the findings.

At the end of the engagement, all work papers are burned to a CD and returned to the client. Communication is done through the company email, encrypted Zixmail, and/or the institution’s secure ftp site. Completion of the project is usually 4-6 weeks depending on scheduling commitments.

2. Do you take physical possession of the ALM model for the IRR model assessment?
   When applicable, I can take possession of a back-up of the client’s database for the validation.

3. What specific model technical verification techniques do you use, and why?
   The technical verification includes an evaluation of the inputs, assumptions, and outputs. Contractual characteristics are compared to the source documents, internal/external studies, local/national trends and finance theory. More subjective assumptions are reviewed for reasonableness and consistency with industry best practices.

4. What specific model forecast validation techniques do you use, and why?
   The model’s EVE/NEV/NII IRR outputs are reviewed for both the short term and longer term horizons in a variety of shocked, ramped, and alternative interest rate scenarios. Mathematical accuracy is determined by reviewing the profiles’ shapes (arched, indirect, direct, V) and volatility (limited, moderate or extreme) compared to expected behaviors. Present value to book value ratios, percent change from the Base Case, as well as the yields and costs are independently calculated for comparison. Additional testing is done to determine adherence to the categories’ contractual terms and sensitivity to key assumptions. Reliability is also placed on the vendors’ software certifications.

5. What specific model governance review techniques do you use, and why?
   The institutions’ policies, processes and procedures are reviewed to determine if they are reasonable, if the control systems are consistent with the complexity of the ALM/IRR activities and whether the systems dependably meet or exceed industry best practices. Personnel involved with
Choosing the Right ALM Modeling Solution: In-House and Outsourced Solutions and Risk Assessments

the asset/liability management function are interviewed to determine if they clearly understand the source of risk, strategic direction of the institution, management’s risk tolerance limits, and applicable policies. Reporting is reviewed to ascertain the ability to provide timely and accurate information to management, ALCO and the Board. The exposure limits are reviewed, as well, to determine if they are consistent with the overall approach to measuring interest rate risk and are based on capital levels, earnings performance, and risk tolerance.

6. What internal quality assurance processes do you use?

All validations are performed by a subject matter expert with more than 27 years of experience. Public information is obtained via independent sources, and current period data is reconciled to the institutions’ ledgers, subledgers and other internal documentation. Reports are subject to peer review before the Drafts are sent to the clients.

7. Are industry standard and best practice references defined in your deliverable?

Yes. Testing is done to determine the clients’ compliance status with regulatory requirements and industry best practices. If required, recommendations are provided for corrections and enhancements.

F. IRR MODEL RISK ASSESSMENT REPORT DELIVERABLE

1. Describe the general format and content of your IRR model risk assessment report?

The reports are provided in PDF format. The regulatory requirements for each risk are included within each conceptual section. Each risk grouping documents the potential risk (why the need for review of that area is required), the test step (the manner and method in which the compliance was determined), and the Observation, Recommendation or Finding (compliance status). Detailed examples are provided for each finding. Summary and detailed charts and graphs appear throughout the various sections and as exhibits at the back of the report. The final deliverable includes a comprehensive report, summary management report, and management response template. If requested, a customized Power Point presentation is also provided for ALCO/Board continuing education.

Sample Table of Contents

ALM IRR Validation and Management Report Scope
Model Governance
Suggested Framework for Supervisory Review
Summary of Validation Findings
Validation Programs and Model Policies
Inventory Governance
Theory
Data
Assumptions
Security and Change Control
Ongoing Review
Model Construction (including historical performance analysis)
Reporting
2. What is the conceptual or theoretical reason each component is included in your IRR model risk assessment report?

Each section is designed to show compliance with the regulatory requirements in terms of documentation, internal controls, model implementation, assumption development, data accuracy, modelers’ experience, and the ability of the software to model the institutions’ balance sheet. The components are included to ensure that there is an adequate and effective interest rate risk process that enables management, with confidence, to identify, measure, monitor, and control interest rate risk in a timely and comprehensive manner.

3. Does your IRR model risk assessment report provide prioritized recommendations for model corrections, upgrades, and advanced refinements? If yes, what are some recent examples?

Yes. Where there were no exceptions, an “Observation” states such. In the event that there are opportunities for enhancements or corrections, a “Recommendation” or “Finding” is generated. Findings are deemed to be minor if they occur in small balance categories, have minimal effect on the overall profile, or occur in scenarios that are not likely or probable. Moderate findings are for data and/or assumptions that cause the results to be incorrect, or for occasions when there is an inconsistency with regulatory requirements. Material findings are reserved for those instances where the incorrect input, calculation, or reporting of information is so inaccurate that values are misstated, causing management to draw incomplete or incorrect conclusions.

Recommendations would include the suggestion for ALCO/Board continuing education or clarifications to the policy(s).

Minor findings would include requirements for additions to the policy(s), certain data corrections or enhanced documentation.

Moderate findings would include requirements for updating stale or incorrect assumptions, the need for additional stress testing scenarios, segregation of records within categories by type, or refinement of the exposure limit definitions.

Material findings would include requirements for the correction of cash flows or errors in the key assumptions, as well as the need to transition from a model that can no longer model the institution’s balance sheet in a manner consistent with regulatory or management requirements.
4. Do you assist clients in implementing any IRR model enhancements or refinements recommended by your report?

Yes. An explanation is provided as to why the enhancements, refinements, or corrections are needed, as well as the probable consequences of not doing so, but only to the extent that it does not provide a conflict of interest with the validation engagement. Direction is also given to the proper location within the software to make the change. I do not provide answers to more subjective assumptions, nor do I conduct studies (such as core deposit or prepayment) that result in information for use within the model.

5. Do you help clients implement enhancements to their model governance solution?

Yes. An explanation is provided as to why the enhancements, refinements, or corrections are needed, as well as the probable consequences of not doing so, but only to the extent that it does not provide a conflict of interest with the validation engagement.

G. IRR MODEL RISK ASSESSMENT REPORT REGULATORY ACCEPTANCE

1. Have examiners in the field reviewed your IRR model risk assessment report? If yes, which agencies?

Yes, the reports have been reviewed by the FDIC, OCC, NCUA, and various state banking agencies.

2. What feedback have examiners generally provided with respect to the methodological approach, content/scope, and findings of your reports?

The examiners have accepted the format, methodology, content and scope, which follows the regulatory framework for interest rate risk exams. They have been complimentary as to the thorough nature of the verification as well as the educational content and beneficial nature of the recommendations and findings.

3. Do you offer assistance to your clients if regulators challenge your report? Specifically, what types of support do you provide?

Yes. I am available for phone conferences, and meetings with management, committee, ALCO, Board members, internal/external auditors, and any of the regulators when required. The comprehensive nature of the report and design allows for clear documentation of each recommendation and/or finding. Work papers provided to the client serve as an additional support for the conclusions drawn.

H. OPEN-ENDED COMMENTS

Increasing dependence on models has resulted in the need for augmented scrutiny and regulatory guidance. Model risk is defined as the possibility that management decisions based on model results may be compromised if the source data, assumptions, programming, and/or code are inaccurate. Institutions accept this risk, but take steps to mitigate it. The regulators expect institutions to have an adequate system of internal controls to ensure the integrity of all elements of their IRR management process, including the adequacy of corporate governance, compliance with policies and procedures, and the comprehensiveness of IRR measurement and management information systems.

Independent verifications and validations can provide management with a sense of confidence that the data is correct, the assumptions are reasonable, and forecasts are reasonably predicting probable positions based on the most accurate set of circumstances.
A. GENERAL INFORMATION

1. Vendor contact information

Darling Consulting Group, Inc.
260 Merrimac Street
Newburyport, MA 01950
Phone: 978-463-0400
Fax: 978-465-6033
Web: www.darlingconsulting.com
Mark Haberland at mhaberland@darlingconsulting.com
Joe Kennerson at jkennerson@darlingconsulting.com

2. Describe the general nature of the current client base (charters, asset range, business models)

A large and highly diverse group of banks and credit unions ranging in asset size from $20 million to more than $300 billion seek Darling Consulting Group’s (DCG) expertise in helping them enhance the effectiveness of their interest rate risk modeling and related processes (model risk assessment/validation and management.) We are actively engaged with institutions encompassing a broad range of business models, including all facets (simple and complex) of residential, commercial and consumer driven strategies.

3. Number of IRR model risk assessment reports delivered in the past three years

DCG has delivered hundreds of these reports over the past three years.

4. Describe any special business activities commonly engaged in by your IRR model risk assessment clients (e.g. mortgage servicing rights, loan pipeline management, indirect lending)

Given the diversity of DCG’s client base, there are numerous special business activities in which clients are engaged, including: use of derivatives, back-to-back swap programs, mortgage servicing, loan pipeline management, indirect lending, international financing, structured investments (i.e. CDOs, CLOs), REITs, BOLI, loss share agreements, Troubled Debt Restructurings (TDRs), TARP, structured funding, debt issuance, M&A, liquidity and credit stress testing.

B. ALM MODEL(S) ON WHICH YOU HAVE PERFORMED IRR MODEL RISK ASSESSMENTS

1. ALM model name(s), level(s) and version(s)

ALMeter
Baker Group’s Interest Rate Risk Monitor
BASIS
Brick & Associates
Farin Foresight
FIMAC Risk Analytics and Balance Sheet Manager
Fiserv ALM (Sendero)
Choosing the Right ALM Modeling Solution: In-House and Outsourced Solutions and Risk Assessments

In addition, DCG has provided validations for more than 20 independent ALM model outsource providers, including:

- ALM First
- ALM Network
- AMG
- Austin & Associates, LLC
- Balance Sheet Solutions, LLC
- CMyers
- FICAST
- FinPro
- First Empire
- FTI
- FTN
- MC Planning (First Southwest)
- MHA Stakeholders
- PCBB
- Olson Research Associates, Inc.
- Online ALM
- Stockton Financial
- Velligan-Blaxall Consultants, LLC
- Vining Sparks

2. For each ALM model named above, how many IRR model risk assessments have you conducted in the past three years?

   Below is a distribution of DCG IRR model risk assessment clients:

   - Fiserv/Sendero: 30%
   - Sungard/BancWare: 15%
   - Farin: 10%
   - PROFITstar: 10%
   - ZM: 10%
   - BASIS: 5%
   - SRI: 5%
   - QRM: 5%
   - Other: 5%

3. Provide any relevant comments regarding your expertise and experience with particular ALM models and types of IRR analysis

   As reflected in the prior two questions, DCG has extensive broad-based experience with examining interest rate risk models. Additionally, we are practitioners – informed by extensive hands-on experience with a large, diverse client base for whom we have built tens
of thousands of models over our history. Importantly, we have a large, highly skilled and
dedicated full-time staff.

C. TYPES OF RISK ASSESSMENTS PERFORMED

   x Model Verification: A detailed assessment of model data, chart of accounts setup,
   attributes, contractual inputs, behavior assumptions and reports.

   x Model Validation: Confirmation of category model forecasts compared to expected
   category behaviors given their contractual terms and embedded options.

   x Model Governance Review: Assessment of an institution’s model control environment,
   policy directives, modeling procedures, and IRR analysis scope and quality.

D. VENDOR INDEPENDENCE

1. Are you connected in any way with, or do you receive any payments from, the ALM vendor(s)
   whose model(s) you assess? If so, please describe the relationship.

   No.

2. Are you connected in any way with, or do you receive any payments from, any securities
   brokers? If so, please describe the relationship.

   We are independent and are not compensated by security brokers relating to any advice we
   provide.

3. Do you offer an in-house ALM model or outsourced IRR analysis service? If so, please
   describe any potential influence of these on your IRR model risk assessments.

   DCG provides outsourced ALM modeling and strategic advisory services utilizing BASIS, DCG’s
   proprietary ALM modeling platform. Our substantive consultative and analytical experience greatly
   informs our model risk assessments.

E. IRR MODEL RISK ASSESSMENT PROCESS

1. Describe your IRR model risk assessment process?

   DCG’s reviews extend beyond just a standard “model audit.” DCG provides its clients with a
   comprehensive end-to-end review of the entire process with the goal of a) providing “effective
   challenge” (as specified by regulatory model risk management guidelines) and b) helping
   organizations elevate the performance of the ALM model and modeling process in support of
   the institution’s long-term strategic business needs – the ability to assess multiple risks (i.e. IRR,
   liquidity, capital and credit), effectively perform assumption sensitivity and stress testing, strategy
   and what-if simulations and promote more proactive decision-making within ALCO.

   Management and the Board must have confidence in the efficacy of their risk measurement
   model, from the quality and sufficiency of the data inputs to model construction and configuration,
   scenario selection, assumptions development and testing, reporting and governance (i.e. policies,
   procedures, processes and controls). This is an important focus of DCG.

   We also provide feedback on how to improve our clients’ process and comply with all of the
   relevant regulatory pronouncements, including the regulatory guidance on model risk management
   (OCC 2011-12/SR 11-7).
2. Do you take physical possession of the ALM model for the IRR model assessment?

For select ALM modeling systems, DCG will take physical possession of the model. That said, it is not a requirement to facilitate an effective review. DCG’s model validation experts have notable hands-on experience with all of the most popular vendor models, and they utilize client-provided system diagnostic reports and model output in combination with several validation and testing techniques such as benchmarking and other related analytical processes to drive the assessment process.

3. What specific model technical verification techniques do you use, and why?

DCG employs several quantitative and qualitative methods to effectively evaluate the accuracy and reliability of an institution’s ALM model. While the depth and level of analytics may vary from project to project, the following highlights some of the most notable tools/methods used:

- Substantive analytical data review and reconciliation
- Complete review of model configuration and structure
- Evaluation of key assumption development, support and use
- Assessment of interest rate scenario selection and use
- Review of model output
- Benchmarking
- Back testing
- Sensitivity testing
- Documentation review

4. What specific model forecast validation techniques do you use, and why?

The validation techniques employed by DCG will depend upon the depth of review desired or required by clients and the forecasting methodologies and assumptions utilized. In addition to outcomes analysis, back testing of key modeling assumptions is often employed (assessing actual new and existing business activities vs. forecast).

5. What specific model governance review techniques do you use, and why?

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6. What internal quality assurance processes do you use?

In addition to employing a substantive internal review process managed by DCG’s Director of Risk Management Analytics & Validation, the model validator facilitates a complete walk-through of the model assessment with the client model manager or operator prior to issuing the final report. This ensures agreement and full understanding of the key findings and avoids a situation whereby a model owner is placed in a situation of having to answer to erroneous findings with other stakeholders (ALCO, ERMC, model risk management, audit committee, examiners, etc.). During this process, members of a client’s model risk management or audit are encouraged to participate.

Additionally, the validation group meets regularly to discuss recent trends and observations in order to continually enhance the client experience.

7. Are industry standard and best practice references defined in your deliverable?

Yes. In addition to recommendations that will ensure compliance standards are addressed, DCG
provides the client with best practice suggestions as a way to promote ongoing development and enhancement of the model’s performance and contribution to the decision-making process of the organization. DCG’s best practice suggestions are inspired by decades of industry-leading modeling and balance sheet risk management advisory experiences.

F. IRR MODEL RISK ASSESSMENT REPORT DELIVERABLE

1. Describe the general format and content of your IRR model risk assessment report?
   DCG’s IRR model risk assessments addresses all aspects of the model and modeling processes including data management, model structure/configuration, assumption development and support, output and model governance (processes and controls). In addition to the detailed assessment, an executive summary highlighting the key findings, ideas and recommendations is also provided.

   DCG’s recommendations are prioritized and classified as “High Priority Action Items,” “Moderate Priority Recommendations,” or “Low Priority Considerations.” This ranking system allows stakeholders (model managers/owners, model risk management/audit, the Board and examiners) to have a clear understanding of the outstanding issues with the model or process and effectively establish remediation and enhancement plans commensurate with the risk posed. A supplemental document featuring industry “Best Practices” is also provided.

   DCG also assigns a risk rating to each major component of the ALM model and modeling process, as well as an overall rating using a four-tiered system: “Above Average,” “Satisfactory,” “Needs Modest Enhancement,” and “Needs Significant Improvement.”

2. What is the conceptual or theoretical reason each component is included in your IRR model risk assessment report?
   DCG’s model risk assessment framework is designed to effectively address all of the regulatory requirements for interest rate risk and model risk management, including:

   ✓ Joint Policy Statement on Interest Rate Risk (SR 96-13)
   ✓ Interagency Advisory on Interest Rate Risk (OCC 2010-1/SR 10-1)
   ✓ Questions and Answers on Interagency Advisory on Interest Rate Risk Management (SR 12-2/FDIC FIL-2-2012)
   ✓ Guidance on Model Risk Management (OCC 2011-12/SR 11-7)

   Additionally, a driving principal behind DCG’s assessments is to provide clients with a clear understanding of the strengths and weaknesses of the model and its effectiveness in supporting a proactive ALCO decision-making process.

3. Does your IRR model risk assessment report provide prioritized recommendations for model corrections, upgrades, and advanced refinements? If yes, what are some recent examples?
   Yes. Our reports provide a broad range of recommendations specific to each individual client situation, and are appropriately prioritized. These recommendations embrace all elements of the validation from all aspects of the model and modeling processes including data management, model structure/configuration, assumption development and support, output and model governance (processes and controls).
4. Do you assist clients in implementing any IRR model enhancements or refinements recommended by your report?

While DCG’s staff includes several system-specific modeling experts who are capable of directly assisting with implementing enhancements or refinements, current model risk management standards do not embrace this practice as it jeopardizes the independence of the model validator. That said, DCG’s team of model and model validation experts regularly provide system-specific remediation guidance to model managers.

In the case of governance or ALCO policy, reporting or strategic performance-related ideas and recommendations, DCG consultants will facilitate in-house education and work directly with ALCOs and Directors to enhance decision-making effectiveness.

5. Do you help clients implement enhancements to their model governance solution?

As long as independence is not compromised, DCG’s risk management consultants will help clients implement model governance-related initiatives. This may include assistance with model documentation, policies and processes/controls surrounding data, modeling, assumptions and reporting.

G. IRR MODEL RISK ASSESSMENT REPORT REGULATORY ACCEPTANCE

1. Have examiners in the field reviewed your IRR model risk assessment report? If yes, which agencies?

Yes. All regulatory agencies are familiar with DCG’s model risk assessments (FDIC, OCC, FRB, NCUA and state regulatory bodies)

2. What feedback have examiners generally provided with respect to the methodological approach, content/scope, and findings of your reports?

Examiners consistently rely on DCG’s assessments as part of their risk assessment process and appreciate the approach, level of transparency and the technical and business expertise applied.

3. Do you offer assistance to your clients if regulators challenge your report? Specifically, what types of support do you provide?

Yes. Should a regulator have an issue or question regarding our report or recommendations, DCG welcomes the opportunity to assist. This support could include discussions with the model manager/owner, model risk management/audit or the Board to ensure a full understanding of the issue raised along with an appropriate response, assistance with a written response or direct discussions with the examiner. We are known for establishing long-term relationships with our clients and, to that end, are always available to address issues or questions that arise in-between validations.

H. OPEN-ENDED COMMENTS

Our Approach to ALM Modeling
Darling Consulting Group (DCG) specializes in empowering Asset/Liability Management Committees (ALCOs) with the means to make effective business decisions. As a recognized expert in providing Asset/Liability Management (ALM)-related consulting and educational services, we know the importance of developing and maintaining accurate and effective ALM models, processes and controls. The ongoing success of our clients, and our more than 30 years in the industry, is testament to our knowledge, experience and expertise in developing and using the
right tools and resources. DCG continues to set new standards for maintaining a “best practices” approach to ALM modeling and balance sheet management. Our commitment to assisting banks and credit unions to continuously improve their decision-making capabilities is at the foundation of all DCG services.

**DCG’s Qualifications and Unique Value Proposition**

The value that our clients derive from their relationship with DCG will be driven by three key elements: People, Methods, Technology.

**People** – Our team is made up of the best ALM experts you can find, who are all working together to help improve our clients’ processes. Not only are they concerned about even the smallest perceived details of the process, they are always available to provide assistance when the need arises. This highly skilled group forms the foundation of DCG’s core business of asset liability and risk management. As part of our clients’ relationship with DCG, they get all the resources that have made us the foremost ALM Management Company in the country.

**Methods** – Throughout DCG’s history, we have developed and enhanced our methods for identifying interest rate risk, measuring liquidity and presenting it in a manner that is accurate, complete and understandable. We take these years of experience and develop a process that provides the best outcomes for our clients.

**Technology** – We have had a company-wide focus on developing and maintaining key technologies to provide a very strong modeling and validation process for our clients. Our technologies are developed and maintained here at DCG, allowing us to customize the best process, have complete say over the final product and continue to develop and adapt to the changing marketplace with input from some of the industry’s top minds.

Professionals within DCG have worked with institutions using all of the commercially available ALM modeling systems. Our team’s strong backgrounds in the banking, regulatory and external auditing fields, combined with their many years of active involvement in developing models and assisting financial institutions nationwide with the ALM decision-making process, uniquely qualifies them to assist our clients with their risk assessment needs.
A. GENERAL INFORMATION

1. Vendor contact information
   www.fimacsolutions.com
   877-789-5905 Ext. 1

2. Describe the general nature of the current client base (charters, asset range, business models)
   Clients range from very small credit unions to multi-billion asset banks and insurance companies.

3. Number of IRR model risk assessment reports delivered in the past three years
   Approximately 75.

4. Describe any special business activities commonly engaged in by your IRR model risk assessment clients (e.g. mortgage servicing rights, loan pipeline management, indirect lending)
   Focus has been quite varied. Our consulting staff is comprised of former bankers and credit union officers, so our experience base is wide.

B. ALM MODEL(S) ON WHICH YOU HAVE PERFORMED IRR MODEL RISK ASSESSMENTS

1. ALM model name(s), level(s) and version(s)
   Bancware – all versions since 2000
   ProfitStars
   Farin
   FiServ – all versions and models
   Fisher Rager (FiServ model)
   First Empire Securities
   Mark Smith (in house and Farin models)
   R2Metrics
   Risk Analytics
   ZM Financial

2. For each ALM model named above, how many IRR model risk assessments have you conducted in the past three years?
   We don’t maintain that information.
3. Provide any relevant comments regarding your expertise and experience with particular ALM models and types of IRR analysis

Our consultants have practical, hands-on experience with Bancware, FiServ, Profit Stars, Risk Analytics, and ZM.
We are also adept at conducting parallel model runs.

C. TYPES OF RISK ASSESSMENTS PERFORMED

- **Model Verification**: A detailed assessment of model data, chart of accounts setup, attributes, contractual inputs, behavior assumptions and reports.
- **Model Validation**: Confirmation of category model forecasts compared to expected category behaviors given their contractual terms and embedded options.
- **Model Governance Review**: Assessment of an institution’s model control environment, policy directives, modeling procedures, and IRR analysis scope and quality.

D. VENDOR INDEPENDENCE

1. Are you connected in any way with, or do you receive any payments from, the ALM vendor(s) whose model(s) you assess? If so, please describe the relationship.
   
   We are a wholly owned subsidiary of FIMAC Solutions LLC who has two proprietary A/L models: FIMACMountain™ – A/L© and Risk Analytics® ALM Model©.

2. Are you connected in any way with, or do you receive any payments from, any securities brokers? If so, please describe the relationship.
   
   We receive no payments from them, but do receive referrals for work.

3. Do you offer an in-house ALM model or outsourced IRR analysis service? If so, please describe any potential influence of these on your IRR model risk assessments.
   
   We do not market our parent company’s software solutions to our consulting clients. In the past 3 years we have had one risk assessment client move to a FIMAC Solutions model, but it was purely coincidental with the client coming through an independent channel.

E. IRR MODEL RISK ASSESSMENT PROCESS

1. Describe your IRR model risk assessment process?

   We send an initial data request to clients including all input data utilized and support for subjective assumptions. Also requested are appropriate policies and control procedures including the ALCO charter, and investment and liquidity policies. Based on this information we make a subjective determination if, in our opinion, the model utilized is appropriate for the client’s balance sheet structure and ALM/IRR needs.

   Upon receipt of data we begin the review first by understanding and validating the control procedures and then verifying the accuracy of all objective assumptions input by balancing to the GL and balancing any aggregated accounts and determining if the aggregation appears appropriate. We then analyze the subjective assumptions, their entry, and any support the client provided for justification of the assumptions.
The next step is to review all policies provided to determine completeness and to ascertain that all policies correctly and appropriately interface with each other and don’t provide contradictory requirements or call for data or information not being produced by their model.

Upon completion of the work, and generally during the work, we contact the client to ask any questions that have risen during the process. We then begin production of the work product output. At completion we deliver a Discussion Copy to the client and schedule a conference to discuss and review. After the conference is complete any modifications that may be required are completed and the final report is issued.

2. Do you take physical possession of the ALM model for the IRR model assessment?
   Generally not. Most work is performed off site. If the model in question is an on-line model, we will ask for access if necessary.

3. What specific model technical verification techniques do you use, and why?
   We consider that information proprietary.

4. What specific model forecast validation techniques do you use, and why?
   Although also proprietary, we often utilize a FIMAC Solutions model as a test run to determine initial likelihood of accuracy, though if the model being assessed has an independent audit, we rely upon that in most cases, but still test to determine proper usage of the model.

5. What specific model governance review techniques do you use, and why?
   We follow a combination framework of AICPA guidelines and regulatory guidance we have developed over the past 15 years. Our process has not been challenged by CPA’s, regulators or the Securities and Exchange Commission.

6. What internal quality assurance processes do you use?
   All work conducted is reviewed by a party who did not conduct the engagement to assure that the work followed our procedures and that the results can be supported and defended.

7. Are industry standard and best practice references defined in your deliverable?
   We reference regulatory guidelines and compliance therewith. “Industry standard best practices” tend to be defined by the speaker, not by a specific written guide, other than guidance provided by regulatory bodies. Therefore we generally reference known guidance.

F. IRR MODEL RISK ASSESSMENT REPORT DELIVERABLE

1. Describe the general format and content of your IRR model risk assessment report?
   We first present the framework under which our work is conducted. We then address each of the findings under the steps outlined in E (1) above.

2. What is the conceptual or theoretical reason each component is included in your IRR model risk assessment report?
   To ensure accuracy of the output, integrity of input, and usefulness of the results. Also to determine if risk limits and other needed guidelines and information is delivered to the appropriate areas within the institution and that the institution understands their output and the risk measurements.
provided by their model. Further, our review determines if the model input is being updated (as to subjective assumptions) as should be done regularly.

3. Does your IRR model risk assessment report provide prioritized recommendations for model corrections, upgrades, and advanced refinements? If yes, what are some recent examples?

Our work product identifies any issues and clearly prioritizes them according to need/urgency. Most commonly we see errors in data entry or failure to update assumptions. In some models account code types may be modeled in more than one fashion, but one approach may be more appropriate than the other. When we discover that a client is taking the least appropriate approach, they are informed and instructed.

4. Do you assist clients in implementing any IRR model enhancements or refinements recommended by your report?

If the recommendation is to change model providers, we will suggest the type of model that would be most appropriate for them. If the refinement is of an internal nature, we provide instruction on the proper procedure.

5. Do you help clients implement enhancements to their model governance solution?

As a separate engagement, though our work product does provide general direction.

G. IRR MODEL RISK ASSESSMENT REPORT REGULATORY ACCEPTANCE

1. Have examiners in the field reviewed your IRR model risk assessment report? If yes, which agencies?

All federal agencies and the Federal Reserve Banks, along with many of the State regulatory bodies.

2. What feedback have examiners generally provided with respect to the methodological approach, content/scope, and findings of your reports?

We have not received any negative comments that have been shared with us.

3. Do you offer assistance to your clients if regulators challenge your report? Specifically, what types of support do you provide?

Should such event ever occur, we would “go the extra mile” to assure that we respond to the commentary and provide satisfaction to all parties.

We have had regulators (field examiners) ask questions of us regarding our work, and we always respond with the educational response which they are seeking.

H. OPEN-ENDED COMMENTS

Financial Institution Management Associates Corp. is a team of experienced risk management practitioners, all with hands on experience as former officers of financial institutions. We have been where you are and have experienced the regulatory examination process ourselves and understand its challenges and demands. We work to provide you with the process and recommendations to help remove the Sensitivity to Market Risk section of the Safety and Soundness Exam from undue scrutiny.
A. GENERAL INFORMATION

1. Vendor contact information

   Greg Garcia  
   Managing Director  
   FinPro, Inc.  
   158 Route 206  
   Gladstone, NJ 07934  
   ggarcia@finpro.us  
   908-604-9336  
   www.finpro.us

2. Describe the general nature of the current client base (charters, asset range, business models)

   Community banks and credit unions with asset sizes ranging from $50mm to $10 billion in total assets with a wide range of balance sheet composition complexity.

3. Number of IRR model risk assessment reports delivered in the past three years

   20

4. Describe any special business activities commonly engaged in by your IRR model risk assessment clients (e.g. mortgage servicing rights, loan pipeline management, indirect lending)

   Mortgage servicing rights, indirect auto lending, securitizations, hedge accounting and leveraged lending, among others.

B. ALM MODEL(S) ON WHICH YOU HAVE PERFORMED IRR MODEL RISK ASSESSMENTS

1. ALM model name(s), level(s) and version(s)

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2. For each ALM model named above, how many IRR model risk assessments have you conducted in the past three years?

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3. Provide any relevant comments regarding your expertise and experience with particular ALM models and types of IRR analysis

   For over 25 years, FinPro has provided expertise in analyzing interest rate risk for community-based financial institutions. With a combined total of over 200+ years of banking and regulatory expertise, we have a unique ability to analyze risk from both a regulatory and shareholder value approach.

   In addition to risk assessment services, we provide a wide range of consulting services to
community-based financial institutions, including outsourced interest rate risk modeling and reporting. Our proprietary model was built in-house and has been independently audited and received a very high rating for its accuracy and capabilities.

C. TYPES OF RISK ASSESSMENTS PERFORMED

- **Model Verification**: A detailed assessment of model data, chart of accounts setup, attributes, contractual inputs, behavior assumptions and reports.

- **Model Validation**: Confirmation of category model forecasts compared to expected category behaviors given their contractual terms and embedded options.

- **Model Governance Review**: Assessment of an institution’s model control environment, policy directives, modeling procedures, and IRR analysis scope and quality.

D. VENDOR INDEPENDENCE

1. Are you connected in any way with, or do you receive any payments from, the ALM vendor(s) whose model(s) you assess? If so, please describe the relationship.
   
   No, unless the model was created in-house by the client.

2. Are you connected in any way with, or do you receive any payments from, any securities brokers? If so, please describe the relationship.
   
   No.

3. Do you offer an in-house ALM model or outsourced IRR analysis service? If so, please describe any potential influence of these on your IRR model risk assessments.
   
   Yes, we have a proprietary ALM model that is used to provide outsourced IRR services. This model may be utilized in the review and verification of analytics during IRR model risk assessment.

E. IRR MODEL RISK ASSESSMENT PROCESS

1. Describe your IRR model risk assessment process?
   
   FinPro’s risk assessment process begins with a conversation with the client on the scope of the assessment followed by a comprehensive information request based on the scope of the assessment.

   Upon receipt of information that is uploaded via each client’s unique secure, data-encrypted website, a FinPro client manager will begin the process of analyzing the data and schedule an interview with the appropriate staff at the client to discuss the internal processes and any specific questions that arise from the initial review of data. After the interview, a parallel analysis utilizing FinPro’s proprietary in-house IRR model will be run to compare modeling results.

   After the comparison and initial review of the model is complete, a follow up interview with the client will take place to discuss results and findings. At this point during the process, the client will have the ability to refute or explain any findings with the FinPro client manager prior to the finalization of the assessment report.

   Once all interviews are complete and questions are resolved, a FinPro client manager will
issue an assessment report to the client for their final review. Once the report is finalized, the client may request that the FinPro client manager provide a presentation of the findings and recommendations to the Asset Liability Committee.

2. Do you take physical possession of the ALM model for the IRR model assessment?
   No. We review the inputs and outputs that are generated from the model and assess against our in-house model output and general industry practices for accuracy.

3. What specific model technical verification techniques do you use, and why?
   We verify that all inputs tie back to the Bank's actual financial results as of the reporting period date to make sure that the model does not manipulate the results by using inaccurate or stale data. All data extract files must tie back to general ledger balances in order to proceed to the next level of model behavioral assumption testing and forecast validation.

   Model output, based upon the inputs, is tested relative to a control model to validate the results.

4. What specific model forecast validation techniques do you use, and why?
   We run a parallel analysis of the Bank's Economic Value of Equity (EVE) and Net Interest Income Simulation under the standard regulatory rate shock scenarios to determine if the modeling assumptions are working appropriately and that IRR risk assessments are being properly modeled. Our proprietary in-house model is periodically audited by an independent third party and has received very high grades for modeling accuracy.

5. What specific model governance review techniques do you use, and why?
   Our assessment service reviews policy and procedure manuals as well as Asset Liability Committee (ALCO) meeting minutes/reporting packages to determine if the modeling assumptions are being appropriately vetted through ALCO.

6. What internal quality assurance processes do you use?
   Our in-house model utilized to verify modeling assumptions is periodically audited by an independent third party and has received a very good rating for its accuracy on modeling of interest rate risk.

7. Are industry standard and best practice references defined in your deliverable?
   Yes. Our risk assessment reports will frequently reference industry standard and best practices within the report. The assessment will also provide a list of recommendations to enhance reporting capabilities, if needed.

F. IRR MODEL RISK ASSESSMENT REPORT DELIVERABLE

1. Describe the general format and content of your IRR model risk assessment report?
   The risk assessment report is generally in .PDF format but generated using Microsoft Word. The risk assessment report will include an Executive Summary that includes general findings and recommendations followed by detailed sections that assess specific modeling assumptions and output. The scope of the analysis is customized to each client but generally, the risk assessment will cover the following areas:
   • Behavioral modeling assumptions including prepayment speeds, deposit decay, beta values and market rates
2. What is the conceptual or theoretical reason each component is included in your IRR model risk assessment report?

Our risk assessment reports cover all critical areas surrounding the identification, measurement, monitoring, and controlling of an institution's asset liability and interest rate risk position. More than any other risk area of the Bank, interest rate risk analytics are heavily dependent on modeling assumptions and it's the accuracy of those modeling assumptions that provides Management with the proper information needed to make safe and sound business decisions for the institution.

With the increased sophistication of IRR models, it is very difficult for independent Board members, who are not experts in the field of IRR management, to validate the accuracy of Management's reports without independent verification of the modeling assumptions that have the biggest impact on the overall IRR results.

In addition to assessing the inputs and outputs of the IRR model, we also feel that it is critical for our clients to have the proper tools in place to properly identify, measure, monitor and control risk. As a result, most of our risk model assessments include a review of IRR policies and risk limits. We provide our clients with industry comparisons on risk limits and risk assessments utilizing the assessments from our outsourced modeling client universe of over 70+ community-based financial institutions. This helps our clients put their own risk assessment into context relative to the rest of the industry.

3. Does your IRR model risk assessment report provide prioritized recommendations for model corrections, upgrades, and advanced refinements? If yes, what are some recent examples?

Yes. Some recent examples of recommendations include:

- Utilizing account level data to analyze interest rate risk, not Call Report data
- Utilize modeling behavioral assumptions that are based on the institution's own historical data and not using industry default assumptions
- Conduct in-depth deposit decay and depositor loyalty studies to more accurately assess the risk characteristics of non-maturity core deposits
- Incorporate dynamic modeling (balance sheet shifts and growth economic impacts) into net interest income simulations to predict future interest rate impacts on budgeting and strategic plan financial projections
- Utilize different beta values on non-maturity deposits based on the magnitude of change in interest rates. For example, +100 bps shift has a 25% beta but a +200 bps shift has a 40% beta

4. Do you assist clients in implementing any IRR model enhancements or refinements recommended by your report?

Yes. We will discuss modeling enhancements with the client and review the revised output of those enhancements as part of the engagement if the client wishes to implement and test within the time frame of the engagement.
5. Do you help clients implement enhancements to their model governance solution?
   Yes. We are a full service consulting firm servicing community-based financial institutions. We have helped many clients implement improved model governance and overall corporate governance as well as other areas of risk.

G. IRR MODEL RISK ASSESSMENT REPORT REGULATORY ACCEPTANCE

1. Have examiners in the field reviewed your IRR model risk assessment report? If yes, which agencies?
   Yes. NCUA, FDIC, Federal Reserve, OCC and state banking agencies.

2. What feedback have examiners generally provided with respect to the methodological approach, content/scope, and findings of your reports?
   No specific feedback. Regulators have typically had no objections with our approach and findings contained in our assessment reports.

3. Do you offer assistance to your clients if regulators challenge your report? Specifically, what types of support do you provide?
   Yes. Our primary goal is to educate and inform the client on our approach and findings prior to regulatory interaction so that the client can articulate the assessment and discuss the merits of our recommendations relative to their specific situation with regulators. However, our firm is available to discuss the findings of our assessments with regulators and the client if needed. We provide both verbal and written communication support as well as in-person meeting support, if needed.
A. GENERAL INFORMATION

1. Vendor contact information
   R2Metrics, Inc.
   6930 Cahaba Valley Road
   Suite 201
   Birmingham, AL 35242
   analytics@r2metrics.com
   205-991-9415

2. Describe the general nature of the current client base (charters, asset range, business models)
   Commercial banks and credit unions, $50 million to $3 billion in asset size.

3. Number of IRR model risk assessment reports delivered in the past three years
   Between 20 and 25 IRR model risk assessment reports and approximately 300 full ALM
   reports including stress testing. BondRisk reports which measure interest rate risk and reward
   in bond portfolios – over 20,000.

4. Describe any special business activities commonly engaged in by your IRR model risk
   assessment clients (e.g. mortgage servicing rights, loan pipeline management, indirect
   lending)
   None

B. ALM MODEL(S) ON WHICH YOU HAVE PERFORMED IRR MODEL RISK
   ASSESSMENTS

1. ALM model name(s), level(s) and version(s)
   Baker Group, Catalyst Strategic Solutions, Client Strategies Group, FICast Data Corporation,
   FIMAC Solutions, Plansmith Corporation, ProfitStars, SABER, Vining Sparks, ZM Financial

2. For each ALM model named above, how many IRR model risk assessments have you
   conducted in the past three years?
   Baker Group – 2
   Catalyst Strategic Solutions – 1
   Client Strategies Group – 1
   FICast Data Corporation – 1
   FIMAC Solutions – 4
   Plansmith Corporation – 1
   ProfitStars – 2
   SABER – 6
   Vining Sparks – 3
   ZM Financial – 2
3. Provide any relevant comments regarding your expertise and experience with particular ALM models and types of IRR analysis

Key R2Metrics personnel have been involved in assessing the accuracy of financial modeling for over 45 combined years in various capacities, including ALM, hedging strategies, bond portfolio management, bond and interest rate swap transactions, and financial programming.

C. TYPES OF RISK ASSESSMENTS PERFORMED

- **Model Verification**: A detailed assessment of model data, chart of accounts setup, attributes, contractual inputs, behavior assumptions and reports.
- **Model Validation**: Confirmation of category model forecasts compared to expected category behaviors given their contractual terms and embedded options.
- **Model Governance Review**: Assessment of an institution's model control environment, policy directives, modeling procedures, and IRR analysis scope and quality.

D. VENDOR INDEPENDENCE

1. Are you connected in any way with, or do you receive any payments from, the ALM vendor(s) whose model(s) you assess? If so, please describe the relationship.

   **No**

2. Are you connected in any way with, or do you receive any payments from, any securities brokers? If so, please describe the relationship.

   Yes, we license our software, primarily BondRisk and SwapRisk and related programs, to 14 different bond dealers and 2 ALM providers. Through the licensees, our calculation engines are used by 500-700 different financial institutions on a monthly basis.

3. Do you offer an in-house ALM model or outsourced IRR analysis service? If so, please describe any potential influence of these on your IRR model risk assessments.

   Yes, BankRisk; it is the model we use to perform the comparative analysis mentioned in section E1 below.

E. IRR MODEL RISK ASSESSMENT PROCESS

1. Describe your IRR model risk assessment process?

   - We provide reviews of all pertinent assumptions, data accuracy, back testing and modeling soundness. See below:
     - Validation of the Asset/Liability report information by comparing category balances for the ALM report to the financial institution’s general ledger
     - Comparison of bond portfolio market value sensitivity estimates to ALM report forecasts
     - Review of all important assumptions underlying model results – including loan betas and applicable prepayment speeds, as well as deposit betas, decay rates, and early redemption methodology
     - Back testing of the Asset/Liability report by comparing projections of asset yields and liability costs to model forecasts from the previous year’s report
• Verification of the Asset/Liability report’s compliance with the financial institution’s Asset/Liability Management Policy and review of the Policy to ensure that it is in compliance with the latest regulatory statements
• Review of the market valuation methodology used in the primary Asset/Liability model
• Highlight potential modeling issues that may potentially impact overall model accuracy

Once the areas mentioned above have been reviewed, our primary focus is providing a comparative sensitivity analysis by running our BankRisk model in parallel with the primary ALM model and trapping out all modeling discrepancies by individual balance sheet category and by assets and liabilities in total. If, in the review stage, certain important assumptions are perceived by R2Metrics personnel to be inappropriate, we may question management on how they arrived at these assumptions, and often the consensus is that they need changing.

Once changes are made and both models are rerun, we will compare the yield and cost sensitivity of individual asset and liability categories over 1 month, 6 month, 1 year, 2 year, and 5 year time horizons. Where significant discrepancies exist, R2Metrics personnel will work with management and personnel at the primary ALM vendor to ascertain which model is correct, and then that model will be rerun. We do this until all substantial modeling discrepancies have been eliminated.

We then go through the same process for EVE calculations. Usually the process of fixing the yield and cost sensitivity issues will bring the EVE calculations substantially into line, but the possibility exists that some additional modeling calculation issues may impact EVE. We usually find significant modeling errors on initial comparisons, and even where R2Metrics has been retained to assess accuracy on an ongoing basis, there is often not consistency in the primary ALM model due to changes in personnel at either the financial institution or the ALM provider, or changes in market rates which impact refinancing probability, betas, etc.

It is our conclusion from this process that even with conceptually sound models and experienced personnel, it is all but impossible to assess overall accuracy without comparing to another “second opinion” model, as there are too many areas where mistakes can occur.

2. Do you take physical possession of the ALM model for the IRR model assessment?
   No, just the results

3. What specific model technical verification techniques do you use, and why?
   Based on the results in E1 above, we may ask for principal cashflows for individual categories in all shock scenarios, early redemption methodologies on CD’s, option and prepayment modeling in the case of bonds, and structured convertible, puttable, expandable FHLB advances, structured repos, etc, as well as cap/floor modeling on loans.

4. What specific model forecast validation techniques do you use, and why?
   See section E1 above

5. What specific model governance review techniques do you use, and why?
   See section E1 above

6. What internal quality assurance processes do you use?
   We have a number of quality control procedures designed to catch inaccuracies both in the data set up process as well as within the output
7. Are industry standard and best practice references defined in your deliverable?
   Yes

F. IRR MODEL RISK ASSESSMENT REPORT DELIVERABLE

1. Describe the general format and content of your IRR model risk assessment report?
   We have two validations – level 1 and level 2. Level 1 is a review of model results, ALCO policies and procedures, and model governance. Level 2 provides a 2nd opinion analysis which highlights model discrepancies in both net interest margin and market value of equity, as well as an opinion letter, and if applicable, how the differences were resolved.

2. What is the conceptual or theoretical reason each component is included in your IRR model risk assessment report?
   To improve the accuracy of the primary ALM model as well as increase confidence levels of executive management and the board when considering short and long term risk management decisions.

3. Does your IRR model risk assessment report provide prioritized recommendations for model corrections, upgrades, and advanced refinements? If yes, what are some recent examples?
   Yes. Some recent examples: bond portfolio option and prepayment related methodology; refine (or even implement in some cases) more robust premium amortization routines for bonds; correct principal cashflow schedules on loans; incorporate periodic caps and floors in loan and bond modeling; correct unlikely betas and decay rates for certain deposits, as well as betas for certain loan types; incorporate or amend early redemption penalties for CDs; and adjust bank owned life insurance dividend yield sensitivity, etc.

4. Do you assist clients in implementing any IRR model enhancements or refinements recommended by your report?
   Definitely, often they will rerun their primary model at least once and then ask us to do another comparative analysis.

5. Do you help clients implement enhancements to their model governance solution?
   Yes

G. IRR MODEL RISK ASSESSMENT REPORT REGULATORY ACCEPTANCE

1. Have examiners in the field reviewed your IRR model risk assessment report? If yes, which agencies?
   Yes, various state banking agencies, FDIC, OCC, NCUA, Federal Reserve.

2. What feedback have examiners generally provided with respect to the methodological approach, content/scope, and findings of your reports?
   1) Comprehensive and sound modeling platform, 2) Many have requested that the financial institutions implement all of the recommendations contained within validations.
3. Do you offer assistance to your clients if regulators challenge your report? Specifically, what types of support do you provide?

Yes, we would provide anything that is needed. For example, we have provided: cashflows on a number of individual items within a category; yield forecasting as needed; early redemption methodology; relevant calculations when requested; all historical data and backtesting; and Model Validation certificates.

**H. OPEN-ENDED COMMENTS**

Our level 1 validations review the inputs, assumptions, and methodology used when running the primary ALM model. Included in level 1 are a balance sheet comparison, bond portfolio market value sensitivity comparison, review of key modeling assumptions such as betas, prepayment speeds, decay rates, etc. We also perform a back-testing analysis by comparing the forecasted yields/costs from the prior year’s ALM report to the current yields/costs, a review of the bank or credit union’s ALM Policy to ensure that it is in compliance with the latest regulatory statements, and a review of market value methodology used in the primary ALM model.

Our level 2 validations include level 1 plus a comparative analysis of yield and cost sensitivity and market value changes and is a blend of quantitative and qualitative factors and ultimately requires a significant understanding of all items typically found in a bank or credit union balance sheet. We have never run a comparative analysis, especially the first time, where we did not find substantial modeling issues.

There are so many important dials that need to be set accurately that we believe all financial institutions will benefit from a second opinion and a comparative analysis periodically.
A. GENERAL INFORMATION

1. Vendor contact information
   Hugh Blaxall, President
   215.822.9097
   HBlaxall@VelliganBlaxall.com

   Brian A. Velligan, CEO
   610.526.1869
   BVelligan@VelliganBlaxall.com

   Velligan-Blaxall Consultants, LLC
   721 Millbrook Lane
   Haverford, PA 19041-1210
   www.VelliganBlaxall.com

2. Describe the general nature of the current client base (charters, asset range, business models)
   VBC, LLC has a national reach and works with Banks and Credit Unions ranging from de-
   novos to multi-billion dollar institutions. We have also consulted with institutions chartered
   abroad. We work with a large variety of institutions with different charters ranging from strong
   earnings and low risk to others under financial stress or regulatory scrutiny.

3. Number of IRR model risk assessment reports delivered in the past three years
   We have worked with over 100 institutions. We pride ourselves in our long term relationships
   and breadth of services provided.

4. Describe any special business activities commonly engaged in by your IRR model risk
   assessment clients (e.g. mortgage servicing rights, loan pipeline management, indirect
   lending)
   Loan Servicing Rights, pre-CECL loan cash flow calibration, liquidity stress testing, off-balance
   sheet positions, complex/nonstandard optionality.

B. ALM MODEL(S) ON WHICH YOU HAVE PERFORMED IRR MODEL RISK
   ASSESSMENTS

1. ALM model name(s), level(s) and version(s)
   Fiserv ALM 3.5
   Fiserv Vantage Risk and Budgeting Manager V2.2
   ZMFS onlineALM/ZMDesk 4.30
   ProfitStar V2011a.79
   FIS/Sungard Ambit ALM 6
   Risk Analytics ALM V5.6
   PALMS
   Financial Compass V8.3.30
2. For each ALM model named above, how many IRR model risk assessments have you conducted in the past three years?

Fiserv ALM - 7
Fiserv Vantage – 1
ZMFS online ALM/ZMDesk - 3
ProfitStar – 8
Ambit ALM – 3
Risk Analytics ALM – 7
PALMS – 2
Financial Compass (Plansmith) – 2
Proprietary models - 11

3. Provide any relevant comments regarding your expertise and experience with particular ALM models and types of IRR analysis

Most financial institutions we have worked with seem to select models relevant to their balance sheet composition and complexity more so than asset size. Others have “acquired” a model license through an acquisition and chosen to continue that contract.

C. TYPES OF RISK ASSESSMENTS PERFORMED

___ x Model Verification: A detailed assessment of model data, chart of accounts setup, attributes, contractual inputs, behavior assumptions and reports.

___ x Model Validation: Confirmation of category model forecasts compared to expected category behaviors given their contractual terms and embedded options.

___ x Model Governance Review: Assessment of an institution’s model control environment, policy directives, modeling procedures, and IRR analysis scope and quality.

D. VENDOR INDEPENDENCE

1. Are you connected in any way with, or do you receive any payments from, the ALM vendor(s) whose model(s) you assess? If so, please describe the relationship.

   No

2. Are you connected in any way with, or do you receive any payments from, any securities brokers? If so, please describe the relationship.

   No

3. Do you offer an in-house ALM model or outsourced IRR analysis service? If so, please describe any potential influence of these on your IRR model risk assessments.

   We offer outsourced ALM modeling using either:
   Fiserv ALM 3.4, or
   ZMFS onlineALM 4.30
   This offers us an opportunity to stay current with industry and regulatory trends/expectations.
E. IRR MODEL RISK ASSESSMENT PROCESS

1. Describe your IRR model risk assessment process?

   Our risk assessment process consists of three components, defined as "MAP":
   
   (a) Model Review (M) – this stage of the process is designed to obtain a comprehensive understanding of the entity and the model results/reports. We verify sample data sets, model setup, and review and assess stress test scenarios. We also assess compliance with internal policies, regulatory guidance, and compare to industry best practices.
   
   (b) Assumptions Review (A) – during this stage we review and assess the operating environment, key assumptions employed in modeling, sources, validity, documentation and the approval process.
   
   (c) Process Review (P) – the final component of our MAP process reviews Board approved policies, Governance structure, internal control measures, procedures, skill level and training.

2. Do you take physical possession of the ALM model for the IRR model assessment?

   We do provide that option.

3. What specific model technical verification techniques do you use, and why?

   Review model maintenance reports, frequency, and authorization of account setup/definitions. Verify output and model calculations (samples based on materiality).
   
   Objective is to establish consistency of methodology from one period to the other, stability of models, adequacy of control and documented procedures over models.

4. What specific model forecast validation techniques do you use, and why?

   Benchmark against market data (of liquid instruments or any publicly available data that are relevant and measurable).
   
   Benchmark forecasts with Client’s internal actual results. Review loan/CD/Investment activity or originations to assess reasonableness and relevance of input assumptions and output results.

5. What specific model governance review techniques do you use, and why?

   Since the financial crisis regulators have placed significant emphasis on model governance. Our process generally follows the Supervisory Guidance on Model Risk Management (SR 11-7 / OCC 2011-12), with specific focus on Section VI. Governance: Policies and Controls.

   We focus on the following areas related to governance:
   
   - Roles and responsibilities
   - Documentation requirements (policies and procedures)
   - Approval and change control processes
   - Model continuity, security and data protection
6. What internal quality assurance processes do you use?

In a word, experience. All of our associates have at least ten and some have over twenty years of real world experience with ALCO. The partners and most of our associates have been involved with ALCO for over fifteen years. We employ agreed upon procedures with each Client to ensure data integrity. Also to protect confidentiality, a secure website is available for Client data uploads, accessible only to authorized users. Data provided to our Company will only be available to employees who work directly with the Client on a specific validation. Questions, answers, and test material are documented and maintained for reference.

7. Are industry standard and best practice references defined in your deliverable?

Yes, as well as regulatory expectations as outlined in issued guidance.

F. IRR MODEL RISK ASSESSMENT REPORT DELIVERABLE

1. Describe the general format and content of your IRR model risk assessment report?

Our risk assessment report consists of three components, defined as “MAP”:

(a) Model Review (M) – this stage of the process is designed to obtain a comprehensive understanding of the entity and the model results/reports. We verify sample data sets, model setup, and review and assess stress test scenarios. We also assess compliance with internal policies, regulatory guidance, and compare to industry best practices.

(b) Assumptions Review (A) – during this stage we review and assess the operating environment, key assumptions employed in modeling, sources, validity, documentation and the approval process.

(c) Process Review (P) – the final component of our MAP process reviews Board approved policies, Governance structure, internal control measures, procedures, skill level and training.

2. What is the conceptual or theoretical reason each component is included in your IRR model risk assessment report?

Our review process generally follows the Supervisory Guidance on Model Risk Management (SR 11-7 / OCC 2011-12). We believe the three components of our review (model, assumptions and process) cover all aspects discussed in that guidance specifically related to model validation and governance.

Furthermore, all of our validators have practical modeling experience, having been IRR modelers in previous positions. This allows us to incorporate comprehensive technical and IRR modeling theory knowledge into each review.

3. Does your IRR model risk assessment report provide prioritized recommendations for model corrections, upgrades, and advanced refinements? If yes, what are some recent examples?

Yes. These would include alternative stress tests scenarios, including non-maturity deposit decay and repricing betas as well as prepayment speed stress tests. These are scenarios prescribed by the regulators.

4. Do you assist clients in implementing any IRR model enhancements or refinements recommended by your report?

Generally yes, but it depends on the scope of the initial engagement. We are happy to help as long as the help does not produce a conflict.
5. **Do you help clients implement enhancements to their model governance solution?**

Yes, we have worked with clients to develop and enhance comprehensive model risk management governance programs, including drafting policies and assisting with implementation and resource allocation.

**G. IRR MODEL RISK ASSESSMENT REPORT REGULATORY ACCEPTANCE**

1. **Have examiners in the field reviewed your IRR model risk assessment report? If yes, which agencies?**
   
   NCUA, FDIC, FHFA, FRB, OCC

2. **What feedback have examiners generally provided with respect to the methodological approach, content/scope, and findings of your reports?**

   In any contact we have received directly, their comments have been entirely positive. Their comments to our clients have also been very favorable.

3. **Do you offer assistance to your clients if regulators challenge your report? Specifically, what types of support do you provide?**

   Although the Partners have been providing this service at two firms for over fifteen years, we have never experienced a regulatory challenge. We have assisted clients with answering questions from regulators and found that the regulators were satisfied with our explanations. We have communicated directly with regulators via a conference call or discussed regulator questions with our clients so the client can provide the feedback to the regulator.

**H. OPEN-ENDED COMMENTS**

Our mission is to deliver the highest level of personalized service. We provide the best quality insights and analysis to position you for the future. Our aim is to be a long-term extension of your internal team and integral to your success.
Sample In-House ALM Model Request for Proposal

Below is an example of a request for an ALM model proposal from a vendor. Replace the information enclosed in <angle brackets> with your institution’s specific information to customize the form to your needs. A list of vendor questions that you can enclose with the request for proposal follows the request form.

<Asset/Liability Management Model Vendor>
<Institution Name>
<Institution City, State, Zip>
<Date>

Executive Summary

<Institution name> requests that selected ALM model vendors provide information and a demonstration of an asset/liability management (ALM) model that specifically meets the following balance sheet management and risk assessment needs:

1. Fully, or nearly fully, automated data extract and download into the ALM model.
2. Efficient processes for defining asset and liability category setup attributes, inputs, behavior assumptions, interest rate scenarios, and other routine model elements.
3. Ability to model and forecast uniquely by interest rate scenario the category-level balance sheet repricing and maturity characteristics, pricing, re-pricing, rate limit relationships, option-related interest rate dependencies, core deposit behaviors, and all other unique performance and risk attributes of the institution’s balance sheet.
4. Ability to measure net interest income (NII), net income (NI) and <economic value of equity (EVE)/net economic value (NEV)> IRR at high precision levels in rate shock, rate ramp and custom rate ramp scenarios.
5. Ability to produce multi-scenario business plan strategy analyses using realistic rate forecasts for most likely, rising and declining interest rate projections.
6. Ability to readily produce standard and custom reports from model outputs, with the ability to directly export model reports to standard spreadsheet software.
7. Ability to produce detailed liquidity and contingency funding forecasts internally, or to interface with in-house systems to measure liquidity and contingency funding.
8. <add to list as desired>
9. <if applicable> Ability to simultaneously produce budgeting forecasts with business plan analyses.
10. <if applicable> Ability to interact with or produce forecasts relevant to profitability analysis and funds transfer pricing (FTP) applications.

Data processing for <institution> is provided by <specify firm or in-house department>. Management anticipates working closely with the data servicer and the ALM model vendor in coordinating the model’s data and category setup related installation activities.

Submit information and materials relating to the model or models deemed to be solutions to our needs and a proposal to the address below. Deadline for submission of proposals and completion of demonstrations is <allow 30 days if possible>. Submit materials to <Contact Name, Title>
Balance Sheet and Performance-Related Background Information
As of <latest quarter end>, the institution had total assets of $<data>. Total capital was <data>% of assets. The institution has posted <adjective> recent financial performance and has <no or describe> unusual risk problems or other unique financial characteristics.

- Qualitative reviews <or current ALM model analyses> of balance sheet data <do or do not> suggest a wide mismatch between asset and liability re-pricing in the short term.
- Qualitative reviews <or current ALM model analyses> of balance sheet data <do or do not> indicate significant maturity mismatch.
- Different driver rates, pricing behaviors and rate limits for individual asset and liability categories <are or are not> material factors.
- A <significant or not> degree of optionality is embedded in the balance sheet.
- Core deposits <are or are not> a significant percentage of overall funding.
- The institution needs to be able to quantify the performance implications of <specify any unique items> for IRR and business plan performance.

Management Issues Regarding an In-house ALM Model
- <Institution> wishes to assess earnings-at-risk<and equity at-risk> IRR <quarterly or monthly>.
- Rate shocks, linear rate ramps and non-linear basis risk and yield curve shape changes are required as IRR tests.
- IRR analyses must be capable of producing high-precision forecasts with optimal commitment of time and staff resources.
- <Institution> desires model functionality that can produce back tests of model forecast outcomes and behavior assumptions compared to actual subsequent values.
- <if applicable> The institution uses a comprehensive business plan as its primary planning and decision-making tool. Management wishes to update the business plan on a periodic basis and requires the ability to readily construct future business plans.
- <if applicable> The ability to cost-effectively review outcomes of “what if” balance sheet strategies is a high priority as the model will be actively used by the institution.
- <if applicable> The ability to produce relevant budgeting, profitability and FTP data simultaneously with ALM outputs is important to the institution.

Model Choice Criteria
Vendors should propose ALM models that specifically address current institution needs and goals. Vendor demonstrations should speak directly to how their ALM models will address each specific aspect of balance sheet value, performance, and risk present in <the institution's> balance sheet.

The vendor is expected to provide convincing evidence on how the model provides solutions to specific ALM-related needs of the institution. Model functionality and features are of interest only as they contribute to this goal.

A key factor in the decision will be the “all-in” model cost, including optional components and ongoing indirect costs. Vendor financial condition, level of ongoing user support, and cost of annual maintenance are also significant inputs. The ALM model proposal should include information relating to these issues.
Sample Outsourced IRR Analysis Request for Proposal

Below is an example of a request for proposal relating to engaging an outsource IRR analysis provider. Replace the information enclosed in <angle brackets> with your institution’s specific information to customize the form to your needs.

<IRR Analysis Outsource Solution Provider>
<Institution Name>
<Institution City, State, Zip>
<Date>

Executive Summary
<Institution name> requests that selected providers of outsource IRR analysis services deliver information describing a specific solution that meets the following balance sheet management and risk assessment needs:

1. Efficient process for initial specification of our institution’s Outsourced IRR analysis/ ALM model.
2. Efficient processes for completing all phases of each period’s IRR analysis.
3. Fully, or nearly fully, automated data extract and download into the ALM model.
4. Ability to model and forecast uniquely by interest rate scenario the category-level balance sheet re-pricing and maturity characteristics, pricing, re-pricing, rate limit relationships, option-related interest rate dependencies, core deposit behaviors and all other unique performance and risk attributes of our institution’s balance sheet.
5. Precise analyses of net interest income (NII), net income (NI) and <economic value of equity (EVE)/ net economic value (NEV)> IRR in standard rate shocks and custom rate scenarios including basis risk and yield curve shape change tests.
6. Ability to readily produce reports that effectively communicate IRR positions to technically oriented (e.g. ALCO) and non-technically oriented audiences (e.g. Board).
7. <add to list as desired>

Data processing for <institution> is provided by <specify firm or in-house department>. Management anticipates working closely with the data servicer and the Outsourced IRR analysis provider in coordinating model data related installation activities.

Submit information materials relating to the Outsourced IRR analysis solution deemed to meet our needs and a proposal to the address below. Deadline for submission of proposals and completion of demonstrations is <allow 30 days if possible>. Submit materials to

<Contact Name, Title>
<Institution Name>
<Street Address>
<City, State, Zip>
<Phone and Fax Numbers>
<E-mail Address>
Balance Sheet and Performance-Related Background Information
As of <latest quarter end>, the institution had total assets of $<data>. Total capital was <data>% of assets. The institution has posted <adjective> recent financial performance and has <no or describe> unusual risk problems or other unique financial characteristics.

- Qualitative reviews <or current ALM model analyses> of balance sheet data <do or do not> suggest a wide mismatch between asset and liability re-pricing in the short term.
- Qualitative reviews <or current ALM model analyses> of balance sheet data <do or do not> indicate significant maturity mismatch.
- Different driver rates, pricing behaviors and rate limits for individual asset and liability categories <are or are not> material factors.
- A <significant or not> degree of optionality is embedded in the balance sheet.
- Core deposits <are or are not> a significant percentage of overall funding.
- The institution needs to be able to quantify the performance implications of <specify any unique items> for IRR and business plan performance.

Management Issues Regarding the Outsourced IRR Analysis Solution

- <Institution> wishes to assess earnings-at-risk<and equity at-risk> IRR <quarterly or monthly> to meet regulatory compliance mandates
- Standard rate shock IRR tests are required on a <quarterly or monthly> basis and reporting that effectively meets the varied needs of multiple institution audiences
- Assessments of rate tests addressing basis risk and yield curve shape changes are required on a periodic basis
- IRR analyses must be capable of producing high-precision forecasts with limited commitments of institution time and staff resources

IRR Outsource Provider Choice Criteria
Providers should propose outsource IRR analysis solutions that directly address current institution needs and goals. Provider demonstrations should speak directly to how their service will address each specific aspect of IRR present in <the institution’s> balance sheet. The vendor is expected to provide convincing evidence on how their outsource service provides solutions to specific regulatory-related IRR needs of the institution.

All-in cost of the proposed outsource IRR analysis solution, including initial ALM model set up, resource mandates, and ongoing direct and indirect costs are key factors in the decision. Deliverable quality, vendor reputation, and other issues will also be reviewed.
FMS Questionnaire for In-House Model Vendors

A. GENERAL INFORMATION
   1. Vendor contact information
   2. Describe the general nature of the current client base (charters, asset range, business models)
   3. Number of active in-house clients
   4. Describe any relevant special client characteristics addressed by the model (e.g. mortgage servicing rights, loan pipeline management, indirect lending)

B. MODEL USER SUPPORT PROGRAM
   1. Toll-free, phone-based user support group (enter “yes” or “no”)
   2. Location(s) of the phone support group
   3. Hours during which phone support group operates
   4. Number of phone support group staff normally available
   5. Typical time to resolve client inquiries by phone support group
   6. Web-based user support function (enter “yes” or “no”)
   7. If your response to question 6 is “yes”, typical time to resolve client inquiries by web-based user support function?
   8. Other unique client support characteristics of special note (e.g. user training institute, annual user conference, local user groups)

C. MODEL INFORMATION
   1. Model name
   2. Current version number
   3. Date of last major model update
   4. List operating system and the version employed plus any other required associated software
   5. Can clients opt for a vendor-supplied outsource modeling service using the same model?
   6. What other vendor-provided financial management products directly interface with the model?
   7. What is included in the initial vendor-provided model installation?
   8. Do you offer direct client support beyond initial model installation, i.e. advanced application, risk analysis consulting, or extended model implementation assistance?

D. DATA EXTRACT AND INTAKE
   1. Briefly describe the model’s available intake capabilities for balance sheet information (e.g. general ledger, maturity, and re-pricing detail) from an existing data processor system
   2. Briefly describe the model’s capabilities for in-taking non-contractual behavior assumptions (e.g., loan prepayment, core deposit repricing and decay, CD options)

E. CHART OF ACCOUNTS
   1. Identify any special features and/or limitations of the model’s ability to address the balance sheet behaviors listed below
      a. Re-pricing and maturing balances for categories without embedded options
      b. Interest rate adjusted re-pricing and maturing balances for categories that have continuous and call/put embedded options
- Re-pricing and maturing balances for unique categories (e.g., hybrid ARMs, teaser products, step-up/callable CD’s or FHLB advances)
- Re-pricing and maturing balances for indeterminate behavior categories (e.g., core deposits, lines of credit, credit card outstandings)

2. Are there any limitations on automated control of pricing, re-pricing, embedded caps/floors, or teaser rates?

3. Can the model effectively amortize discounts/premiums in any defined alternate interest rate scenario?

4. Can the model effectively address unique balance sheet items (e.g. off-balance-sheet positions, mortgage servicing rights, loan pipelines, indirect lending)?

F. PRICING, RE-PRICING, OPTION-RELATED CAPABILITIES, INTEREST RATE SCENARIOS, AND MISCELLANEOUS

1. How are contractual inputs (e.g., pricing spreads, re-pricing limits) entered?

2. How are interest rates and driver rates input and periodically updated?

3. How are pricing and re-pricing relationships defined and updated?

4. How does the model define investments or FHLB advances with puts or calls in alternate interest rate scenarios?

5. How does the model define re-pricing and apply decay rates (or similar inputs) to core deposits by interest rate scenario? How does the model calculate core deposit present values? Can user-defined non-interest expense inputs be accurately applied in core deposit present value calculations?

6. How does the model intake and apply rate ramps (and/or rate shocks) that test for yield curve shape change basis risk?

7. Describe the model’s analysis and reporting capabilities for standard IRR tests and other forecasts.

8. Can the model export outputs and reports to spreadsheets or other financial information reporting products?

9. Can the model readily produce outcome analyses (e.g. back tests and retrocasts) of prior forecasts and behavior assumptions?

10. What internal liquidity analysis capabilities does the model have? Can the model interface with typical internal liquidity models and contingency funding plan spreadsheets?

11. Does the model have stochastic forecasting capability? If so, describe it.

12. Can custom (institution-specific) equations for loan prepayments, core deposit behaviors, and CD options be embedded in the model to drive cash flow behaviors by interest rate scenario?

G. OPEN-ENDED COMMENTS
A. GENERAL INFORMATION
1. Vendor contact information
2. Describe the general nature of the current client base (charters, asset range, business models)
3. Number of active outsource clients
4. Describe any relevant special client characteristics addressed by the model (e.g. mortgage servicing rights, loan pipeline management, indirect lending)

B. OUTSOURCE SUPPORT PROGRAM
1. Toll-free, phone-based user support group (enter “yes” or “no”)
2. Location(s) of the phone support group
3. Hours during which phone support group operates
4. Number of phone support group staff normally available
5. Typical time to resolve client inquiries by phone support group
6. Web-based user support function (enter “yes” or “no”)
7. If your response to question 6 is “yes”, typical time to resolve client inquiries by web-based user support function?
8. Other unique client support characteristics of special note (e.g. user training institute, annual user conference, local user groups)

C. MODEL(S) USED IN OUTSOURCE ENGAGEMENT
1. Model(s) name(s)
2. Current version(s) number(s)
3. Date(s) of last major model update(s)
4. Do you also offer the model(s) as an in-house solution?
5. What other vendor-provided financial management products directly interface with the model?

D. MECHANICS OF OUTSOURCE RELATIONSHIP
1. How are balance sheet data (G/L, maturity, repricing, and contractual options) and behavior assumptions (loan prepayments, core deposit behaviors, and CD options) transferred to you?
2. At what point and by whom is the “run-ready” IRR model approved?
3. How fast are IRR analyses provided to the client after the final data is approved?
4. How are completed IRR reports sent back to the institutions (e.g. Word, Excel, pdf)?
5. Describe the format and content of your standard IRR client report
6. Who is responsible for IRR analysis quality assurance?
7. If needed, how are reruns of a period’s IRR analysis handled?
8. Are there written operating guidelines for clients and vendor staff?
9. How are client questions or disputes remediated?
E. CHART OF ACCOUNTS

1. Identify any special features and/or limitations of the model’s ability to address the balance sheet behaviors listed below
   • Limitations to the number of accounts/categories that can be modeled
   • Detailed re-pricing and maturing balances for categories without embedded options
   • Interest rate adjusted re-pricing and maturing balances for categories that have continuous and call/put embedded options
   • Re-pricing and maturing balances for unique categories (e.g., hybrid ARMs, teaser products, step-up/callable CD’s or FHLB advances)
   • Re-pricing and maturing balances for indeterminate behavior categories (e.g., core deposits, lines of credit, credit card outstandings)

2. Are there any limitations on automated control of pricing, re-pricing, embedded caps/floors, or teaser rates?

3. Can the model effectively amortize discounts/premiums in any defined alternate interest rate scenario?

4. Can the model effectively address unique balance sheet items (e.g. off-balance-sheet positions, mortgage servicing rights, loan pipelines, indirect lending)?

F. PRICING, RE-PRICING, OPTION-RELATED CAPABILITIES, INTEREST RATE SCENARIOS, AND MISCELLANEOUS

1. Who defines contractual inputs (e.g., pricing spreads, re-pricing limits)?

2. How does the model obtain information on investments or FHLB advances with puts or calls in alternate interest rate scenarios?

3. Who defines re-pricing and decay rates (or similar inputs) to core deposits by interest rate scenario? Are there any limits on specifying assumptions (e.g. repricing lags, scenario specific decay rates)?

4. How does the model calculate core deposit present values? Can user-defined non-interest expense inputs be accurately applied in core deposit present value calculations?

5. What standard IRR tests are provided? Can (and how) does the model define rate ramps (and/or rate shocks) that test for yield curve shape change basis risk?

6. Describe the model’s analysis and reporting capabilities for standard IRR tests and other forecasts.

7. Can the model export IRR inputs and outputs and report to spreadsheets or other financial information reporting products?

8. Can the model readily produce outcome analyses (e.g. back tests and retrocasts) of prior forecasts and behavior assumptions?

9. What internal liquidity analysis capabilities does the model have? Can the model interface with typical internal liquidity models and contingency funding plan spreadsheets?

10. Does the model have stochastic forecasting capability? If so, describe it.

11. Can custom (institution-specific) equations for loan prepayments, core deposit behaviors, and CD options be embedded in the model to drive cash flow behaviors by interest rate scenario?

G. OPEN-ENDED COMMENTS
FMS Questionnaire for Model Risk Assessment Suppliers

A. GENERAL INFORMATION
1. Vendor contact information
2. Describe your recent client base (charters, asset range, business models)
3. Number of IRR model risk assessment reports delivered in the past three years
4. Describe any special business activities commonly engaged in by your IRR model risk assessment clients (e.g. mortgage servicing rights, loan pipeline management, indirect lending)

B. ALM MODEL(S) ON WHICH YOU HAVE PERFORMED IRR MODEL RISK ASSESSMENTS
1. ALM model name(s), level(s) and version(s)
2. For each ALM model named above, how many IRR model risk assessments have you conducted in the past three years?
3. Provide any relevant comments regarding your expertise and experience with particular ALM models and types of IRR analysis

C. TYPES OF RISK ASSESSMENTS PERFORMED (given the following somewhat arbitrary definitions, check all that apply)

- Model Verification: A detailed assessment of model data, chart of accounts setup, attributes, contractual inputs, behavior assumptions and reports.
- Model Validation: Confirmation of category model forecasts compared to expected category behaviors given their contractual terms and embedded options.
- Model Governance Review: Assessment of an institution’s model control environment, policy directives, modeling procedures, and IRR analysis scope and quality.

D. VENDOR INDEPENDENCE
1. Are you connected in any way with, or do you receive any payments from, the ALM vendor(s) whose model(s) you assess? If so, please describe the relationship.
2. Are you connected in any way with, or do you receive any payments from, any securities brokers? If so, please describe the relationship.
3. Do you offer an in-house ALM model or outsourced IRR analysis service? If so, please describe any potential influence of these on your IRR model risk assessments.

E. IRR MODEL RISK ASSESSMENT PROCESS
1. Describe your IRR model risk assessment process
2. Do you take physical possession of the ALM model for the IRR model assessment?
3. What specific model technical verification techniques do you use, and why?
4. What specific model forecast validation techniques do you use, and why?
5. What specific model governance review techniques do you use, and why?
6. What internal quality assurance processes do you use?
7. Are industry standard and best practice references defined in your deliverable?
F. IRR MODEL RISK ASSESSMENT REPORT DELIVERABLE
   1. Describe the general format and content of your IRR model risk assessment report
   2. What is the conceptual or theoretical reason each component is included in your IRR model risk assessment report?
   3. Does your IRR model risk assessment report provide prioritized recommendations for model corrections, upgrades, and advanced refinements? If yes, what are some recent examples?
   4. Do you assist clients in implementing any IRR model enhancements or refinements recommended by your report?
   5. Do you help clients implement enhancements to their model governance solution?

G. IRR MODEL RISK ASSESSMENT REPORT REGULATORY ACCEPTANCE
   1. Have examiners in the field reviewed your IRR model risk assessment report? If yes, which agencies?
   2. What feedback have examiners generally provided with respect to the methodological approach, content/scope, and findings of your reports?
   3. Do you offer assistance to your clients if regulators challenge your report? Specifically, what types of support do you provide?

H. OPEN-ENDED COMMENTS
APPENDIX F

FMS 2015 Quick Poll: Asset Liability Modeling Practices
http://fmsperspectives.com/2015/11/05/fms-quick-poll-asset-liability-modeling-practices/

APPENDIX G

OCC Supervisory Guidance on Model Risk Management

APPENDIX H

FED Supervisory Guidance on Model Risk Management

APPENDIX I

NCUA Supervisory Guidance on Model Risk Management

APPENDIX J

FFIEC FAQ on Interagency Advisory on Interest Rate Risk Management