EXHIBIT 2. STATISTICAL ANALYSIS OF EARNINGS AND MARKET RATES

	Correlation Matrix			Sensitivity Matrix		
Category	Fed Funds	5 yr. UST	Spread	Fed Funds	5 yr. UST	Spread
Yield (TE)	85%	88%	9%	50%	93%	44%
COF	92%	93%	2%	55%	99%	12%
NIM (TE)	-45%	-33%	22%	-5%	-7%	31%
ROA	-9%	-4%	5%	0%	0%	3%
BOLI Yield	66%	73%	12%	13%	26%	14%

- Correlation; and
- Sensitivity (also known as slope or beta).

Correlation measures the tendency for two factors to move together. For the purposes of hedge accounting (i.e., SFAS 133), the correlation between a derivative instrument and the financial product being hedged, a correlation of 80 percent is required for the hedge to be *effective*. When there is a correlation of around 80 percent between a market rate and bank performance metric, we will suggest that it is a good fit.

The Bank's yield and cost of funds correlation to market rates have been about 85 to 95 percent, respectively. This suggests that the Bank's margin components are well correlated with fed funds and the five-year U.S. Treasury rate.

Sensitivity measures how sensitive the change in one factor is to the change in another factor. For example, the historic sensitivity of the Yield to the Fed funds rate is 50 percent. This means that, over the past six years, a 100 bp increase in Fed funds has resulted in a 50 basis point increase in the asset yield. The liability cost sensitivity is 55 percent; resulting a net *liability sensitive* position of minus 5 percent. This means that for a 100 basis point increase in the five-year UST rate, the Net Interest Margin is estimated to decrease five bps.

This is consistent with the Bank's ALM strategy. They target assets with a slightly longer duration than liabilities to benefit, over time, from a positively sloped curve. Further, this historic analysis is consistent with their projected earnings sensitivity for yield curve shifts, including slope changes. Note that the Bank's ROA sensitivity is 0 percent, meaning that it is unrelated to the level of rates (albeit with a statistically insignificant R-squared).

Finally, note that the interest level measures for the yield, cost and margin are relatively strong, statistically significant at the .9 level (stats not displayed), and consistent with their strategy and pro forma ALM analysis. The slope measures are less strong and less statistically significant. This result is consistent with the typical performance attribution results, where interest rate level measures are stronger and more meaningful than slope measures.

This analysis, while relatively simple (the full analysis is more granular and rigorous), provides the ALM team, management, the Board, and regulators some additional insight into the bank's ALM profile.

FRED POORMAN
The ALM Network

A Primer on Core Deposit Duration — Part 1

Estimates for core deposit duration have two direct business applications in the banking industry. First, institutions with sizable core deposit balances must estimate core deposit durations to accurately hedge their equity. Second, regulators frequently require banks to provide duration estimates backed by a reasonable set of hypotheses regarding bank pricing and consumer balance behavior.

This article addresses the issues facing the professional responsible for the estimation and reporting of duration of various core deposit products by providing a simplified framework for understanding the sensitivity of duration estimates to assumptions and assessing their reasonableness. This article is called a *primer* because it bounds the estimates of duration for core deposits using a series of *stylized* models to represent core deposit pricing and consumer balance behavior. These models are used to elicit and nest a variety of hypotheses regarding bank pricing and resulting consumer responses to identify the most critical assumptions, and illustrate how they impact

the estimated durations. The article concludes with a cautionary note regarding the potential for destabilizing duration models created by embedding rate sensitive balance behavior into them.

The models we use to explore the effects of bank pricing and consumer responses on duration estimates can each be replicated in a spreadsheet. While more complex models exist and may be required for a specific modeling purpose (for example, models of core deposits utilized in stochastic interest rate generation systems require additional equations if rates among the models are to behave consistent with tier pricing structures), these stylized models simulate the reasonableness of far more complex calculations and can help ALM practitioners to understand and explain to senior management the key determinants underlying core deposit duration estimates.

In Section I, the textbook definition of effective duration applicable to core deposits is presented. In Section II, a simplified rate model described in Hawkins and Arnold (see September 2000 *BALM* "Relaxation Processes in Administered Rate Pricing" Physics Review E) is described to capture several key aspects of bank pricing behavior and show that one of the four standard rate parameters dominates the others. In Section III, a stylized model of rate sensitive *balances* to the stylized *rate* model is added. A simple model is shown of how *balance* sensitivity can significantly complicate the duration calculation and its interpretation.

This article is divided into three parts. Part 1 in this issue will present Section I: The Textbook Definition of Effective Duration.

Section I: The Textbook Definition of Effective Duration. A simple definition of effective duration is:

Effective Duration or D = $\Delta NPV/(NPV\Delta r)$ ...(1)

This example illustrates how effective duration is calculated. Suppose we have a $100 5-year bond carrying a fixed coupon of 5 percent paid semiannually; further assume the current discount rate is constant at 5 percent. The duration of the bond following a 1 bp parallel shift in interest rates is 4.37 years. The calculation is: 4.37 = - (-.0437)/(100*.0001). Note that all we did in this calculation was to write down the cash flows and discount the cash flows twice. Also note that even a fixed coupon bond has convexity. If we had shifted interest rates by 10 bps instead of 1 bp, we would have calculated a slightly different value for duration.

Part 2 of this series will address Rate Models and Core Deposit Duration (Section II).

MICHAEL R. ARNOLD, PRINCIPAL,
ALCO Partners, LLC

ALM Training—Update and Call for Vendors

REPLY REQUESTED BY JUNE 15, 2006

One important way to assure a comprehensive ALM program within a financial institution is through formal training. Training is crucial to the achievement of the objectives for any bank's ALM staff. Accordingly, *BALM* plans to present the second annual sampling of the more prominent ALM training practitioners, with a brief overview of each.

ALM training programs, designed specifically for bank A/L managers and their staffs, can assist in defining, measuring, monitoring and managing exposure to interest rate and liquidity risks. Successful completion of training can provide bank ALM professionals with the knowledge of what needs to be done, as well as the tools to enhance their bank's profitability.

Training institutions interested in being included in future ALM training article updates and profiles, or those who have any changes to last August's *BALM* listing, should contact *SCI* no later than June 15, 2006, at (704) 541-0489 or *SECI@aol.com*.

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environment as well as changes in membership composition. In some ways the tighter capital requirements echo the constraints being placed on Fannie Mae and Freddie Mac by their regulator, the Office of Federal Housing Enterprise Oversight (OFHEO). Like their GSE brethren, this regulatory scrutiny is born of rising concern in Washington and among their private-sector competitors that these institutions are abusing their privileged status in the capital markets to expand their activities beyond their core missions and reap arbitrage profits. This scrutiny is not likely to abate soon.

While the FHFB's proposed rule will have far-reaching implications for the 12 regional FHLBs, the resulting impact to members may not be as severe as some had previously thought. The biggest impact to members may come in the form of reduced dividend payments while their respective FHLB builds its retained earnings to the prescribed minimum. The possibility of the FHLBs liquidating substantial MBS holdings to meet the proposed rule may be over-stated and should not be significant enough to impact on its own the MBS market. However, restrictions on the size of the MBS portfolios held by Fannie Mae and Freddie Mac (as currently proposed), coupled with a similar pay-down of MBS balances at the FHLBs, would most likely create enough reduction in aggregate demand for mortgage product to drive spreads materially higher.

Thus, financial institution managers should determine the minimum level of investment in FHLB stock based on their respective FHLB's requirements and consider redeeming any excess that exists so as to minimize the impact of reduced dividend payments if the proposed rule is adopted.

TOM FITZGERALD AND JON KOZLOWSKI
SunTrust Robinson Humphrey

A Primer on Core Deposit Duration (Part 2)

The issues facing the asset/liability (A/L) professional responsible for the estimation and reporting of duration of various core deposit products are numerous and complicated. By providing a simplified framework for understanding the sensitivity of duration estimates to assumptions, and assessing their reasonableness, the A/L professional can take a more organized approach with these issues. This series of articles contains three sections. Part 1 discussed Section I, the textbook definition of effective duration applicable to core deposits (see *BALM* June 2006, p. 7). This Part 2 article discusses a simplified rate model to capture several key aspects of bank pricing behavior. One of the four standard rate parameters will be shown to dominate the others.

Section II—Rate Models and Core Deposit Duration. Core deposit rates and balances are notoriously path dependent. While best practice requires the use of stochastic rates to estimate the duration of a core deposit balance, most institutions lack the in-house modeling resources to build models that will work satisfactorily using stochastic interest rates. (The author built models of core deposits to be utilized in a major U.S. bank's proprietary risk measurement system in the 1990s.) Hence, the remainder of these two article parts will explore how duration estimates vary using single scenario analyses.

To calculate the duration of a core deposit, a model is required to describe the response of bank deposit rates to changes in market rates. We use LIBOR forward rates as the market rate for this stylized model. Since we can also use the LIBOR forward rates to discount future cash flows, forward rates turn out to be a key input for most models of duration.

While different forward curves can impact the discounted value of a core deposit, the choice of rates has less impact on the calculation of duration than some of the key behavioral parameters. This is because the second rate path used to estimate duration is a function of the first rate path. If we replace the constant 5 percent discount rate assumption (see example in Part 1) with a positively sloped yield curve, then the estimate of duration changes by a small amount. We calculate the duration as 4.18 years, based on the forward curve utilized throughout the rest of this article. This is consistent with the convexity of a bond, where duration declines with lower interest rates.

❑ *Modeling Deposit Rates as a Floater and Floater with a Spread.* Rather than a fixed coupon and a bond, suppose we have a deposit balance that has a floating rate. If deposit is a *pure* floater (the rate reprices at least monthly, which is usually the shortest period used to model core deposit rates) and forward rates are used in the calculation to generate the deposit rate, the deposit will have zero duration. Changing the forward rates does not change this conclusion, nor does changing the liability's maturity. For example, high tier money market accounts will almost by definition have short durations, independent of what is assumed about customer balance responses.

If the deposit rate is below LIBOR, or the respective discount curve, such as in equation (2) below (equation 1 is shown in Part 1 of this article series), duration is not equal to zero.

(2) Deposit rate = 1M LIBOR rate – constant spread(2)

EXHIBIT 2. ILLUSTRATIVE DEPOSIT RATE FUNCTIONS

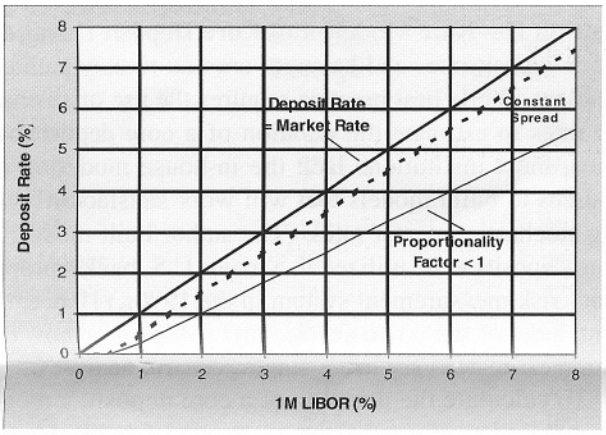
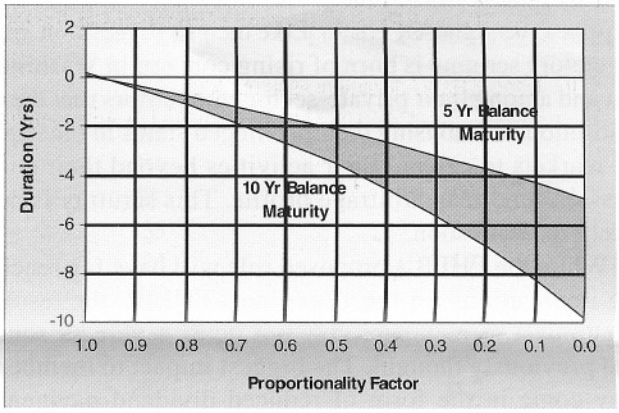


EXHIBIT 3. RELATIONSHIP BETWEEN BALANCE AND RATE ASSUMPTIONS



When the deposit rate is below LIBOR, where LIBOR is the implicit cost of funds for the institution, there is an implicit annuity in the calculation of duration. This asset is the so-called *core deposit intangible*. While it has a relatively small impact on duration, it is important to recognize that it has the opposite sign from all the other rate parameters impacting duration. In other words, if equation (2) describes the evolution of the deposit rate, the duration of the deposit is a small positive number, reflecting the duration of the implied annuity stream associated with the constant spread. Under these circumstances, balance assumptions will have only minor effects on the duration values.

❑ *A Floater with a Spread that Increases with the Level of Interest Rates.* The next variant of the deposit rate model accounts for the *proportionality factor*. This factor describes the case when the difference between the deposit rate and market rate, hereinafter referred to as the *deposit pricing spread,* is a function of the market rate level. The proportionality construct can be represented in two ways.

First, we define the deposit rate algebraically as:

(3) Deposit rate = [Proportionality Factor * 1M LIBOR rate] – constant spread

where,

0 ≤ Proportionality Factor ≤ 1.0 and Deposit rate

Next, we illustrate equation (3) in Exhibit 2, using various values for the proportionality factor. As indicated, there are three lines. The *45 degree* line (the thick line in Exhibit 2) represents the points of a pure floater and deposit rates equal market rates at all rate levels. The dashed line below and parallel to the 45 degree line represents a pure floater with a constant spread. The third line (the thin line in Exhibit 2) is flatter than the other lines and represents a pure floater with a rate that is a proportion of the market rate. All deposit rates are subject to a lower boundary of zero.

When duration is calculated in the proportional pricing case, it is necessary to make a statement about balances. Whenever deposit pricing is based on a proportionality factor, the balance maturity profile, or runoff assumption, impacts duration.

In Exhibit 3, we represent the relationship between balance maturity profiles and the proportionality assumption. Two balance profiles are presented to illustrate how balance maturity and rate setting behaviors interact in this simplified framework. Duration is calculated for a range of proportionality factors (from 0 to 1) using a 5-year and 10-year constant balance profile. As indicated in this simple deposit pricing assumption, lower proportionality factors have greater effects on balance assumptions. This turns out to be a key finding: **duration calculations are dependent on the interplay between rate and balance maturity assumptions when the rate model incorporates a proportionality factor significantly less than 1.**

When the deposit rate is constant, that is, the proportionality factor is zero, the balance profile translates directly to the duration calculation. On the other hand, when the deposit rate more closely tracks the market rate with a constant spread, the balance maturity assumptions have less impact on the duration calculation. In business terms: balance maturity assumptions have little impact on high-tier money market accounts. They have greater significance on DDA or savings accounts with rates that do not adjust to market rates.

EXHIBIT 4.

Partial Response Deposit Pricing Model

I. *Steady State* Deposit Pricing Assumption:

(4) Deposit Rate(t)* = Spread + Proportionality Factor x Market Rate(t)*

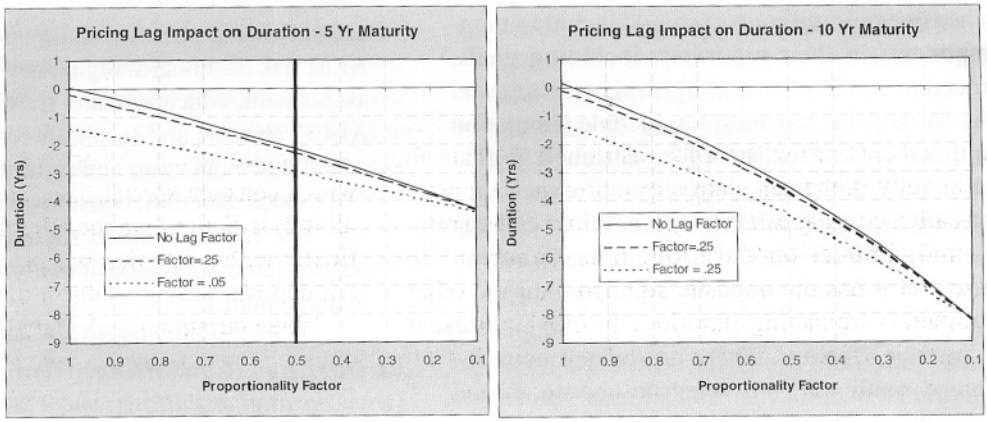
II. Deposit Rate Adjustment Assumptions

(5) Deposit Rate (t) = Deposit Rate (t-1) + Adj_speed(a,b)x[Deposit Rate* (t)–Deposit Rate(t-1)]

where,

- * indicates a steady state value (this construct is used to create stability. It is the answer to the question, "What will the deposit rate be should market rates evolve to a specific level and remain there?")
- Adj_speed(a,b) has two values, reflecting when deposit rates are above (a) or below (b) the steady state value. Both are between zero and one.

EXHIBIT 5. IMPACT OF PRICING LAGS ON DURATION OF CORE DEPOSITS



❑ *Deposit Pricing Lags.* Most banks set deposit rates by committee, after considering market conditions and competitor pricing responses. This process results in pricing lags that are consistent with the widely held perception that banks are slower to raise deposit rates in response to an increase in market rates than they are to lower deposit rates in response to a decline in market rates. This behavior is commonly referred to as an *asymmetric pricing lag*. As will be shown, after accounting for the proportionality factor in equation (3), pricing lags have only a small impact on duration calculations.

Building a model that incorporates asymmetric pricing lags is a little bit more complex than equation (3) above. For this exercise a *partial response model* is used specified in two equations. (Exhibit 4).

The model described in Exhibit 4 can be applied to actual data series and estimated using the EXCEL *Solver* tool. In addition, it captures a broad set of pricing characteristics and forecasts when forecast variables are used to estimate coefficients.

Equation (5) represents a long-term relationship that can be graphed as shown in Exhibit 3. When data is utilized, the difference between the value in equation (5) and the previous time period's deposit rate is the basis for the adjustment. If the adjustment speed is 1.0, then the model converges to Equation (4). If the adjustment speed is zero, the rate remains constant at its current value.

The graphs in Exhibit 5 display how pricing lags affect duration. As indicated, the addition of pricing lags impacts the duration calculation, but does so in non-intuitive ways. If adjustment speeds are above 0.25 (indicating a 25 percent adjustment in each period), the effects are small. However, as adjustment speeds lengthen and approach but do not become zero, the effect is greater on products with rates described by higher proportionality factors. This is because lower proportionality factors and pricing lags have similar, but not identical, effects on simulated deposit rates. When a proportionality factor is present, the addition of pricing lags does not add significantly to duration. Alternatively, when the proportionality factor approaches one, adding a significant pricing lag lengthens duration noticeably. The *relative* effects do not vary significantly by what is assumed about balance maturity.

Part 3 of this series will discuss Section III—Balance Sensitivity Assumptions and Core Deposit Duration.

MICHAEL R. ARNOLD, PRINCIPAL,
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Asset/Liability Management Training Update

Formal training is an important way to guarantee that your financial institution maintains a comprehensive A/L management (ALM) program. Training is crucial to the achievement of the numerous objectives for any bank's A/L management staff. Accordingly, this article presents an update of ALM training vendors and programs designed specifically for bank A/L managers and their staffs.

Comprehensive training courses should include a number of components in their programs, including goals, policies, procedures and systems; evaluating, selecting and installing ALM models; gap analysis; income simulation analysis; and more. Courses should be designed so that any member of the A/L team, regardless of experience level, can attend. Novices can be introduced to the training that is necessary in this field, while experienced analysts and managers can update their skills and knowledge.

Training Course Offerings. There are numerous training courses and seminars from which to choose. Listed below is a *sampling* and *update* of the more prominent ALM training practitioners, with a brief overview of each.

❑ *BancWare (Stephen M. Roy, 617-542-2800 x248, www.bancware.com).* A leader in balance sheet management software, offerings include the following courses for 2006:

- ALM Overview: Theory and Practice. Move from model design to value creation through practical applications. Includes IRR management, stochastic simulation, OAS valuation, non-maturity deposit modeling, EVE, liquidity risk management, FTP, and model risk management principles.
- Basic ALM 4. Obtain a strong grasp on the basic functionality of ALM 4 software. Provides hands-on training on all basic aspects of ALM 4. Learn how to define a model, build chart of accounts, load data into the model, etc.
- Advanced ALM 4. Build upon Basic ALM 4 skills. Provides user with hands-on training on all advanced aspects of ALM 4. Learn about advanced directive and report writing, troubleshooting techniques and more.
- Basic BancWare Data Integration. Obtain a strong grasp on basic functionality of BDI software. Provides hands-on training on all basic aspects of Convergence.
- Basic ALM 5. Obtain strong grasp on basic functionality of ALM 5 software. Provides hands-on training on all basic aspects of ALM. Learn how to build dimensions, load data into model, build chart of accounts; etc.

❑ *BNK Advisory Group, Inc.* (Update) *(www.bnkadvisorygroup.com).* BNK has worked with banks from de novos to super-regionals and has presented our approach at leading conferences. The following represents offerings in ALM education and training:

- Board education, ranging from ALM 101 through ALM 801 (intro to ALM; what is EVE and why should we care; ALM metrics for Board reporting)
- ALCO (assessing and developing an integrated risk management framework for institutions; developing and reviewing policies; setting policy limits; using an ALM risk dashboard; regulatory insight; ALCO assessment, education, and training; developing an ALCO charter; and results-focused reporting
- ALM staff education and training (needs assessment and model selection; consulting and implementation services; results-focused reporting; pricing core deposits and core deposit analysis; and database management.)

❑ *Darling Consulting Group, Inc.* (Update) *(www.darlingconsultling.com,* 978-463-0400). With more than 25 years of experience providing ALM education and training to financial institutions across the country, DCG's educational programs are considered the industry benchmark. In addition to providing custom-tailored, in-house seminars for financial institutions, DCG conducts numerous onsite, Web and phone-based educational programs for many national, regional and state banking associations, regulatory agencies, and the FHLBs. DCG also participates in quarterly examiner training programs facilitated through the Federal Financial Institutions Examination Council's (FFIEC). DCG's Balance Sheet Management Conference, held annually in June, has become one of the industry's most respected ALM events. Following is a partial list of speaking topics:

- Core ALM Education for Management and Directors (ALM Policy Development From a Business Perspective; Liquidity Measurement and Management; Measuring and Managing Interest Rate Risk (IRR); Developing and Documenting Balance Sheet Management Strategies; Risk/Return Trade-offs in Balance Sheet Management; Risk Management for the Bank Director; Effective Use of the ALCO Process; High Performing ALCOs: What Separates the Best From the Rest)
- Strategy-Development Workshops (Balance Sheet Strategies in a Highly Volatile Environment; Managing