Vol. 20, No. 1 January 2004

Bank Asset/Liability Management

SCI

Prepared by Mary Brookhart

Validating Statistical Projections of Core Deposit Retention Rates

A growing body of experience indicates that long and stable core deposit average lives are the norm, not the exception, for banks, thrifts, and credit unions. A nagging concern, however, is whether the projected data compare well to subsequent actual retention behaviors. Information amassed over many time periods across multiple studies now allows that concern to be directly addressed, by back testing previous statistically based forecast values against retention data collected since the initial forecasts.

The back testing exercises also provide a platform to examine the comparative predictive accuracy of Office of Thrift Supervision (OTS) interest rate risk (IRR) model inputs and Office of the Comptroller of the Currency (OCC) average life values. To illustrate the accuracy of statistical-based forecasts, and comparable OTS and OCC values, this article examines back test experiments for two representative community banks. Forecasted behaviors, and back-test results, are typical of experiences across asset size and charters.

Retained Balances Back Testing: Conceptual Issues. Core deposit average lives and values are often a contentious asset/liability management (ALM) model input because, unlike total balances supplied and repricing, they are not directly observable in the course of business. Thus, industry participants often disagree about the length of average lives, even when statistically derived information is available and documented.

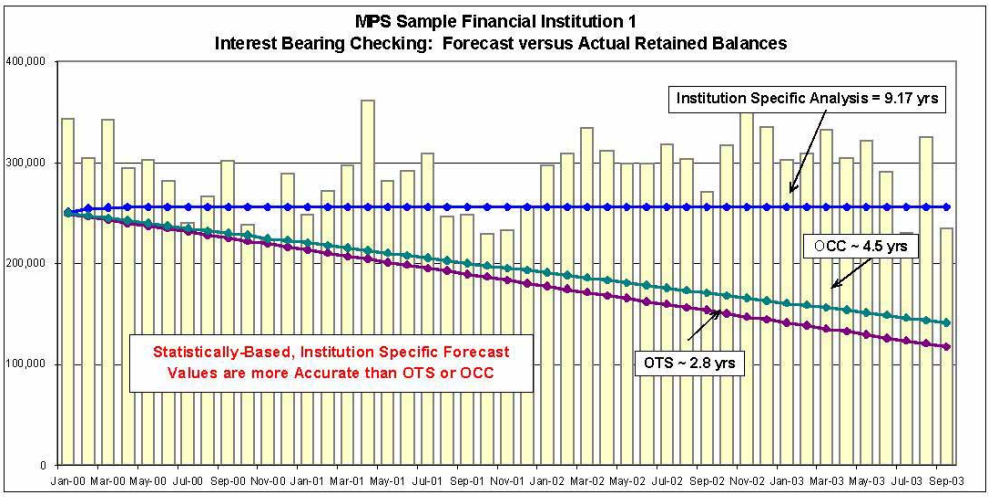
The solution to these disagreements is four fold: (a) develop a comprehensive model of core deposit retention behavior, (b) statistically analyze institution specific, customer-level retained balances data using an empirical model built from the theoretic model, (c) use the estimated empirical model to forecast retention and run off, producing average life estimates, and (d) prove the veracity of the exercise by back testing forecast values to actual retention level observed over time. Without all of the above steps, there may be grounds for doubt; with them the case for statistically estimated average lives is firmly and unambiguously made.

Steps (a) through (c) have been outlined in previous editions of this newsletter (see "A New Approach to Evalu-

Also in This Issue:

THOMSON PRATT

EXHIBIT 1. BACK TEST FOR INTEREST BEARING CHECKING



ating Core Deposit Behavior and Value," *Bank Asset/Liability Management*, June 1996).

Step (d), back testing, is a comparatively straightforward activity. It calls for comparing prior forecasts of retained balances to later observed actual retention values. Regulatory average life estimates via their implied retention/run off patterns can also be examined in competition across the same set of subsequent actual retention data.

Retained Balances Back Testing: Short Term Examples. In the interest of space, only two categories of personal type core deposits are back tested in this article. These are Interest Bearing Checking (DDA often behaves similarly) and Statement Savings (traditional MMDAs often behave in similar fashion). Experience indicates that the examples are representative of typical back test results.

Exhibit 1 presents the back test for Interest Bearing Checking. The bars, beginning in 01/31/00 and going through 09/30/03, are the actual retained balances observed for this category in each month. The bar values are the aggregated individual balances of customer accounts remaining from the sample of accounts used to produce the statistical forecast. No new accounts are included in the actuals data. Run off balances, if desired, can be obtained by calculating the differences in retained balances between periods.

Conceptually, to the left of the 01/31/00 starting point for the actuals data is a time series of aggregated account balances used to estimate the retained balances forecast equation. In this analysis, monthly data began at 12/31/94 for a sample of 247 customer accounts. (The small sample size in this case is due to high data collection costs (i.e., early period data were on microfiche). Current retention analyses use much larger samples or cohorts—all accounts open at the designated point—as most data is now available via electronic media.)

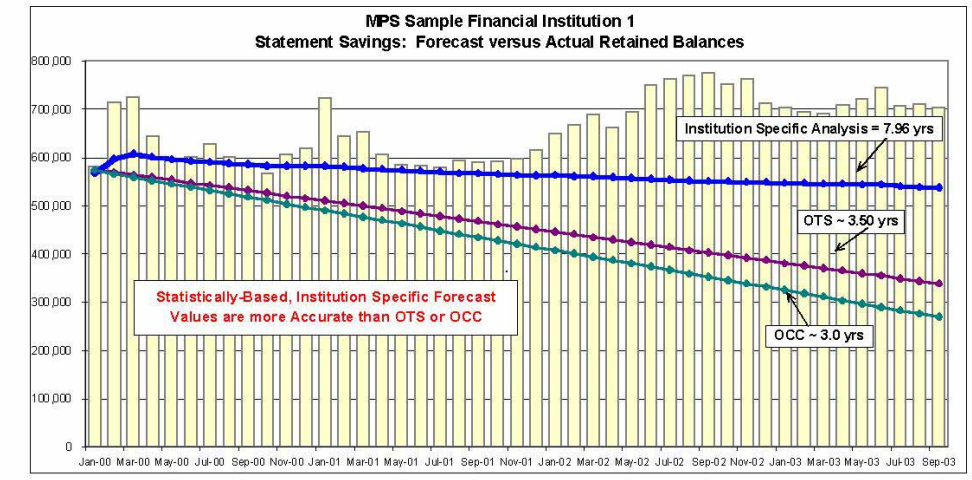
The line labeled *Institution Specific Analysis* depicts forecast values produced as of 12/31/99 by an advanced statistical analysis of the institution's historic data. The average life defined by this forecast was 9.17 years. The forecast data match the later actual retention data closely, validating that average life value. In fact, the statistical forecast values are, if anything, conservative—actual average lives may in fact be longer (as indicated in the very strong retention and stability of the monthly actual retention data).

For contrast, the retention forecast values and average lives implied by OTS and OCC IRR model inputs are presented also. The regulatory forecasts both predict significantly faster runoff (lower retention) and much shorter average lives than experience shows to be the case. This is seen in the sharp divergences between the OTS and OCC retention forecast paths and actual subsequent retention values.

A similar outcome is observed for Statement Savings (see Exhibit 2 on page 3). The statistically based institution specific analysis, also using a sample of 247 customer accounts, again depicts strong retention, with an average life of 7.96 years. The actual retention values subsequent to the forecast confirm the accuracy of that prediction. The statistical forecast again appears to in fact be somewhat conservative, especially later in the time series.

The OTS and OCC values for Statement Savings predict significantly lower retention, and thus much shorter average lives, than is supported by experience. The regu-

EXHIBIT 2. STATEMENT SAVINGS



latory values are simply too short, and by significant amounts, compared to actual outcomes.

Retained Balances Back Testing: A Long Term Example. Confirmation of the absolute and comparative accuracy of statistically-based core deposit retention forecast extends to longer back test horizons also. Consider Exhibit 3. Here forecasts for five core deposit categories (Business DDA, Personal DDA, and Personal NOW, Savings, and Traditional MMDA) are combined into a single portfolio to access the ability of the quantitative methodology to predict overall core deposit retention over time. The comparative regulatory composites are also displayed for reference.

Data presentations are similar to those in Exhibits 1 and 2. Forecast and actual retention are expressed here as retention ratios. A retention ratio in this analysis is the percentage of the 12/31/95 aggregated sample account balances that remains in any period. The underlying samples are again fixed, in this case as of 12/31/88. The forecast was prepared as of 12/31/95 and the back test covers the 105 month (8.75 year) period through 09/30/03. In this analysis, monthly data began at 12/31/88 for a sample of 1172 customer accounts. Again, the small sample sizes are due to high data collection costs (i.e., early period data on microfiche).

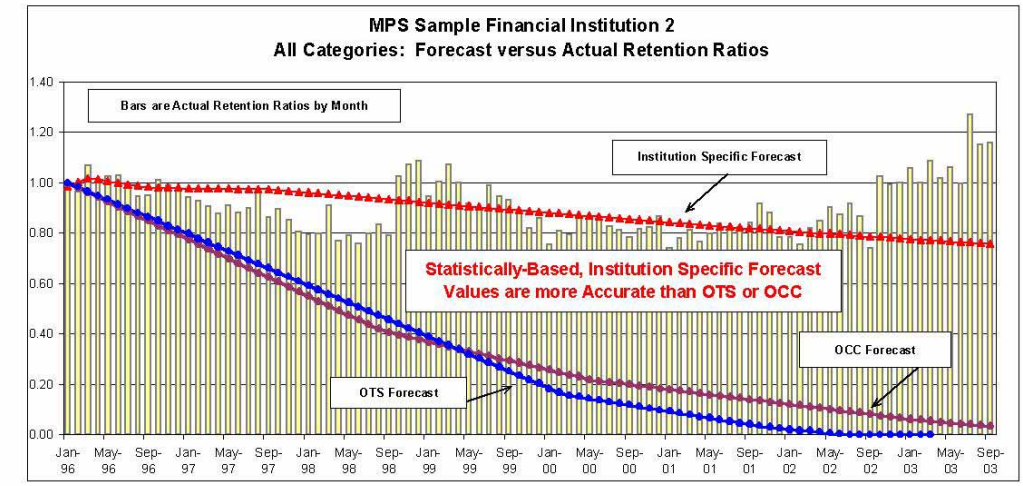
Even without listing the specific average life values (to ensure client confidentiality), it is obvious that the statistically based, institution specific forecast of retention outperforms both of the regulatory projections handily. If one considers the tremendous range of interest rates, economic conditions, stock market values, and other potential influences on depositor behaviors, the closeness of this long-term back test is a compelling vindication of statistically based core deposit average life values.

Regulatory vs. Empirical Forecasts: Empirical Comparisons. The relative lack of precision in the OTS and OCC average lives can be quantitatively demonstrated. Consider Exhibit 3, which presents simple statistical measures of relative forecast accuracy among the three retention forecasts. A standard statistic for establishing comparative forecast accuracy is Root Mean Square Error (RMSE). An RMSE is calculated as the square root of the summed squared difference between each period's forecast value and that period's actual retention value, over the time series reviewed. Lower RMSE values indicate a closer match between forecast and actual values (i.e., that projections from a forecast are more accurate in their description of actual future retention behaviors). For Interest Bearing Checking and Statement Savings, indicators of relative forecast accuracy show the comparative lack of forecast precision in the OTS and OCC average life estimates.

The information presented in Exhibit 3 on page 4 clearly points out that OTS and OCC average life values do not depict real world behaviors. This is not a criticism of these inputs; they are, after all, regulatory oriented by design. But the potential costs of using them for real world balance sheet management can be significant, and need to be discussed.

The Case Against Regulatory Core Deposit Average Life Inputs. OTS data are the most widely used generic level inputs for core deposit average lives in equity-at-risk ALM models. OCC values are rarely encountered

EXHIBIT 3. BUSINESS DDA, PERSONAL DDA, AND PERSONAL NOW, SAVINGS, AND TRADITIONAL MMDA FORECASTS



outside of special regulatory situations. OTS data are often considered conservative because they are shorter than those found in statistical-based analyses.

The conservative moniker is wrong, however, from a declining interest rate perspective. Institutions using OTS average life values as equity-at-risk IRR inputs in early 2000 significantly underestimated the threat, now real, that declining interest rates posed to their long run margins. Institutions employing statistically based average life inputs were alerted early on (by the long durations of their core deposit inputs) to the true level of their exposure in down rate scenarios. When interest rates did fall, beginning in 2001, these institutions were among the fastest to reduce rates paid (to shorten core deposit durations). As such, they outperformed institutions that were conservatively unaware of their looming margin problem.

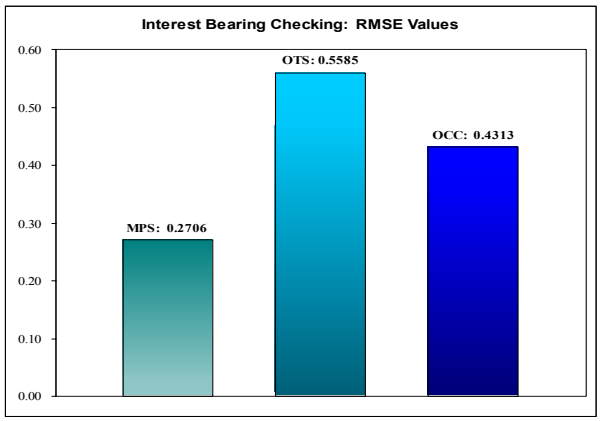
The conservative moniker is wrong also for OTS average life inputs from a rising interest rate perspective. The shorter OTS core deposit average lives define less equity-at-risk IRR hedging, leading institutions in many cases to a more conservatively structured (i.e., assets at shorter terms) balance sheet. But this creates less performance than would a fully deployed asset strategy (longer term assets matched against statistically-proven long term core deposits). This margin shortfall, in today's low interest rate environment, is especially of concern because it is being magnified by funding rate floors, implicit or actual, and declining shorter-term asset yields.

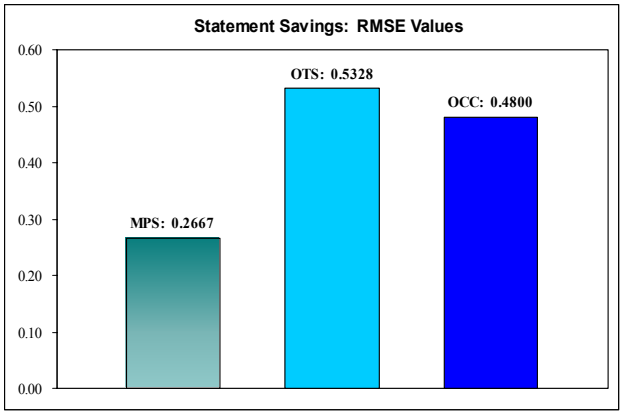
The OTS core deposit inputs mislead financial managers into ignoring the embedded long core deposit durations in their balance sheets, looking instead to likely more risky strategies to improve margin. The typical error of such strategies, e.g., taking more credit risk, adding optionality, or reducing liquidity holdings, is well documented in the history of banking.

Effectively Deploying Core Deposit Durations. An almost assuredly less risky strategy than those noted above is to deploy quantified long-term core deposit behaviors in the balance sheet by matching longer-term assets against them. The core deposit durations deployed derive from the institution's own, and assumably well understood, franchise, and they can be easily monitored on an ongoing basis. Also, the asset deployments can be conservative. For example, even longer-term mortgage-related assets produce strong monthly cash flows (i.e., interest, amortization, and prepayments) that are reinvestable in rising interest rates. Further, the degree of asset deployment can be limited. For example, what if commercial lenders at an institution were authorized to allow just one more year of term on fixed rate loans compared to their (OTS constrained) competitors? Many deployment solutions exist, not just the oft-cited mortgage related strategies.

It is correct to note that deployments as described above match contractually long-term assets against only effectively long-term core deposits. This triggers the question: What if core deposit durations adversely change? A compelling answer is that they probably won't, as history amply shows. Recall the rapid interest rate increases of 1994, which had little impact on traditional DDA, NOW, and Savings balances. But for those who desire greater certainty, the answer is in partially hedging against adverse changes in core deposit behaviors (repricing or supply). This can be done in many ways such as out-of-the-money interest caps, laddered FHLB term advances, interest rate swaps, etc.

EXHIBIT 4. RMSE VALUES





Protection against adverse change in core deposit behaviors can thus be bought, but at an unfortunately margin depressing price. However, the key to success with the deployment of core deposit durations is that full hedging protection is rarely needed. This is because not all balances will likely be affected and/or it will take time for any adverse behaviors to occur. Those core deposit behavior attributes make virtually any asset deployment, even one significantly hedged, an immediate and positive contributor to current margin.

End Note on Regulatory Core Deposit Average Life Inputs. Regulatory core deposit average life inputs have their place, for example in sensitivity testing the implications of adverse changes in liability side term behaviors. But a strong case can be made that they are not suitable for equity-at-risk IRR analyses, because they are not empirically valid. A stronger case still can be made that regulatory average lives have no place in balance sheet management that references equity-at-risk positions. They are neither conservative nor regulatory here; they are wrong.

The right core deposit average life input answers for both IRR analysis and balance sheet management are statistically based estimates derived from institution specific data. Only this level of quantitative precision provides ALM decision inputs that successfully back test against the empirical record. In today's tightly margin-constrained environment, can institutions afford to rely on anything less?

WILLIAM J. MCGUIRE, PH.D.
McGuire Performance Solutions, Inc.

(Contributors to this article are Anne Givens, CFA and MPS VP Consulting, for technical assistance; Farin and Associates (Madison, WI) for the reverse engineered OTS average lives; Rich Sheehan, Ph.D. and MPS SVP research, for the statistical-based forecasts presented, from MPS client data.)

Strategies for Development and Support of Assumptions for Interest Rate Risk Analyses

Many financial institutions rely on simulation models as a primary measure of interest rate risk (IRR) inherent in their balance sheet, not only to satisfy regulatory requirements but also to serve as the best proxy for predicting future financial results in a variety of interest rate environments. But the modeling results are only as good as the accuracy and reasonableness of the assumptions employed. Here are some of the key areas in which assumptions are made in IRR modeling and some pointers as to how to approach and/or document each assumption.

Prepayments/Optionality. Financial institutions have tremendous optionality embedded in their balance sheet. Among these are callable investments or borrowings. They are clear and easy to understand, and there are even tables available through many of the option holders, such as the Federal Home Loan Banks, that can be very helpful in supporting the modeling assumptions used for the instruments in the various interest rate environments used for IRR modeling. The embedded options in mortgages and mortgage-related products can be among the more variable assumptions used in modeling and affect the greatest portion of the balance sheet for most financial institutions. The following lists some sources to be used to develop or support prepayment or call assumptions:

❑ Bloomberg support or Published Prepayment *guidance for like mortgages or investment securities.* This information can be gained with little more than a phone call to the bank's chief investment officer or investment advisor who has access to an abundance of materials. They even model the