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Defining Accurate Core Deposit ALM Model Repricing Inputs

Model risk is the chance that incorrect financial decisions are made based on faulty projections from a financial model. ALM models are subject to model risk, especially in interest rate risk (IRR) applications where fundamental balance sheet decisions are made based on indicted sensitivity positions. A common source of model risk in earnings at risk testing stems from core deposit repricing inputs because they are key influences on the sensitivity of interest expense to changes in interest rates. If these inputs are inaccurate, model risk can quickly morph into résumé risk should the model incorrectly predict a positive earnings response to rising interest rates when the actual outcome is the reverse.

This article lays out a multi-step methodology for defining appropriate core deposit repricing inputs in ALM model IRR testing applications. The approach combines an awareness of the institution's history and current market conditions with forward looking behavior estimates based on quantitative and management inputs. A monitoring and validation process is also outlined. Variations of the methodology can be employed by institutions of all sizes in meeting the core deposit repricing input needs of any ALM model.

Traditional versus Premium Rate Core Deposits. A key point to recognize before addressing repricing input definition is that core deposits break into two distinct sub-groups, based on how depositors view the underlying value proposition.

Traditional core deposits, such as zero or low rate paid checking, savings, and low tier MMDA categories, are primarily motivated by non-rate value proposition elements such as service, convenience, and product. Institutions *own* these deposits despite negligible repricing when interest rates change as long as non-rate value elements continue to dominate any financial influence on supply.

Premium rate core deposits, such as high rate paid upper tier MMDA and premium checking are, on the other hand, almost exclusively motivated by financial related influences. Institutions *rent* these deposit for only as long as rate paid is competitive against comparable deposit products. This usually requires quick and substantial repricing when interest rates change.

The implication is that different repricing inputs will apply to each core deposit category, depending on depositor value focus. It also implies that different repricing inputs will be needed for gradations within some categories (e.g., low to high tier MMDA). There is no such thing as a generic core deposit ALM model repricing input.

Step One: Understanding the Context of Core Deposit Repricing. Core deposit repricing inputs in an ALM model reflect expected future behaviors by depositors (the supply influence) and institutions (the demand influence). They are further influenced by recent trends, the current state of core deposit markets across the deposit footprint, and expected future conditions. To correctly define core deposit repricing inputs, ALM model users need to have a comprehensive understanding of the context of core deposit repricing.

Core deposit situational awareness is that understanding. In the current environment it first requires assessing whether surge balances are a factor. Surge balances are seen as a marked increase in supply at the point where the financial sector entered a crisis mode, usually defined as late 2007. The surge in supply is driven by flight to safety (deposit insurance), finance influence (rates paid tended to lag interest rate reductions), and portfolio rebalancing (e.g., in IRA categories). Higher rate paid categories tend to see the strongest surge balance activity as depositors choose the least disadvantaged category to park funds. But surge balances can occur in any category.

The second element of situational awareness is reviewing the relationship between current rate paid and its typical reference rate. If current pricing is at a historically abnormal spread to the reference rate (for example, at too small a negative level or positive), an increase in interest rates will less likely translate into aggressive repricing until historic spreads are restored. This is likely a stronger influence on traditional core deposits than high rate core deposits. But pricing spreads eventually return to their equilibrium levels, and this necessarily implies some degree of lag in repricing for all categories if current conditions are not typical.

The last element of situational awareness requires considering likely future influences on core deposit supply and pricing. Examples of factors to consider are expected inflation (higher inflation will normally require more aggressive repricing), loan demand (greater lending activity increases liquidity needs, driving up deposit rates), and depositor attitudes (some recent surge balances may actually be traditional in nature due to a shift in savings habits).

To develop the concepts above at a more concrete level, consider two views of recent data. Exhibit 1 presents history and current conditions for a traditional core deposit category (interest bearing checking) and Exhibit 2 presents parallel data for a premium rate core deposit category (high tier MMDA). There are two very different stories, as one would expect.

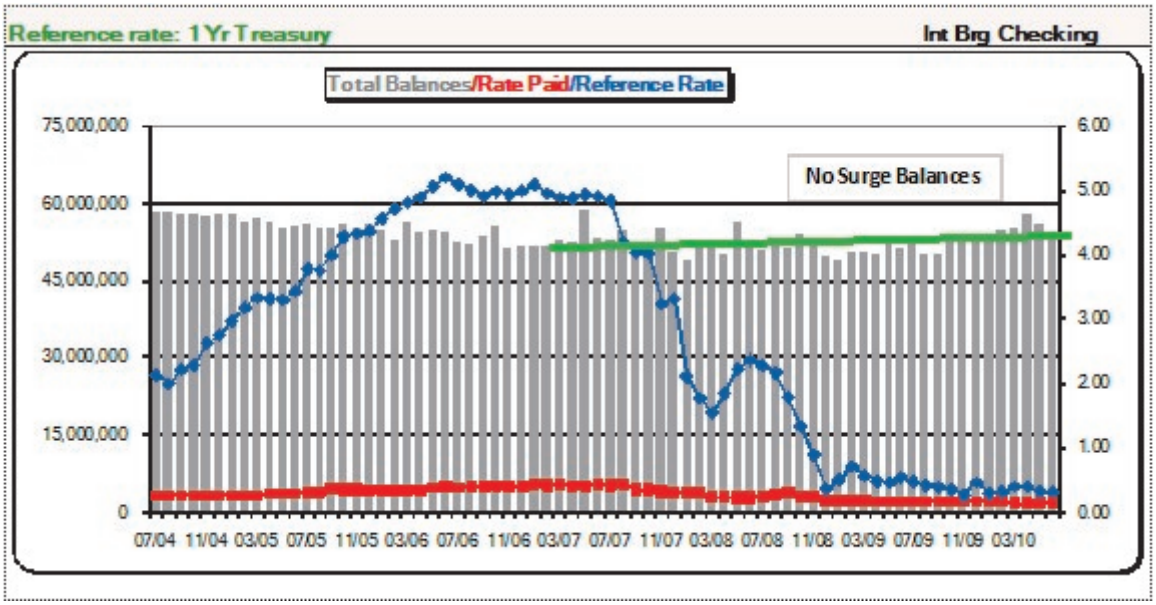
For the traditional core deposit in Exhibit 1, supply displays a minor recent upward trend but no breaks that suggest surge balances. No surprise that surge balances are not a factor, as this is a low rate category whose primary orientation is checking services. The relationship between rate paid and the reference rate (here the 1 year Treasury) is interesting, however. Whereas a 200 to 500 basis point (bp) negative spread characterized most of the period reviewed, recent experience shows almost a zero spread. This strongly points to minimal repricing of this category as interest rates rise, even for very large degrees of interest rate increase. Low levels of expected inflation and lagging loan activity further suggest minimal repricing pressure. This is definitely a category with very limited future repricing!

For the premium rate core deposit in Exhibit 2, recent supply displays material surge balances. Surge balances are a factor because this category is a (relatively) high rate parking place for funds waiting out adverse financial sector conditions. The relationship between rate paid and the reference rate (also the 1 year Treasury) is again interesting. Whereas a rate paid was normally at a negative spread to the reference rate, recent experience is that rate paid is above it. This reversal of historic relationships possibly points to muted repricing of this category as interest rates first rise. Expected reduced loan activity and low levels of expected inflation suggest reduced repricing pressure. But high rate paid categories are normally subject to strong competitive forces; witness the marked outflow of finds early in the historic period as interest rates rose. This is a category to watch very closely with respect to future repricing!

Be sure to recognize the difference between surge balances runoff and reductions in long term trend balances. Once conditions become more favorable in alternate investment sectors, surge balances will return to their long term positions, e.g., in the stock market. No reasonable amount of repricing will retain these balances so it is best to let them run off. This may be hard to see happen but the alternative is the elephant trap of banking – driving up the cost of funds in a futile attempt to control the surge balance tide.

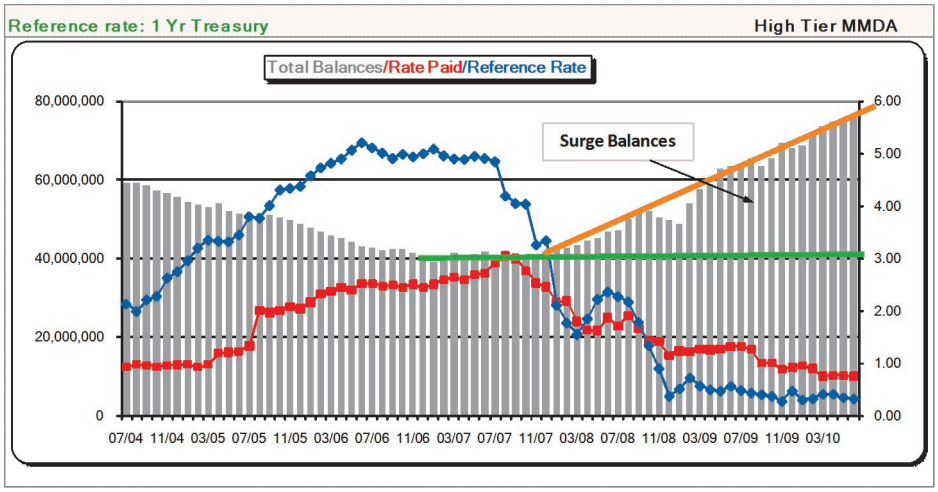
Situational awareness sets the stage for defining core deposit ALM model repricing inputs by formalizing the context against which core deposit repricing decisions are weighed. What are needed next are measures of recent repricing behaviors to form the nucleus around

Exhibit 1



which final management adjustments can be made in light of that context.

Exhibit 2



Step Two: Defining Core Deposit Repricing Inputs.

ALM model repricing inputs for core deposits consist of a beta coefficient and a lag structure. The beta coefficient specifies by how much a rate paid will change for a given interest rate change while the lag structure specifies how fast the change will occur. Defining those two elements of repricing requires understanding your institution's historic repricing behaviors, the relationships between that repricing and supply responses, and the current situation context. All three pieces are required for accurate ALM model core deposit repricing inputs.

Quantifying historic core deposit repricing and supply behaviors can be done at various levels. A greater level of quantification increases the accuracy of repricing inputs but requires a greater resource commitment. Make your decision based on the cost of repricing input acquisition compared to the payoff from more precise repricing control when interest rates rise. The latter is often dominant, as even a small reduction in the speed at which core deposit interest expense rises can translate into large sums very quickly.

A minimum practice repricing input solution is to review the change in rate paid by category relative to the change in a specified reference rate over the two most recent periods of significant interest rate change (mid-2004 to mid-2006 for rising rates and late 2007 to the end of 2008 for declining rates). Be sure to let rates paid evolve for a period after interest rates stop changing as lags in core deposit pricing are normally a factor. A total change in the savings rate of 40 bp across a 200 bp change in interest rates implies a beta of 20 bp. The lag structure is not as readily estimated, but approximations may be possible. Qualitative conclusions may also be possible with respect to supply responses, by looking at contemporaneous supply measures over time (usually general ledger balances). This is at best an inexact science, however.

The best practice repricing input solution is to statistically analyze historic time series data based on rates paid and total balances supplied in a simultaneous equations model that quantifies repricing and depositor supply reactions, including inter-category transfers (cannibalization). Forecasts produced by such an exercise provide specific, quantitative guidance for designing accurate core deposit repricing inputs.

Exhibit 3 presents examples of statistically based forecasts of repricing (lower chart) and supply responses (upper chart) for a hypothetical core deposit category. Base Case is a forecast for a constant interest rate scenario; the other scenarios are forecasts for the associated instantaneous rate shocks. The inter-relationship of core deposit repricing and depositor supply responses is illustrated.

A change in interest rates, say a +100 bp shock, feeds into the rate equation in month one and produces a repricing estimate. That change in rate paid, plus the rate shock change in interest rates, feed into the balance equation and project the supply response in month one. The process continues through time via the influence of lag terms in both equations, until new equilibrium positions are reached. The total change in rate paid defines the beta coefficient, the path of the rate paid change defines the lag structure, and the change in supply is the supply response. Together, these now known behaviors can be used as the nucleus for precise core deposit repricing inputs.

Exhibit 4 illustrates the process of blending historic repricing behaviors with supply responses and situational awareness to produce accurate repricing inputs for a constant balance sheet earnings at risk analysis. For each of the two core deposit categories reviewed above, statistical forecasts of behaviors are presented. The *As Forecast Beta* is the change in rate paid at 12 months (after all lags play out) produced by the statistical forecast of repricing. The *Supply Response* is the change in balances supplied at 12 months, given the interest rate change (here +100 bp) and the forecasted level of repricing. The *Supply Adjusted Beta* is the As Forecast Beta with a management defined *correction factor* to offset the supply response, which must be done to be

consistent with the constant balance sheet modeling assumption.

One final step remains. The *Fully Adjusted Beta* values incorporate a further adjustment by management. This is dialed in to reflect the context defined in the situational assessment exercise. In this case, the betas for both categories are reduced by small degrees. This is to note the mitigating influences of expected low future inflation and lagging lending activity, which reduces the demand for deposits/ liquidity. The path of the Fully Adjusted Beta follows the lag structure as estimated, but with a revised overall magnitude.

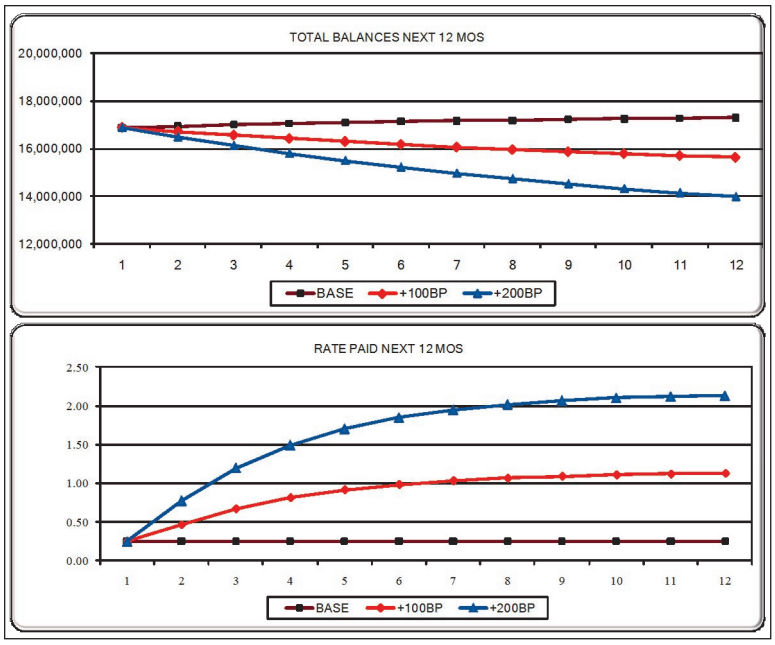
Note that a non-constant balance sheet earning at risk test will require core deposit repricing inputs that uniquely match the growth paths specified for core deposits. This is a special case of the process described above, with adjustments set to match the modeling assumptions. Note also that business plan repricing inputs may be more appropriately defined as discrete repricing events rather than the continuous inputs used in an ALM model. This is acceptable given that the ultimate cumulative discrete repricing equals the betas developed above.

The end result of recognizing all influences on repricing is precise ALM model inputs. These accurately reflect the institution's own history of its core deposit repricing and simultaneous ability to maintain balances supplied as interest rates change plus management adjustments that incorporate known supply responses and market context. The strong ties to institution history and current markets imbed a special empirical reality that gives the inputs a solid basis for their use in measuring IRR positions.

Step Three: Monitoring and Validating Core Deposit Repricing Inputs. Core deposit repricing inputs will change over time as depositor supply behaviors, interest rate levels, and institutional deposit demand varies. An active behavior monitoring program thus needs to be implemented along with upgrades to repricing input accuracy. The monitoring program acts as an ongoing validation of existing inputs or points to needed changes. It can also, in an advanced best practice application, proactively identify core deposit pricing opportunities and supply threats as they develop.

Minimum practice for monitoring repricing inputs is to periodically back test core deposit repricing inputs.

Exhibit 3



Forecasted values are graphically compared to actual outcomes over a defined time period and conclusions with respect to accuracy drawn. The magnitude of the variances can be quantified in a number of ways, but this is seldom done in practice. (For example, the Root Mean Square Error (RMSE) is the square root of the summed squared differences between forecasted and actual rate paid values over the period back tested.)

Back testing is a simple endeavor. Assume that interest rates changed by +100 bp at the start of the period. The institution's discrete administered repricing events are mapped against the projected continuous repricing inputs. A successful back test is one where actual repricing eventually merges with that forecast (the betas are comparable) and lags are also reasonably consistent between forecasted and actual outcomes.

Best practice for monitoring repricing inputs is create more accurate depictions of forecasted repricing inputs to test input accuracy at a higher level. This is done by comparing actual repricing over time to *retrocasts* of rate paid values created by inputting actual interest rates in each period since the original forecast and solving the relevant equation for expected repricing. This has the advantage of being able to incorporate rolling interest rate changes into

Exhibit 4

Category	As Forecast Beta	Supply Response	Supply Adjusted Beta	Management Adj Beta
Int Brg Checking	9.5 bp	-1.65%	12.5 bp	10 bp
High Tier MMDA	95.0 bp	-0.85%	97.5	90 bp

the analysis, rather than being tied to a given set of rate shocks.

An advanced best practice application of the retrocast technique is to apply it in judging supply behaviors relative to expected outcomes assuming a continuation of historic behaviors. This requires forecasting balances supplied since the original forecast is based on actual rates paid and interest rates over time. This can be readily accomplished using the best practice estimated equation system. The value in the exercise is in identifying divergences between actual balance outcomes and retrocasted values, which illustrate a change in supply behavior compared to historic tendencies. If actual balances are exceeding projected balances, then supply is *rich* to its history. This is an opportunity to reduce rate paid, unless the balance growth is desired. Conversely, if actual balances are trailing projected balances, then supply is *weak* to history and (if current balance targets are desired) remedial action is needed.

In rising rate environments the findings of such advanced explorations normally produce many small immediate interest expense savings that accumulate across categories and over time. The outcome can be a stronger margin without any added credit or interest rate risk and only hypothetically affected liquidity risk.

Implementing Accurate Core Deposit Repricing ALM Model Inputs. The exact process of implementing accurate core deposit repricing inputs in ALM models varies according to the model's level of input granularity. Ideally, repricing behaviors should be uniquely input by month, by category, in each rate scenario under review. Some models allow only a beta input per scenario, however, or (in extreme cases) the same beta in all scenarios. If this is the case, calculate the average repricing estimated over time and use that value as the As Forecast baseline input. This value will be less than the full beta since it accommodates the lag effect on overall change, although not the timing of those changes.

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