Documenting Assumptions in Interest Rate Risk Models

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Due to the rising level of interest rate risk in the banking industry, regulators are paying more attention to interest rate risk models. Running a reliable modeling process requires the use of sound and accurate assumptions, and keeping examiners happy requires that they be properly explained and documented. This white paper delineates a basic process for creating and documenting accurate assumptions.

The new reality

As the aftermath of the financial crisis drags on, financial institutions continue to face strong headwinds from multiple directions. This fact is certainly not news that you are reading here for the first time. Financial institutions face a multitude of challenges, including:

- Continued loan losses requiring above average loan loss provisions
- Rising overhead due to regulatory changes, with Dodd-Frank expected to add hundreds of new rules
- Declining fee income due to changes in overdraft rules and interchange rates
- Shrinking margins as asset yields continue to fall while funding costs have stabilized near the lower bound of zero
- Rising capital requirements
- Rising liquidity requirements

These concurrent issues are increasingly pressuring earnings and capital. As a result, financial institutions are searching for earnings. The current steepness of the yield curve offers just such an opportunity, as institutions are able to borrow cheaply on the short end of the yield curve and invest at a healthy spread on the long end of the yield curve. The result is a positive spread, but at the expense of increased interest rate risk.

As the industry has increased the level of interest rate risk, regulators have ramped up the level of scrutiny. An Interagency Advisory on Interest Rate Risk was released in January of 2010 which conveyed the concern among the various regulatory agencies. The advisory stated:

“In the current environment of historically low short-term interest rates, it is important for institutions to have robust processes for measuring and,
where necessary, mitigating their exposure to potential increases in interest rates.

Current financial market and economic conditions present significant risk management challenges to institutions of all sizes. For a number of institutions, increased loan losses and sharp declines in the values of some securities portfolios are placing downward pressure on capital and earnings. In this challenging environment, funding longer-term assets with shorter-term liabilities can generate earnings, but also poses risks to an institution’s capital and earnings… institutions are expected to have sound risk management practices in place to measure, monitor, and control IRR exposures.”

After this guidance was issued, scrutiny of interest rate risk models increased substantially. Banks are reporting that field examiners are using the 2010 guidance as the minimum standard, and are thoroughly questioning the integrity of both in house and outsourced risk models. Exam results show that regulators believe (with merit) that the assumptions being used in the models are the weak link in the risk measurement process. Therefore, even banks with minimal risk and sound management practices are being criticized if they have not properly and adequately documented the evidence that validates the assumptions they are using in the modeling process.

In addition to instructions on the measurement and management process, the 2010 guidance also stressed the importance of clarity and communication between the modeling function and the risk oversight function. In essence, those parties that are setting and overseeing risk limits must be aware of how the results are being measured. The modeling process must be clearly defined, including where assumptions are used, what those assumptions are, and what limitations are inherent in the results due to those assumptions. Although specific structures will vary widely, for simplicity in this document, the following structure is assumed for the interest rate risk measurement and management process:

In this assumed structure, the risk oversight function is held by the board, and delegated to the ALCO. The management of the bank executes the strategy and
risk profile determined by the ALCO, with members of the bank staff performing the day to day duties of modeling and auditing results. Management is responsible for ensuring that the staff handling the model clearly communicates the process (including the assumptions) to the ALCO, with all communication documented in meeting minutes. In structures that differ from the one above, the terms “ALCO” and “management” can be replaced by the parties that handle the described function.

In order to prove that ALCO is aware of the assumptions being used and the limitations of the model, it is vital to record these communications in meeting minutes. Many management teams have a sound process for generating assumptions, but if that process is not documented in meeting minutes, it is assumed that the process has not been vetted by ALCO and that the overseers of risk have not been properly educated on the intricacies of the model.

Because of the growing complexity of asset liability management, and the minimum threshold of expected sophistication in the process, many financial institutions have decided to outsource some of the functions. In fact, a growing number of institutions are outsourcing the entire modeling process so that they will be able to focus on the risk management strategy as opposed to the time consuming measurement process. The guidance stresses that while this is perfectly acceptable, ALCO and management are still responsible for ensuring that their vendors meet the regulatory expectations. This means that if management hires a third party to create and/or validate assumptions, they are still responsible for understanding the results and communicating to ALCO.

Where are assumptions necessary and appropriate?

The first step in the process is to evaluate the data going into the model and determine where assumptions are both necessary and appropriate. All interest rate risk models require dozens of assumptions. After the modeler and management have determined where assumptions are necessary, they should be listed so that they can be communicated to the ALCO. While there are many assumptions inherent in the modeling process, the majority are insignificant assumptions that have a minimal impact on model results. For example, the model must assume at what point in each month that payments are received and reinvestments are made. The number of assumptions in each model will depend on the structure and complexity of the specific model, but as many of these as possible should be listed. However, the focus should be on the assumptions that have the most impact on the model results. In most models being used in financial institutions, the primary high influence assumptions include:

- How will maturing assets and liabilities be replaced?
- What is the most likely structure in each product type for reinvestment purposes?
- How will loan pricing change as market interest rates change?
- How will deposit pricing change as market interest rates change?
• How will prepayment speeds be impacted by changes in market interest rates?
• What are the effective maturity dates and customer behaviors in non-maturing deposit accounts?

With the list of needed assumptions now in hand, modelers can begin gathering the data necessary to create the assumptions. The remainder of this white paper focuses on methods for creating and documenting the six primary assumptions listed.

Gathering data

The regulatory guidance states that the data used for creation of inputs is dependent on the level of risk and complexity within the institution. In theory, a more complex institution should be using advanced stochastic modeling on its own historical data, and a simpler institution should be able to use standard industry data. However, in reality, field examiners are more often expecting the institution to use the best available data. Recent exams show a strong preference for institutions to use their own data, even when it is “noisy” and may not produce the most accurate results. If modelers are going to use anything other than their own historical data, they need to clearly document why they are doing so, and at what they expect to be able to use their own data as opposed to the chosen proxy. The following is a description of potential sources of data for each of the six primary assumptions.

How will maturing assets and liabilities be replaced?

In general, the majority of models assume that all maturing assets and liabilities are replaced with the same product type at the same offering rates. However, there are cases where this scenario may not be the most accurate. For example, different scenarios may include de novo institutions experiencing rapid growth, institutions undergoing significant strategic changes, or institutions under regulatory enforcement actions that dictate changes to the balance sheet. The information to be gathered includes:

• Balance sheet trend reports for the institution
• Industry or peer group trend reports
• Meeting minutes describing specific changes to strategy that will change the balance sheet allocation (if applicable)
• Meeting minutes, exam reports, and correspondence with regulators or auditors describing required or suggested changes to balance sheet allocation (if applicable)

What is the most likely structure in each product type for reinvestment purposes?

The assumed structure will most likely be the structure that is most common for each product type, unless there is a specific and well documented reason to assume otherwise. The information to be gathered includes:

• Recent production reports for each major product type that includes basic structure information like maturity, payment, and pricing/repricing terms
• Meeting minutes describing specific changes to strategy that will alter structures going forward (if applicable)

**How will loan pricing change as market interest rates change?**

In order to generate this assumption, the financial institution will need to be able to measure the correlation between their loan rates and market “driver” rates. This relationship is very unique, and therefore needs to be specific to each institution whenever possible. The information to be gathered includes:

• Historical rates for whatever market rate will be used as the driver (if unknown, gather historical data on multiple rates)

• Institutions historical offering rates for each loan type (prefer booked rates if possible, rate sheets if not possible)
  
  o If institution historical data is unavailable for any reason, minutes detailing a pricing strategy or industry/peer pricing data should be gathered

**How will deposit pricing change as market interest rates change?**

The process for creating deposit pricing assumptions is the same as the process for loans, and will require the same information:

• Historical rates for whatever market rate will be used as the driver (if unknown, gather historical data on multiple rates)

• Institutions historical offering rates for each deposit type (prefer booked rates if possible, rate sheets if not possible)
  
  o If institution historical data is unavailable for any reason, minutes detailing a pricing strategy or industry/peer pricing data should be gathered

**How will prepayment speeds be impacted by changes in market interest rates?**

Determining prepayment speeds is the most difficult assumption for most financial institutions, often due to limitations in their core software systems. In addition, many smaller institutions simply do not have high enough loan counts to generate statistically significant measurements of their portfolio prepayment speeds. Often the speeds measured are highly volatile, and do not correlate well with interest rate shifts. This assumption seems to be the one that in most cases regulators are okay with using an industry or market proxy, as long as the methodology is explained and documented. To determine the best source, the data that needs to be gathered includes:

• Historical rates for whatever market rate will be used as the driver (if unknown, gather historical data on multiple rates)

• Institutions historical principal payments by loan type and coupon

• Projected speeds from a market source (such as Bloomberg)

• Industry speeds (such as OTS data, although this data will no longer be collected after the OTS is folded into the OCC)
What are the effective maturity dates and customer behaviors in non-maturing deposit accounts?

Many financial institutions also choose to use industry standards for decay rates or deposit lives. However, these proxy numbers have received more criticism, as non-maturing deposit behavior is very different between financial institutions, and is easier to calculate. The data to be collected includes:

- All non-maturing deposit accounts with a date opened and date closed
- A record of how many accounts are closed each year
- OTS averages (if institution data is unavailable or unreliable)
- FDICIA 305 guides (if institution data is unavailable)

Create assumptions based on the best available data

The actual building of assumptions requires some basic statistics knowledge, although being able to plug the data into a spreadsheet and run complex calculations has certainly helped. This step is where most financial institutions struggle, as being able to document the validity of the assumptions requires that they be built on a mathematical basis instead of on instinct. For this reason, an increasing number of financial institutions are choosing to outsource this piece even if they are running a model in house. Specific methods vary, but the basic premise is to find a correlation between the institution’s results or behavior and an outside rate.

How will maturing assets and liabilities be replaced?

The first big assumption is perhaps the easiest, because unless there are specific and well documented reasons to do otherwise, it can be assumed that all maturities are replaced with the same product at the same terms. If there is a unique circumstance (de novo, strategy change, regulatory action, etc.), then the specific model change needs to be tied to the documentation for that change. For example, notes to the model may say “based on the terms of the recent memorandum of understanding, all brokered deposit balances are assumed to roll off and are replaced with retail time deposits.”

What is the most likely structure in each product type for reinvestment purposes?

Using the recent production, the modeler can measure the weighted average maturities, amortization schedules, etc. to build the assumption for reinvestments. Again, any deviation from using recent institution specific structures needs to be documented with specific reasons for the change.

How will loan pricing change as market interest rates change?

The institution can use the historical interest rates and historical loan offering rates to calculate the typical relationship between the two. Depending on complexity, many institutions will find different relationships based on rising or declining rates, and many institutions have lags between market moves and offering rate changes. Finding an accurate relationship will require that multiple relationships be measured and tested, with the highest coefficient of determination ($R^2$) determining the best statistical fit.
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How will prepayment speeds be impacted by changes in market interest rates?

As mentioned earlier, prepayment speeds are the most difficult assumption for which to get valid and statistically significant data that is institution specific. Even institutions that are able to capture good prepayment speeds for recent history lack good data from enough different rate scenarios to form an accurate projection of speeds as rates change. For this reason it is often necessary to use a proxy. Many models have been using the OTS prepayment tables, which are based on thrift industry data collected by the OTS. However, new data will not be available as the OTS is folded in the summer of 2011, so many models will be seeking another source. Another common method is to use bond equivalent speeds, and then make adjustments as necessary depending on the loan type. Bond speeds work well, as due to the depth of the market, there is a tremendous amount of data available for many different loan structures and coupon types, and the data (including projected speeds), is updated and kept fresh on a regular basis.

An effective method involves matching loans to similar bonds, and using the projected speeds on the bonds as the basis for the loan prepayments. Actual loan prepayment speeds can then be captured each month and compared to the projection, with adjustments made if necessary. Often a factor of the MBS speed can be used, as commercial and consumer loans are generally not as rate sensitive as residential real estate loans.

What are the effective maturity dates and customer behaviors in non-maturing deposit accounts?

Calculating the effective maturity or duration of non-maturing deposits can be quite simple, or it can be extremely complex. In general, regulators will accept the more basic assumptions if they appear reasonable and if the data fits well (i.e. has a reasonable standard deviation). Using the institution specific data, modelers can calculate an average time that an account remains open, as well as the decay rate (or inversely, the retention rate). These calculations create an expectation for how long the balances will be in these categories. The institution specific number can be compared against the OTS or FDICIA 305 standards for reasonableness. Using these gauges as the assumption should only be done if there is truly no data available. If this is the case (as it would be for a de novo bank), it is important to define how long this proxy will be used, and at what point the institution specific data will be used instead.

Document and communicate the assumptions
Modelers can now take their list of needed assumptions, and define what will be used for each. This information should be compiled in one summary document, with the six primary assumptions (at a minimum) including tables and/or charts that show the statistical logic behind the assumption. This document should explain to the reader what assumptions are being used, why they were chosen, and what the limitations are of that assumption.

This document should then be the basis of an ALCO meeting, preferably with nothing else on the agenda. Each of the major assumptions should be discussed at the committee level so that those responsible for defining the risk tolerance have a very clear understanding of how that risk will be measured going forward. This meeting needs detailed minutes, and should be a recurring meeting that happens once per year to discuss any adjustments. The minutes can then be shared with the full board, showing that the modelers that are measuring the risk have clearly communicated the process to those that are overseeing the risk levels.

Back-test the model results

Once the assumptions are in place and being used to generate forecasts, the process needs to incorporate a regular back test of the forecast accuracy. The depth of this process will again depend on the complexity of the organization, but the goal is to measure the accuracy of the forecast in order to determine if there are faulty assumptions that are skewing the results. A regular (at least quarterly) back test of the overall model accuracy should be completed by someone independent of the modeling process. This back test should have a defined level of expected accuracy, with any results outside of that tolerance triggering a check of the individual assumptions. A less regular (but at least annually) back test should be performed on each of the major assumptions. For example, given the rate scenario that happened, what were the projected prepayment speeds? How did those compare to actual prepayment speeds? This back test allows for adjustments to models where correlations may be breaking down over time, or where better data is now available.

As with all other aspects, the results of the back test should be communicated to ALCO and documented in the minutes so that the risk oversight group is aware of any inaccuracies in their measurement tool.

Engage a qualified third party for validation

Even with a sound and well documented internal process, best practices still dictate a periodic validation of the model by an independent third party. The validations vary in scope, but generally test both the mathematical integrity of the model and the inputs. Such a validation will serve to illuminate any holes in the process, especially since in most smaller institutions, the modeler is the only personnel with sufficient knowledge of the model to adequately question results.

Conclusion

In conclusion, creating and maintaining a valid set of assumptions for interest rate risk models can be quite daunting. Effectively managing the process
requires organization and discipline. In the past, financial institutions have been apt to shortcut the process since it was receiving so little attention from examiners. But, given the current market conditions, properly measuring and managing interest rate risk has become extremely important to the long term viability of organizations. As such, it is getting tremendous scrutiny in exams, and taking the time to have a well documented process is worth the time and effort. Below is a basic checklist for creating valid assumptions.

- Determine where assumptions are necessary, and list them
- Gather the best available data for each assumption
- Use statistics to generate the assumptions based on your data
- Create a document that explains what assumptions are used in the model, how they were calculated, and any potential weaknesses or limitations
- Review this document with ALCO and record in the minutes
- Back test the model results at least quarterly
- Back test the assumption accuracy at least annually
- Review assumptions and their accuracy with ALCO at least annually and record in minutes
- Have the model validated by a 3rd party periodically, or when the model’s accuracy breaks down

Following this list will ensure an accurately measured risk position, and will greatly simplify exams. Examiners will be able to review the assumption document as well as meeting minutes and see clear evidence of the integrity of the process. In addition, once the process is in place, management and ALCO will spend less time trying to learn and trust the model, and more time managing based on the information and insight gleaned from the model. This will allow for an improvement in risk adjusted returns that more than pays for the time used on building the initial process.

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About the author

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