

# Sample Financial Institution

## MODEL VALIDATION TEMPLATE

Model dated xx/xx/xxxx

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## **Model Validation Defined**

Computer models are abstract pictures of reality. They are used to estimate risk exposure, project future performance, analyze the cost/benefits of new strategies, and estimate the fair value of the balance sheet. Sound model practices include a model validation.

Model validation is the process used to ensure that well-grounded principles are used in formulating and evaluating risk positions, as well as, forward balance sheet projections. Model validation is achieved by structuring a detailed review of four major model components: model setup, information input, model logic, and information output.

Modeling is a complex, highly judgmental process that requires significant expertise when applying results to the decision-making process. Model validation measures the effectiveness of using the model as a tool for decision-making. The model validation provides an independent critique of this process. The independent validation promotes ongoing effectiveness of model operations and measureable results.

## **Validation Project Scope**

A model validation measures the effectiveness of the model as a tool for decision-making. It is the process used to ensure that well-grounded principles are used in formulating and evaluating risk positions, as well as, forward balance sheet projections.

Sample has engaged Fisher-Rager Consulting, Inc. (FRC) to perform a model validation. FRC is an independent advisory firm specializing in Asset/Liability Management and Modeling for financial Institutions, and has no other business ties with Sample. The model being validated was processed using data as of xx/xx/xxxx.

FRC has agreed to perform an independent validation of the logical and conceptual soundness of the outsourced model used by Sample. The validation process will be based upon the standards identified in the regulatory bulletin, OCC 2000-16 and FDIC article "Model Governance": Winter 2005 Issue of Supervisory Insights.

The validation will include a written critique on:

- a) the model layout and chart of accounts;
- b) model assumptions used and documentation;
- c) risk measurement components;
- d) sample testing model input to detailed data systems to general ledger for accuracy;
- e) the model cash flow vectors;
- f) the reporting component and its importance in the Alco process;
- g) audit oversight.

Sample has contracted for a non-parallel model validation by FRC. A non-parallel validation does not include processing Sample's data input and assumptions through a second, different modeling platform. This validation also does not include an assessment or critique of the asset/liability management process used by Sample.

Sample outsources the liquidity/rate/market risk measurement functions to XYZ Consultants. XYZ uses the ABC Model. This platform is designed specifically to measure rate and market risks.

### **The Role of the Model**

Sample uses the model specifically for measuring risks, and comparing projected risk volatility to set policy guidelines. Stress-tests are completed using eight scenarios: flat, up 100 through 400 basis points, and down 100 through 300 basis points. The shocked scenarios are controlled by Sample through XYZ. All projections are in a “flat” no growth environment. FRC considers this method appropriate for measuring rate and market risks.

The modeling process at Sample is considered basic and slowly evolving into a pure cash flow model. As liquidity management evolves, regulatory expectations will require greater attention on cash-flows from multiple rate scenarios / rate shocks. This requires more effort in developing liquidity gap analysis.

As the Sample balance sheet becomes more complex, with callable securities, long term mortgage-backed / collateralized mortgages and long term fixed rate mortgage loans, the Management and Board must make sure this model produces the required measurements for effective management. The current risk report does not include liquidity gaps for all of the scenarios. Sample can receive these reports in addition to the quarterly report and it is highly recommended that they do so.

### **Model Layout and Chart of Accounts**

The model layout has significantly improved since the first validation. The model now clearly separates accounts into fixed rate, floating rate, and adjustable rate. Net Interest Income modeling covers a 1 and 2-year forward time horizon, while market risk is measured over the life of the assets and liabilities on the balance sheet. Balance sheet growth is limited to net income generation. Cash-flows are determined using maturity/rate, average life, and prepayment data developed from Sample data files, detail investment files, and OTS prepayment assumptions.

Rate shocks are instantaneous. Rates for non-maturing deposits by rate shock are provided by Management. These rates do not ramp or parallel through the various rate scenarios when calculating net interest income. The “beta shift” does not correlate with a parallel market rate shift. The rates are defined by Sample’s Management.

### Non maturing deposit pricing xx/xx/xx

	-200	-100	FLAT	+100	+200	+300	+400
<b>NOW</b>	0.02%	0.27%	0.52%	0.77%	1.02%	1.52%	2.02%
<b>MMDA</b>	0.56%	0.56%	0.81%	1.06%	1.56%	1.81%	2.31%
<b>Savings</b>	0.13%	0.13%	0.38%	0.63%	0.88%	1.38%	1.88%

### Chart of Accounts

The model's chart of accounts correlates closely with Sample's product types. The data accumulation from data feeds & detail reports to the model is easy to follow. FRC finds the model chart of accounts to be adequate for risk measurement. It would need some adjustment if forecasting was desired.

#### Model Loans

Agriculture  
 Participations  
 HELOC  
 Balloon Mortgages }  
 15-Year Mortgages }  
 30-Year Mortgages }  
 Commercial Mortgages  
 Mortgage Other  
 Commercial  
 Mort Comm App  
 Consumer  
 Personal Loans

#### Data Feeds

Agriculture  
 Participations  
 HELOC  
 Mortgages Single Family  
  
 Commercial Mortgages  
 Mortgage Other  
 Commercial  
 Mort Comm App  
 Consumer  
 Personal Loans

#### Model Investments

Callable Agencies }  
 Non Call Agencies }  
 MBS Securities Fixed  
 MBS Adjustable  
 Collateralized Mortgage Obligations

#### Data Feeds

U.S. Government Agencies  
  
 Agency MBS Fixed  
 Agency MBS Adjustable  
 Collateralized Mortgage Obligation

#### Model Deposits

NOW Accounts  
 MMDA  
 Savings  
 Non Interest Accounts  
 Certificates

#### Data Feeds

No Feeds  
 No Feeds  
 No Feeds  
 No Feeds  
 Certificates

#### Model Borrowings

FHLB Advance  
 Convertible Advances

#### Data Feeds

No Feeds  
 No Feeds

The model setup and calculation definition is defined in an “Attributes Report”. This report should be reviewed by Alco on an annual basis to determine if any modifications are needed as a result of regulatory or operational changes.

## **Model Assumptions and Documentation**

Critical assumptions used in model development include:

1. Market Rates
2. Incremental Rate Assignment per Account/Sub-Account
3. Prepayment Speeds covering all scenarios on cash flow assets
4. Discount Rates for EVE Calculation
5. Decay Factors on Non-maturing deposits

The general mathematical assumptions used in the model are well documented within the XYZ quarterly report.

### **Market Rate Assignments**

Every interest earning/bearing account in the model has been assigned a market rate on the curve. A spread is assigned whereby the sum of the market rate +/- the spread is the Incremental Rate on new net growth per account. These assignments are defined by Sample Management and clearly displayed in the XYZ quarterly report. FRC found no issues with the market rate assignments.

### **Prepayment Tables**

Prepayments speeds were assigned from the OTS tables and are clearly identified in the quarterly report. FRC reviewed the assumptions in detail and found no issues with the speeds. Sample’s Management is encouraged to back-test loan prepayments on a quarterly basis. These back-tests should be reviewed by Alco and documented in the minutes for regulatory perusal.

### **Discount Rates**

Discount rates used in fair valuing the balance sheet are clearly defined in the quarterly report. In some cases, the Incremental Rate is used as the discount rate. This is an accepted method for fair valuing as long as the current incremental rates highly correlate to the general market versus atypical pricing at Sample.

### **Non-Maturing Deposits**

**Decay Factors** used in the model (for gap purposes only) are longer than what are typically used by FRC Clients. This assumption is critical in liquidity management and preparing accurate “sources and uses” statements as suggested by the regulators. This assumption is user defined.

**Beta Pricing** is not parallel in the rate shock analysis. This assumption is user defined and clearly indicated in the quarterly report.

**Fair-Valuing** as defined using the old OTS tables. FRC previously recommended the use of these intangible premiums.

With the merger of the Office of Thrift Supervision (OTS) into the Office of the Comptroller of Currency (OCC) as of 12/31/2011, data used to value non-maturing deposits and prepayments on loans are no longer being offered. The OCC will not continue to offer these OTS services. Sample, working closely with XYZ, must develop new methods for developing these assumptions in the future.

Effective 3/2012, FRC is recommending to its modeling clients that they use FDICIA 305 maturity distributions, discounted at FHLB (alternative funding) advance rates when valuing non-maturing deposits.

FRC has reviewed the model assumptions in detail. All assumptions are logical and consistent with present economic conditions. The decay factors being used are longer than what FRC sees elsewhere. This is an important factor that greatly affects liquidity gaps.

### **Risk Measurement Components**

When producing risk measurements, the model logic keeps all variables static except interest rates and prepayment speeds. Net interest income is calculated using beginning balances and rates, plus or minus forward projected cash flow/re-investment dollars and rates. The model fair values the balance sheet by calculating the net present value of a series of payments for each account defined in the balance sheet. Sample uses the average general product market price when determining a discount rate to be used on each of the accounts. The Economic Value of Equity (EVE) is calculated by subtracting the fair value of liabilities from the fair value of assets under the different rate scenarios. The volatility of EVE measures embedded long term risk.

The model can provide general risk indications on the following risks:

#### **Liquidity Risk**

The basic function of a cash flow model is to identify cash flow as it comes back from loan and investment portfolios or is paid out from the deposit or borrowing pools. Cash flow design must be modeled for each scenario. These cash flow patterns tend to change as interest rates rise or fall. Liquidity is measured using a "Pricing" static gap. The present report does not provide liquidity gaps, but they are available in the model.

**Sample – Liquidity Measures (xx/xx/xxxx)**

	Gap Buckets		
	3-Month	6-Month	12-Month
Assets	\$22,957	\$ 9,578	\$17,733
Liabilities	<u>\$18,371</u>	<u>\$21,293</u>	<u>\$25,192</u>
Net	\$ 4,586	(\$11,715)	(\$ 7,459)
Cumulative	\$ 4,586	(\$ 7,129)	(\$14,588)
Cumulative % Assets	2.2%	- 3.5%	- 7.2%

**Setting Policy Limits for 3 and 12-months is recommended.**

### Rate Risk

Rate Risk is measured and controlled by understanding the Net Interest Income and Net Income Volatility under varying rate scenarios. The period measured by the model for net interest income and net income covers a 1-year time horizon. When measuring NII and NI volatility, changes in projected net interest income (NII) and net income (NI) for each scenario are then compared with the base (flat) case rate scenario. This volatility is compared to policy limits at the quarterly Alco.

FRC suggests that the rate risk measurements cover at least 24-months, as suggested by many regulators. Months 13 through 24 ( Year 2) provide needed information for managing the forward balance sheet and identifying future cash flows that may materially affect Net Interest Income performance. Liquidity gaps, available through the model, could provide this valuable information.

### Earnings at Risk (Year 1)

	NII	% of Base	Policy	NI	% Base
Up 400	\$3,977	- 10.06%	-10%	-\$41	- 116.21%
Up 300	\$4,204	- 4.93%	-10%	\$109	- 56.92%
Up 200	\$4,345	- 1.74%	- 5%	\$202	- 20.16%
Up 100	\$4,445	0.52%	- 5%	\$268	5.93%
Base	\$4,422			\$253	
Dn 100	\$4,228	- 4.39%	- 5%	\$125	- 50.59%
Dn 200	\$3,857	- 12.78%	- 10%	-\$120	- 147.43%

The model is telling us that Sample is liability sensitive in most Up rate scenarios and asset sensitive in all Down rate scenarios. Net Interest Income is moderately volatile. It also shows that the asset duration is longer compared to liability duration. Sample has material asset term risk which must be managed very closely.

### Market Risk

Market Risk is measured and controlled by understanding the volatility of the Economic Value of Equity (EVE). EVE is defined as the fair value of assets minus the fair value of

liabilities. The volatility to base (flat) scenario tends to be greater the more long-term fixed rate assets we have on the balance sheet. EVE is reviewed by the Alco quarterly. Assumptions should be reviewed to ensure confidence in the measurement.

**Economic Value of Equity at Risk**

	<b>EVE</b>	<b>% of Base</b>	<b>Policy</b>	<b>EVE RATIO</b>
Up 400	\$ 3,532	- 77.61%	- 50%	1.86%
Up 300	\$ 8,238	- 47.77%	- 40%	4.20%
Up 200	\$12,078	- 23.43%	- 25%	5.97%
Up 100	\$14,858	5.81%	- 10%	7.17%
Base	\$15,774			7.48%
Dn 100	\$16,878	+ 7.00%	- 10%	7.90%
Dn 200	\$18,327	+ 16.18%	- 20%	8.52%

Based upon the EVE Ratios, the model is clearly indicating that Sample’s market risk could become a regulatory issue if interest rates rise quickly. The model is suggesting that the balance sheet does not have sufficient capital for the amount of embedded term in the balance sheet. Capital planning and proactive asset/liability management is needed to correct this important issue.

**Sample Testing Model Data**

**Data Input**

In a validation, FRC likes to reconcile the model chart of accounts back to the detail files and to the general ledger. In this validation, FRC found this task to be quite similar to the previous validation.

**Beginning balances and rates**

Beginning balance and rate information was traced from the general ledger, to the detail data files, to the model. The results are as follows:

<b>(in 000's)</b>	<b><u>Model</u></b>	<b><u>GL Trial Balance</u></b>	<b><u>Data Files + No Files</u></b>
Investments	\$ 36,236 @ 1.62%	\$ 36,236	\$ 36,236 @ 1.62%
Loans	\$158,163 @ 5.28%	\$158,163	<b>\$158,632 @ 5.27%</b>
Deposits	\$159,984 @ 2.32%	<b>\$159,981</b>	<b>\$158,697 @ 2.32%</b>

The deposit file was off by approximately \$1.2 million as compared to the general ledger. FRC encourages Sample to prepare a written reconciliation between the data files and the general ledger.

FRC traced the following detailed accounts from the model, to the GL trial balance, to the data files.

<b>(in 000's)</b>	<b><u>Model</u></b>	<b><u>GL Trial Balance</u></b>	<b><u>Data Files + No Files</u></b>
Agency Call/Non	\$ 11,491 @ 1.61%	\$11,491	\$11,491 @ 1.61%
Municipals	\$ 947 @ 2.50%	\$ 947	No Files

## Model Validation: Sample Financial Institution

Agricultural Loans	\$ 3,242 @ 4.62%	\$ 3,242	\$ 3,242 @ 4.62%
Construction Loans	\$ 1,455 @ 5.41%	\$ 1,455	\$ 1,455 @ 5.41%
HELOC	\$ 5,846 @ 3.89%	\$ 5,846	\$ 5,846 @ 3.89%
Participations	\$ 6,179 @ 4.44%	\$ 6,179	\$ 6,179 @ 4.44%
Certificates	\$ 98,431 @ 3.42%	\$98,325	\$98,433 @ 3.33%

Data input is considered to be of high quality. In general, the model chart of accounts reconciles fairly well with the general ledger and the detailed data files.

### **Cash flow Vectors**

The Sample cash flow model captures loan, investment and deposit contractual maturity information from the detailed data feeds. This information, with the addition of quality prepayment speeds, is the foundation for quality data input.

Using the Base (Flat) Scenario Re-pricing Gap Report, FRC attempted to trace cash flows on fixed rate accounts only, using maturity information derived from the data feeds and the prepayment assumptions. FRC had success in determining a correlation between the model cash flows and the assumptions. FRC was unable to reconcile cash-flows from other scenarios. Based upon the changes in NII and EVE, we are confident that the prepayment speeds are shifting in the appropriate direction in the other rate scenarios.

Currently Sample does not receive any liquidity gaps in the XYZ Report. However, the model does produce these reports. Multi scenario liquidity gaps clearly provide the Alco with necessary information on callable investments and the effect of prepayment speed changes as rates change. Sample's Management should request liquidity gaps for all rate scenarios from XYZ each quarter.

### **The Reporting Component and its Importance in the Alco Process**

#### **Model Output / Reports Provided**

The XYZ Interest Rate Risk Model report package is quite extensive and provides much useful information to a well-trained ALM Specialist. The package includes:

1. An Interest Rate Risk Profile
2. Key Assumptions
3. Rate Shock Reports
4. Market Value by Shocked Scenarios
5. Static Gap

The Report provides all of the critical information necessary to measure rate and market risks. It does not provide sufficient information to measure liquidity risk.

Based upon Sample's Alco Policy, model output is reviewed, compared with policy, and discussed at the quarterly Alco as an informational component of the meeting.

Sample has a fairly sizable callable agency portfolio. Sample's Management will better understand the effect of the call options if they request and review the liquidity gaps for all scenarios. FRC believes that the majority of the callable securities will be called at the next call date. The Static Gap does not show these securities being called.

### **The need for Audit Oversight**

The Sample Model is focused specifically on rate and market risk measurement. Audit oversight should be minimal, due to its limited purpose, but some actions are recommended.

Data integrity can only be assured through proper oversight. It is recommended that model data input be reconciled from the data feeds to the general ledger, and from the data feeds to the model, on a quarterly basis. Quality of output is in direct relation to quality of input.

Back-testing model projections to actual outcome should be completed and presented to the Alco each quarter. At a minimum, FRC recommends that Sample take the net interest income from the last month of the quarter, annualize it, and compare it to the model's forward 12-month projection.

Sample Management is doing limited back-testing of prepayment speeds. These findings should be shared with all Alco members and documented in the minutes.

### **Points for Consideration**

#### **Assumptions**

All assumptions used in the model should be approved by the Alco; after the fact approval is fine. This is an important issue with the regulators. Discount rates, prepayment speeds, pricing of non-maturing deposits, and decay factors should be reviewed and approved by the Alco on a quarterly basis. Sample has historically used OTS data for many model assumptions. With the OTS merger into the OCC, the OTS tables are no longer available for decay factors and fair valuing non maturing deposits. Sample Management must work with XYZ to replace these important elements in the model.

Sample Management has developed prepayment back-tests, as recommended by FRC in a previous validation, that quantify the actual loan prepayment speeds for each loan type identified in the model chart of accounts. With such a large mortgage exposure, prepayment speeds are critically important to Sample. Early findings suggest that actual results correlate well to the prepayment tables used.

#### **Liquidity Management**

Sample should utilize liquidity gaps from the model to clearly understand cash flow coming off the balance sheet. Alco should develop an understanding of how liquidity

changes as interest rates rise or fall from current levels. This practice should be included in the Liquidity and Contingency Funding Plan. Sample's Management is developing a liquidity management and control system. This system must incorporate the cash-flow design from the model.

### **Operational Documentation**

Sample has reached the asset size where regulators closely scrutinize all aspects of the financial institution with emphasis on risk management. Today, the outside accountants are deeply interested in fair value accounting and the methods used. The modeling process in the financial industry in general is expanding beyond risk measurement into full balance sheet forecasting. As the organization grows and becomes more complex, Management is encouraged to consider expanding modeling capabilities.

Written documentation of the entire modeling process is vitally important. This allows all parties of interest (regulators, outside accountants, auditors, board and management) to quickly conclude what is and is not being done with the model. The written document should cover operational procedures, the identification of critical personnel, including backup support, as well as, a clearly defined contingency program for emergency purposes.

FRC recommends that a written document be prepared that covers the modeling process. This document may be added as an appendix to the Asset/Liability Management Policy.

FRC recommends that a written reconciliation be prepared each quarter, reconciling the data files to the general ledger and to the model.

### **ALM Education**

FRC recommends yearly asset/liability management education for each board and Alco member.

## **Conclusion**

The ABC model continues to provide quality measurements for Sample's rate and market risks. While the model is simple and has limitations, as most models do, it can provide the basic information needed for accurate risk measurement. FRC encourages Sample Management to use the model more fully by measuring forward liquidity risk as well as concentration risk.

The accuracy of model output is in direct relation to the time and money committed to developing accurate input. Ongoing data reconciliation and back-testing will add strength to the modeling process and risk measurement integrity. With the elimination of the OTS non-maturing deposit intangible values and loan prepayment tables, Sample must work closely with XYZ to develop new assumptions for future risk measurements.

The model is currently indicating Economic Value of Equity Ratio issues in Up 200 through Up 400. FRC highly suggests that a few what-ifs be completed to determine the effect on the EVE Ratio if assumptions were modified, such as including security call options, and shortening non-maturing deposit decay factors.

Upon detailed review, FRC believes that the model is providing quality output that can be used to effectively manage and control rate and market risks.

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Ray M. Fisher  
President  
Fisher-Rager Consulting, Inc.

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Date