Non-Maturity Deposit Modeling: Leading Practices

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Presented by:
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Presentation Objectives

Non-maturity deposits (NMD) face unprecedented challenges in today’s economic, regulatory climate

• Concise review of approaches to developing appropriate NMD assumption inputs for IRR models
  • It helps to dig into the past: data mining tutorial
  • Discuss the critical mistake many A/L model users make regarding decay inputs for NMD modeling
  • Developing sound repricing and decay assumptions for institution-specific earnings and EVE analysis

Please Ask Questions!
NMD Modeling Landscape

• High anxiety over retention levels, repricing
• The surge: customer liquidity has a very low cost
• Examiners ramping up their scrutiny of IRR modeling assumptions for non-maturity deposits
• Critical for DI to make an attempt to quantify how segments of the portfolio might react to rate moves
• Use historical relationships as a guide, then model alternative assumptions on surge, deposit mix

Predicting Future Behavior of NMDs is Likely THE Most Important Component of Your IRR Model
Total Deposits, Domestically Chartered Commercial Banks ($M)

Total Deposits, Commercial Banks ($M)

Deposit Balances as % of Total Domestic Deposits
Banks $100 Million to $1 Billion Total Assets

Deposit Balances as % of Total Domestic Deposits
Banks More Than $1 Billion Total Assets

Source: FDIC SDI database.
Annual data through 2001, quarterly thereafter.
This Regulatory Guidance Does Not Mean What it Says...

8. When no growth scenarios for measuring earnings simulations are mentioned, can you clarify what no growth means?

Answer: “No growth” refers to maintaining a stable balance sheet (both size and mix) throughout the modeling horizon. Financial regulators are concerned that including asset growth in model inputs can reduce the amount of IRR identified in model outputs. For example, if model inputs predict significant loan growth occurring after a rate shock, new loans are often assumed to be made at higher interest rates. This has the effect of reducing the level of IRR identified by the model. If this assumed growth does not occur, the model would underreport actual IRR exposure.

- FDIC has clarified this guidance does allow for “no growth” IRR scenarios to incorporate changes in funding mix; crucial modeling element for NMD

Source: Interagency Guidance on Interest Rate Risk FAQ, Jan 2012
The Enigma To Modeling NMD

• Fact: a sub-market funding source contributing to long-term franchise value
  • Issue: how might the offering rate evolve as rates change. Is basis different at different rate levels?
• Fact: balance supply demonstrates rate sensitivity
  • Issues: modeling form of/cost to disintermediation, treatment of surge balances, liquidity implications
• Focus analysis on making intelligent behavioral assumptions, then stress test: prepare range estimates

Answers Will be Key Drivers to IRR Profile
Repricing: the Deposit “Beta”

- Beta: percentage of change in a market driver rate credited to the non-maturity deposit offering rate
  - Beta = 0: coupon unchanged. NMD duration approximates that of a fixed rate bond
  - Beta ≈ 0.5: coupon becomes flexi-fixed, duration falls
  - Beta = 1: near-floating coupon, duration is low

**EV Profile of 0.20% NMD, 10-Year Bullet Maturity**
Why NMDs are so Valuable

• Offering rate betas imply that some or all of the deposit acts as a fixed-rate source of funding
  • Assume MMDA rate beta is 40%: interest expense is as though the product is split into two pieces
    • 40% of the volume floats 100% with market rates
    • 60% of the volume is fixed rate
Deposit Repricing Decision Drivers

• ALCO's past course of rate setting
  • Some product categories show low rate sensitivity, while premium-priced deposits have high betas

• The institution's need for liquidity
  • Premium pricing core products may be advantageous
  • Rising market rates can pressure funding liquidity

• Competitive pressures

• Balance supply response to administered pricing
All Banks, National Data
Betas May Vary Based on Magnitude of Rate Changes

Median Full Phase Beta (1Q04 - 3Q06) = 26%
CU Deposit Rates Show Correlation With Short-Term Market Interest Rates

Source: NCUA Economic Update Video, December 2015
Repricing Betas Are Not Constant
CU MMDA Betas March 2004 - September 2006

Full Phase Beta (1Q04 - 3Q06) = 44%
Modeling Multi-Beta Repricing of Non-Maturity Deposit Offering Rates

- Define how deposit rate change as market rate move
- Single up/down rate betas insufficient if NMD pricing sensitivity varies as market rates change; lags possible
- Result is a non-linear function describing what rates DI expects to pay as index rate changes

* Beta is speed to Required Rate Response.

<table>
<thead>
<tr>
<th>Index Rate Chg (bp)</th>
<th>Product Rate Chg (bp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-50.00</td>
<td>-20.00</td>
</tr>
<tr>
<td>-25.00</td>
<td>-15.00</td>
</tr>
<tr>
<td>0.00</td>
<td>0.00</td>
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<td>55.00</td>
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<tr>
<td>200.00</td>
<td>80.00</td>
</tr>
<tr>
<td>300.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Base Forward Rate

- \( T_0 = 0.50 \)
- \( T_1 = 0.75 \)
- \( T_2 = 1.00 \)
- \( T_3 = 0.80 \)
- \( T_4 = 2.00 \)
- \( T_5 = 0.50 \)
- \( T_6 = 0.25 \)

Product Rate Table

<table>
<thead>
<tr>
<th>Product Rate From RR Table</th>
<th>Required RR (bp)</th>
<th>Beta-Adjusted RR (bp)</th>
<th>Deposit Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.8500</td>
<td>10.00</td>
<td>5.00</td>
<td>0.7500</td>
</tr>
<tr>
<td>1.0000</td>
<td>20.00</td>
<td>10.00</td>
<td>0.9000</td>
</tr>
<tr>
<td>0.8800</td>
<td>-2.00</td>
<td>-1.60</td>
<td>0.8840</td>
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<tr>
<td>1.4250</td>
<td>54.10</td>
<td>27.05</td>
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<td>0.7500</td>
<td>-40.45</td>
<td>-32.36</td>
<td>0.8309</td>
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<tr>
<td>0.6000</td>
<td>-23.09</td>
<td>-18.47</td>
<td>0.6462</td>
</tr>
</tbody>
</table>

* Beta is speed to Required Rate Response.
NMD Betas Struggle in Stochastic Valuation, Historical Simulation

- Repricing lags can result in illogical NMD coupons along a volatile MC rate path, even cause product rates to cross
NMD Product Rates Get Crossed

• Assume +1200bp rate shock, both products on same multi-beta table; tier 2 product has more aggressive down beta, prices relatively lower on the down slope
NMD Balances at Commercial Banks Exhibit Measurable Interest Rate Elasticity

Source: FRB H6, H15. Data through 12-31-2015
Major Share Product Groups

Historical Trends in Dollar Balances

Source: NCUA 5300 Reports.

CUS $100 Million to $1 Billion in total assets
Cage Match: The NMD “Maturity Wrestle”

• NMD average lives are **LONG**
  • Supplied balances are stable despite wide offering rate spreads across time, rate scenarios

• NMD average lives are **SHORT**
  • Depositor sophistication – if market rates rise, some rate-sensitive balances migrate to higher cost funds

• NMD economic profit (in all shifts) is **ZERO**
  • Assumes 100% exercise of overnight liquidity put; insurance fund pays out book value in liquidation, not EV

**Required: Assume Some Ultimate (Term) Repricing Profile for NMD Balances**
NMD Existing Balances Decay

- Direct approach: track individual account opening and closing dates: compute true “attrition” rate

  - Hold age constant: accounts in the age group are changing
  - Acquired accounts need to be tracked separately
  - Per FDIC, simply tracking account openings and closings is insufficient because changes in dollar volumes are not addressed

<table>
<thead>
<tr>
<th>Age</th>
<th># of Accts</th>
<th># of Accts</th>
<th>Age</th>
<th># of Accts</th>
<th># of Accts</th>
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<tr>
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<tr>
<td>Total</td>
<td>1000</td>
<td>990</td>
<td></td>
<td>1100</td>
<td>1082</td>
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</table>

Attrition Rate: 1.0% 1.6%
Attrition Rates
Personal MMDA, Age-Constant Vintages

<table>
<thead>
<tr>
<th>Age</th>
<th>Current Factor</th>
<th>Recent Trends</th>
</tr>
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<tr>
<td>12-23 Mths</td>
<td>2.62</td>
<td>Current 2.41</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Last 3 Mths 2.57</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Last 12 Mths 2.79</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Last 24 Mths 2.66</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age</th>
<th>Current Factor</th>
<th>Recent Trends</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 Mths +</td>
<td>1.61</td>
<td>Current 1.16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Last 3 Mths 0.91</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Last 12 Mths 1.18</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Last 24 Mths 1.41</td>
</tr>
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</table>
Balance Decay is a Second Pricing Process
Coupon = 0.50%, Vintage Attrition Decay, 5-Yr Final

- For EVE, balance decay results in a sloped repricing beta
- Cannibalization of NMD into time deposits is not captured
Vintage Runoff Methodology

• Segregate balances by opening date; read balance change of cohort over time to closure date as “decay”

• Consider drawbacks to this static pool method:
  • Vintage balances may grow over time, not erode
  • Lots of data is not used (originations before vintage date)
  • Data in vintages may be sparse
  • Methodology usually excludes rates as a risk factor
  • Results between cohorts likely unstable year to year
  • Mixes closure rates with balance management

We Don't Care About Accounts,
We Care About Balance Supply
Leading Practice Approach: Track Balances at Account/Product Level

• Objective is to estimate how deposit balances might change with deposit rates and market rates
  • Not every high-tier MM deposit is rate sensitive; need customer's total balances with the institution

• Data: balances, rate paid, time on books (new accts)
  • Decay rate = Run-off ÷ Product category total

• Adjust for qualitative factors
  • Depositor response to regained confidence in economy
  • Competitive environment for the institution
  • Changing demographics, product technology, etc.
## Deposit Balance Management Analysis

<table>
<thead>
<tr>
<th>Date</th>
<th>FF$eff</th>
<th>Regular Shares</th>
<th>MMS</th>
<th>Total Certs</th>
<th>Total Shares and Deposits</th>
<th>Decay Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>31-Mar-04</td>
<td>1.00%</td>
<td>89,904,341</td>
<td>52,435,498</td>
<td>60,900,994</td>
<td>263,487,128</td>
<td>-3% -3% 1%</td>
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<tr>
<td>30-Jun-04</td>
<td>1.26%</td>
<td>91,320,043</td>
<td>53,031,662</td>
<td>60,505,326</td>
<td>265,483,356</td>
<td>-3% -5% 9%</td>
</tr>
<tr>
<td>30-Sep-04</td>
<td>1.76%</td>
<td>90,396,412</td>
<td>51,956,417</td>
<td>61,087,944</td>
<td>263,795,789</td>
<td>-3% -7% 19%</td>
</tr>
<tr>
<td>31-Dec-04</td>
<td>2.28%</td>
<td>88,534,349</td>
<td>51,230,192</td>
<td>61,769,000</td>
<td>262,794,805</td>
<td>-3% -9% 30%</td>
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<tr>
<td>31-Mar-05</td>
<td>2.79%</td>
<td>90,921,622</td>
<td>50,482,027</td>
<td>63,485,579</td>
<td>267,353,240</td>
<td>-3% -11% 46%</td>
</tr>
<tr>
<td>30-Jun-05</td>
<td>3.26%</td>
<td>89,856,146</td>
<td>49,559,143</td>
<td>66,496,292</td>
<td>268,135,273</td>
<td>-3% -13% 60%</td>
</tr>
<tr>
<td>30-Sep-05</td>
<td>3.78%</td>
<td>87,667,936</td>
<td>48,193,437</td>
<td>69,227,096</td>
<td>268,695,625</td>
<td>-3% -15% 65%</td>
</tr>
<tr>
<td>31-Dec-05</td>
<td>4.29%</td>
<td>85,959,145</td>
<td>47,408,154</td>
<td>72,471,192</td>
<td>269,595,058</td>
<td>-3% -17% 70%</td>
</tr>
<tr>
<td>31-Mar-06</td>
<td>4.79%</td>
<td>87,841,545</td>
<td>47,229,999</td>
<td>75,855,869</td>
<td>276,734,455</td>
<td>-3% -19% 80%</td>
</tr>
<tr>
<td>30-Jun-06</td>
<td>5.24%</td>
<td>84,998,692</td>
<td>46,932,081</td>
<td>79,471,958</td>
<td>275,894,919</td>
<td>-3% -21% 90%</td>
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<tr>
<td>30-Sep-06</td>
<td>5.25%</td>
<td>81,146,082</td>
<td>46,230,105</td>
<td>84,055,711</td>
<td>275,060,920</td>
<td>-3% -23% 100%</td>
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<tr>
<td>31-Dec-06</td>
<td>5.25%</td>
<td>75,436,365</td>
<td>46,338,170</td>
<td>89,004,910</td>
<td>274,688,544</td>
<td>-3% -25% 110%</td>
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<tr>
<td>31-Mar-07</td>
<td>5.25%</td>
<td>76,844,498</td>
<td>47,498,485</td>
<td>90,998,556</td>
<td>281,601,487</td>
<td>-3% -27% 120%</td>
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<tr>
<td>30-Jun-07</td>
<td>5.26%</td>
<td>75,569,538</td>
<td>48,557,802</td>
<td>93,424,086</td>
<td>283,817,151</td>
<td>-3% -29% 130%</td>
</tr>
<tr>
<td>30-Sep-07</td>
<td>4.76%</td>
<td>71,698,539</td>
<td>48,071,632</td>
<td>95,396,660</td>
<td>280,178,098</td>
<td>-3% -31% 140%</td>
</tr>
<tr>
<td>31-Dec-07</td>
<td>3.94%</td>
<td>69,606,021</td>
<td>48,169,983</td>
<td>97,521,172</td>
<td>279,678,898</td>
<td>-3% -33% 150%</td>
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<tr>
<td>31-Mar-08</td>
<td>2.28%</td>
<td>73,507,963</td>
<td>51,020,955</td>
<td>102,132,617</td>
<td>293,921,092</td>
<td>-3% -35% 160%</td>
</tr>
</tbody>
</table>

**Balance Change**

<table>
<thead>
<tr>
<th></th>
<th>(20,298,321)</th>
<th>(4,265,515)</th>
<th>36,620,179</th>
<th>16,191,771</th>
</tr>
</thead>
</table>

Great Recession Starts Dec2007 - Jun2009
Treatment of NMD Repricing / Balance Supply in NI Simulation

- Balance management reflects behavior of principal disintermediating into market-priced funding

- Modelers often inject a serious disconnect when simulating NMD balances for EVE versus NI
  - Industry common view is NMD average lives are solely associated with EVE analysis – mistake!
  - “Flat” balance sheet for NI short-circuits decay when simulated replacement volume coupon rate is set same as the current offering rate

- This modeling “error” misstates NI sensitivity
  - Major source of divergence for NI and EVE results
Identifying Surge Balances
Seasonally-Adjusted Linear Regression

Institution-specific regular shares history, pulled from NCUA 5300 Reports.
Cash Flow to Taxable Retail Money Market Funds is Related to Rate Spread

2009-2010 net new cash outflow from retail MMFs was $432 billion

Download an Excel file of this data.

1 Net new cash flow is the percentage of previous month-end taxable retail money market fund assets, plotted as a six-month moving average.

2 The interest rate spread is the difference between the taxable retail money market fund yield and the average interest rate on money market deposit accounts.

Sources: Investment Company Institute, iMoneyNet, and Bank Rate Monitor
Early Withdrawal Risk – Time Deposits
Remaining Maturity or Repricing Frequency

- Factors to early withdrawal behavior include remaining maturity, new volume rate spread, dollar penalty
- Low coupon dispersion in current bank CD portfolios
- Run sensitivity analysis on various early withdrawal rates

Source: FDIC SDI database
All Commercial Banks $100M to $1B

Time Deposits/Total Deposits = 47.9%
Time Deposits/Total Deposits = 28.7%
Breakeven Rates To Cover Simple Interest Early Withdrawal Penalty

- CDs are priced competitively in many markets
- Incentive to break can be high, since new CD rates may need rise only 25bp to recoup 6-month early withdrawal interest penalty
Summary Thoughts

• NMD assumptions must be properly understood, correctly set up in system and then stress-tested
  • Avoid reliance on external proxies like industry estimates
• Model customers: balance management is next gen
• Managing liability stability will be crucial in the first +200bp; use sensitivity testing to establish what betas you can afford given asset repricing
• Integrate NMD supply factors into NI simulation: capture in shocked earnings the COF impact from expected shift in funding mix towards time deposits