Global Research
& Risk Solutions

CRISIL
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Modeling short-term bank deposits

In a post-Silicon Valley Bank, Signature Bank world

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When NMD management unravels

Traditional banking business models rely on creating short-term liabilities via deposits and funding, and investing in long-term assets to make profits.

The Silicon Valley Bank (SVB) was no different. What mattered most was a strong, robust asset and liability management (ALM) framework that manages the risks emanating from dynamic interest rate environments, fluctuating deposit volumes, and changing investment profiles.

The collapse of SVB and other regional banks such as Signature highlights how porous risk-management processes and weak modeling, especially for non-maturity deposits (NMDs), can wreak destruction.

This whitepaper discusses the key elements of interest rate risk in banking book (IRRBB), best practices in ALM, and regulatory expectations for the banking industry, specifically in the context of non-maturing deposits (NMDs).

NMDs are a key source of funding for banks that must be dealt with at a granular level, from a risk-management perspective. As NMDs can be withdrawn at any time, banks must carefully manage their liquidity to address depositors' demands.

Categorisation, classification, and structure

The primary identification and classification of deposits into 'wholesale' and 'retail' are important for risk modeling and monitoring. This is largely because banks typically use different funding strategies for wholesale and retail deposits. For instance, banks rely heavily on wholesale funding for short-term liquidity and retail deposits for long-term funding.

Wholesale deposits are typically larger and more volatile, and have a larger impact on a bank's liquidity and funding costs as they are typically more sensitive (higher deposit beta) to interest rate changes.

Retail deposits are further split into transactional and non-transactional deposits. Based on historical data (typically more than 10 years), banks can distinguish between stable and non-stable NMDs. A stable NMD is defined as a portion that remains undrawn, with a higher degree of likelihood of being drawn. Core deposits are the portion of stable NMDs that are unlikely to reprice even if there are significant changes in interest rates, and thus have lower deposit beta.

IRRBB measures that capture inherent risk

The Basel Committee for Banking Supervision (BCBS) has provided guidelines to enhance control framework for managing IRRBB, which is getting increased attention from regional regulators as they revise their respective prudential standards. In line with BCBS recommendations, The asset-liability management committee (ALCO) in a bank is required to have a strong oversight on policies, procedures, assumptions, and risk-mitigation plans. The treasury typically calculates the net interest income (NII) and economic value of equity (EVE).

Net Interest Income (NII) — the difference between interest received from asset and interest paid to liabilities

Economic Value of Equity (EVE) — the difference between present value of all asset cash inflows and the present value of all liability cash outflows

Stress testing interest rate risks is the key and for this, BCBS recommends that banks apply six prescribed interest rate shock scenarios to measure IRRBB risk:

- Parallel shock up
- Parallel shock down
- Steepener shock (short rates down and long rates up)
- Flattener shock (short rates up and long rates down)
- Short rates shock up
- Short rates shock down

Changes in interest rates impact the present value and timing of future cash flows, thereby affecting the underlying value of the NMDs and their EVE. Changes in interest rates also impact banks' earnings by changing interest rate expenses, thereby affecting the NII of NMDs.

The BCBS has identified three risk sub-types within IRRBB: gap, basis and option

Gap risk	Gap risk arises from the term structure of instruments. It exists because rate resets occur at different tenors for these instruments, and there is a risk to the bank when the rate of interest paid on liabilities increases before the rate of interest received on the liabilities.
Basis risk	Basis risk arises due to interest rate changes for instruments with similar tenors but priced in different indices. Option risk arises due to the elements embedded within a bank's assets and liabilities, where the bank or its customers can alter the timing of cash flows.
Option risk	Optional risk is a major concern within the NMD portfolio due to the potential impact of depositors exercising their rights to withdraw their investments due to the underlying economic environment.

The BCBS guidelines states that banks should consider the following dimensions that can influence exercising the behavior options within the NMD portfolio:

Responsiveness of product rates to changes in market interest rates	Current level of interest rates
Spread between the bank's offer rate and market rate	Competitive situation and competitive forces
Geographic characteristics	Demographic characteristics

Although several metrics converge on interest rate risk management between the Federal Reserve (Fed) in the US and the Prudential Regulatory Authority (PRA) in the UK (since they both draw from BCBS), there are differences in how the two regulators treat interest rate risk management:

Interest Rate risk treatment	US regulatory treatment	UK regulatory treatment
Framework	Regulatory guidance issue by Office of the Comptroller of the Currency (OCC) and Federal Deposit Insurance Corporation (FDIC) for banks to assess and manage their exposure to interest rate risk in the banking book.	EBA and Prudential Regulation Authority (PRA) has set out elaborate IRRBB framework to report key metrics NII and EVE and governance frameworks to be mandatorily followed.
Reporting requirements	Banks should report these metrics as part of the Consolidated Reports of Condition and Income (Call Reports) or CCAR submissions.	Banks required to report NII and EVE using (Common Reporting) COREP templates

Modeling for NMDs

Key inputs for calculation of IRRBB metrics

Inputs	Description
Deposit balances	The total amount of balances held by the bank at any given point in time
Maturity	The time until deposits are paid back to customers
Deposit rates	The interest rates paid on deposits to customers
Deposit rate elasticity (DRE)	Sensitivity of deposit flows to changes in deposit interest rates
Discount rate	The rate used to calculate the present value of future cash flows, including interest payments on deposits
Customer rate lag	The number of periods between a change in the market rate and the corresponding change in deposit rates.
Market data scenarios	The interest rate scenarios under which the IRRBB metrics are to be forecast or simulated.

It is imperative for banks to prepare these inputs at the right level of granularity — in preparation of developing risk-models. Treasury ALM team in G-SIBs monitor delta net interest income (ΔNII) and delta economic value of equity (ΔEVE) for NMDs based on a five-stage modeling framework.

Step 1
Product segmentation (based on their contractual features and calculation of DRE)

Step 2
Behavioral characteristics and overlays

Step 3
Calculation of ΔNII and ΔEVE

Step 4
Implementation

Step 5
Use cases

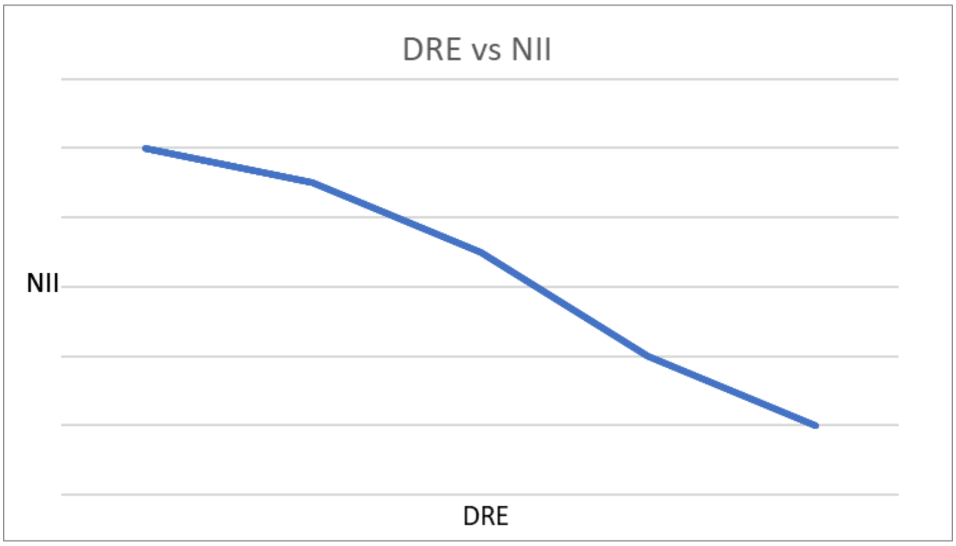
NMDs are classified based on contractual features i.e., fixed, or floating and the DRE is calculated. The DRE measures sensitivity of deposit flows to changes in deposit interest rate. If a bank's DRE is high, then depositors are more sensitive to changes in interest rates, and they are more likely to shift their funds to other banks or alternate investments, which will result in a decrease in the bank's deposit base.

Impact of DRE on NII

The impact of DRE on NII is significant. If a bank's DRE is high, it must increase deposit rates more than it would generally like to, to retain customers, which in turn will increase funding costs and lower the NII. Conversely, if interest rate falls, the bank should lower the deposit rates to reduce funding costs and increase NII.

Competitive forces thus shape a bank's ability to set funding rates, and hence there is a need to carefully manage deposit rates and monitor DRE to optimise NII.

Indicative impact of increasing DRE on Bank NII, based on CRISIL's implementation for a leading bank

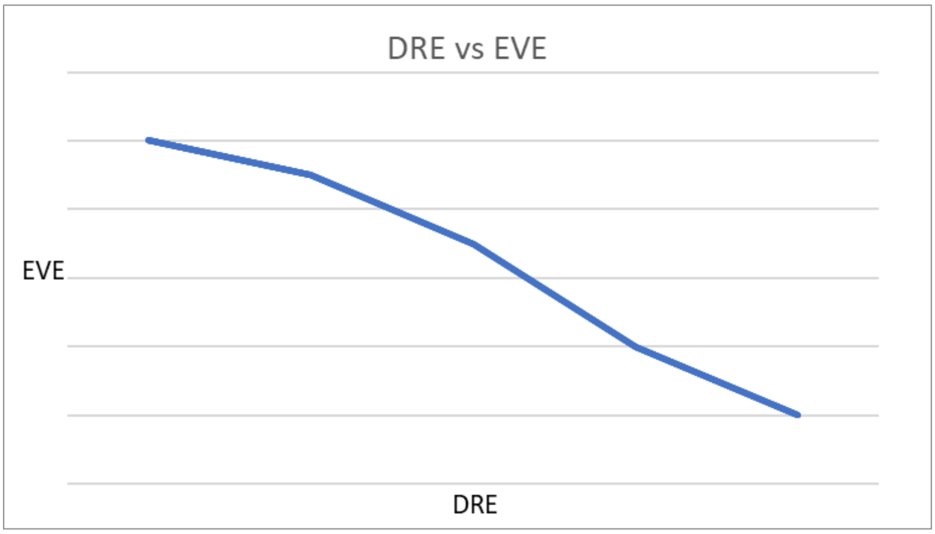


Impact of DRE on EVE

Changes in interest rate also have a significant impact on a bank's EVE. If the DRE is high, even a small change in interest rate can lead to significant changes in the quantum of deposits held by the bank, which will ultimately affect the bank's EVE. In addition to customers' behavioral factors, the impact on EVE depends on several factors such as the bank's balance sheet structure, interest rate volatility, and the duration of deposits.

The next part of the modeling framework requires the creation of a replicating portfolio. In case of NMDs, the replicating portfolio can be created using interest rate-sensitive assets (such as bonds) and interest rate-sensitive liabilities (such as loans). As a precursor, the expected deposit balances, the interest rates that will be paid on deposits, and the expected deposit behavior need to be estimated. The replicating portfolio approach can help banks manage the interest rate risk associated with NMDs by providing a hedge against changes in interest rates.

Indicative impact of increasing DRE on bank EVE, based on CRISIL's implementation for a leading bank



Incorporating the impact of behavioral aspects

Deposits behavioral modeling involves predicting depositor behavior, such as deposit run-offs. To build an effective deposit model, a combination of internal and external factors should be considered, and regression techniques are typically used to model depositor behavior. Most common inputs and regression techniques used in deposit behavioral modeling include:

Inputs

- **Demographic data:** Age, gender, income, education level
- **Historical deposit data:** Deposit amounts, frequency, duration
- **Product data:** Type of deposit products used, interest rates, fees
- **Economic data:** Interest rates, inflation rates, GDP growth
- **Competitor data:** Interest rates, marketing strategies, product offerings

The choice of modeling technique depends on the specific objectives of the bank's deposits modeling efforts and data constraints.

Technique	Effective when	Important considerations
Logistic regression	Most popular technique used in deposit behavioral modeling for the objective of predicting the likelihood of depositor actions, such as opening a new deposit account, making a deposit, and withdrawing a deposit account.	For this technique to be effective, it is critical that customer data should be accurate, complete, and representative of the target population.
Time series analysis	Most effective for modeling trends and patterns in deposit behavior over time; especially useful to identify seasonal or cyclical patterns in deposit behavior and to predict future deposit trends.	Requires data from multiple sources with a large sample size to build a comprehensive time series model and use of statistical techniques to fill in missing data or outliers to account for model bias.
Linear regression	Less popular choice for deposit modeling because it cannot capture non-linear effects like time series models.	It can be particularly useful for identifying potential outliers or influential observations that may have a significant impact on deposit behavior. Or, for instance, to examine one-to-one relationships between interest rates and deposit flows.
Cluster analysis	Deployed to identify segments of depositors with similar behaviors. The dataset of each segment of customers is utilised to model the behavior of depositor actions.	Depending on the complexity of dataset and size, clustering requires sufficient computational resources and high-quality data representative of the relevant features of deposits.

Calculation of ΔNII and ΔEVE

The calculation of ΔNII and ΔEVE can be implemented in third-party ALM tools such as QRM, SunGard, Misys, and IBM. In our experience, there have been notable challenges while using third-party systems, and most of them are linked to a less flexible, rigid implementation that leaves little room for accommodating bank-specific nuances.

The computations can also be implemented in an in-house risk-calculation engine

ΔNII is used in the following submissions:

- Pillar 2 reporting
- Pillar 3 disclosures, which include NII sensitivity
- Internal and regulatory stress tests
- NII forecasting

ΔEVE is used for several purposes, including:

- Internal and regulatory stress tests
- Pillar 2 reporting
- Pillar 3 disclosures
- Economic capital
- MI and reporting

Notable challenges in implementing ΔNII and ΔEVE modeling frameworks

In our experience of working with several large and regional banks in the US, the UK and the EU, we have come across themes that either significantly delay or create a weak implementation of modeling frameworks in banks. We highlight a few of them below:

- Unavailability of key data inputs for modeling — missing granularity, standardisation and pre-processing across portfolios and legal entities
- Ineffective ALCO — In banks where implementation was weak, ΔNII and ΔEVE were viewed as compliance metrics, and no decisions were directly linked to them
- Inadequate management attention and bandwidth

Conclusion

Calculating NII and EVE is key to not only efficient risk management, but also for the effective survival of a bank, as evidenced by the collapse of SVB and other banks. It is time that management and Boards of banks pay adequate attention and provide sufficient resources to upgrade risk frameworks to implement ΔNII and ΔEVE calculation frameworks.

The frameworks have been implemented in larger banks, and significant learnings from those can be drawn to ensure that the upgraded framework is effective and efficient. In addition, without a strong management will to accept these metrics in business management, any amount of modeling and/or risk-framework implementation will be inadequate.

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