it includes all non-core liabilities, regardless of their maturity. As such, you could have a five-year brokered CD, or even a 10-year non-callable FHLB borrowing, and the ratio would consider both to be *non-core* funding sources. You should certainly be aware of when such liabilities mature, and consider that in your assessment of funding risk. However, automatically considering them to be non-core funding sources, and then by default, liabilities that increase funding risk, is short-sighted and inappropriate. Under this definition, you could use a five-year non-callable FHLB advance to match fund a 5-year FHLB bond, and the ratio would indicate you increased your funding risk.

- **Third, the ratio only includes investments with maturities less than a year.** This is perhaps the most egregious weakness of the NNCFD Ratio. As we just pointed out, the ratio definition considers the noted liability categories, regardless of their maturities, to be non-core. However, it only measures the extent to which investments maturing in less than one year cover all non-core funding sources, regardless of their maturities, as just discussed in the second point. As such, the ratio would not give you credit for a Treasury note maturing in 366 days, but one maturing in 364 days would be included. It would seem far more appropriate to include any unencumbered marketable security at its market value. That is, why should maturity have any relevance if it could be sold or pledged to get cash to pay off a maturing non-core liability?
- **Fourth, the ratio ignores pledging.** All short-term investments are included, regardless of if they are pledged. So, going back to our example in the third point, you could have a security maturing in 364 days that is fully pledged, and the ratio would consider it as an offset to the non-core liabilities. However, a completely unencumbered bond, not pledged, maturing in 366 days would be excluded from the calculation. This is due to the fact that it matures in more than one year.
- **Fifth, the ratio fails to include many liabilities that are, in fact, volatile in nature, which actually understates risk in many cases.** Examples of liabilities not included as non-core by definition are internet/listing service CDs under $250,000 and high-rate deposits under $250,000. In many cases, these CDs are certainly *rate-driven* and likely to leave the institution if competitive rates are not paid. As such, it would appear that these deposit are non-core by nature, and in turn, increase funding risk.

Conclusion

Using ratios to assess risk and measure performance is something that will never go away. However, it's critical to understand how the ratios are calculated and what they're intended to measure. Clearly, the Net Non-core Funding Dependence Ratio is archaic and nearly meaningless in evaluating liquidity. Conversely, the Liquidity Ratio itself remains a good barometer of funding risk, but it certainly does not tell the whole story. In next month's *Bank Asset Liability Management Newsletter*, we'll move on to analyzing cash flow modeling and the newest liquidity metrics being used frequently at regulatory examinations.

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On Attrition Measurement and Customer Balances

Our careful analyses of our clients' deposit databases have led to some robust conclusions regarding the use of product and customer based attrition analyses as a proxy measure of the liquidity of commercial banks. These conclusions are best illustrated with the results from one of our client banks depicted in Figure 1 on page 4.

Figure 1 contains three lines. The lower (blue) line is a calculation of attrition associated with the total deposit accounts in the clients' historical deposit data. The database contained over seven years of monthly data, through June 2018, and includes time deposits as well non-maturity deposits. Total accounts at any calculation period starting time are *locked* and no new accounts are added. The accounts surviving at the end of any subsequent period are reported as a proportion of the starting account population. The line traces the average of the calculations over many different periods; the variance is quite small. It takes the form close to a *geometric decay* function, which is typical in an attrition analyses performed using this methodology.

The middle (red) line represents the attrition of customers and is calculated in a similar manner. We were able to make this calculation because the database included a field showing customer IDs for all depositors. We aggregated accounts by customer and discovered that a small but meaningful proportion of bank customers holding multiple accounts will, with some regularity[1], transfer funds within the bank and close one, or more accounts. Failure to measure and capture this internal transfer effect results in a calculation that understates liquidity and under-values

the depositor relationship.

The observation that depositors with multiple accounts occasionally close one of their accounts is consistent with what we've all observed throughout the industry. Banks have successfully marketed multiple accounts to their depositors and made the movement of funds between accounts virtually costless. Depositors have responded accordingly and, for their own reasons, close one of their multiple accounts. In the data we have reviewed, typically about half of the depositors have at least two accounts. In addition, we have observed that most banks have depositors that exhibit consistent types of behaviors described here. However, their mix of depositors by type and length of relationship may vary materially, which in turn, impacts the overall attrition rates.

What About Deposit Balances?

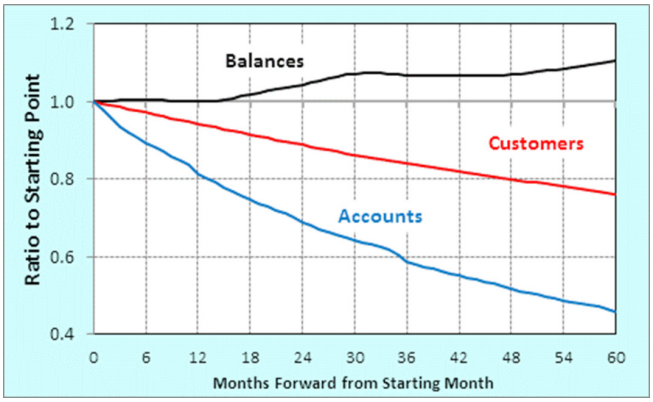
In the many attrition studies we have performed over the past decade, we have observed a relatively consistent pattern: when **product balances** are stratified by account age cohorts, there are many cohorts in which balances grew at a faster rate than accounts were being closed.

Others working in this area[2] have confirmed that they have also observed this empirical result, which conflicts with the analysis and reporting framework mandated by the regulators. Some analysts have resorted to grouping cohorts differently to avoid a *reversal* in the calculated attrition rate; and/or resort to account attrition rates rather than balances in their attrition analyses.

So what conclusion does the data from our example bank support? As the upper (black) line in Figure 1 demonstrates, when customer balances are taken into account, total deposit balances over long periods are growing faster than customers are leaving the bank. As the variance between the premise of decline in balances and the empirical observation of growth of balances widens over time, we need to caveat it (to explain it away). First, household and personal customers' behaviors may be different than commercial and municipal depositors. Second, a recession that raises bankruptcy rates may trigger a different pattern[3].

The observation that balances of existing (retained) customers have been increasing rather than decreasing over the period analyzed requires further discussion, as it challenges commonly observed measures of bank liquidity and what is meant by the word *attrition.* To the extent an individual bank's customer base is adding balances to their accounts faster than the customers are leaving the bank, computations of economic value of equity, core deposit intangibles, fund transfer prices, and RAROC may be underestimating – potentially significantly – the maturity and the valuation of the depositor relationship.

Figure 1: Calculated Attrition Curves Employing Different Methodologies



We illustrate this conclusion with a simple example of the present value of the cash flows and the duration of deposit balances associated with a 100 dollar checking account, depicted in Figure 2 on page 5.

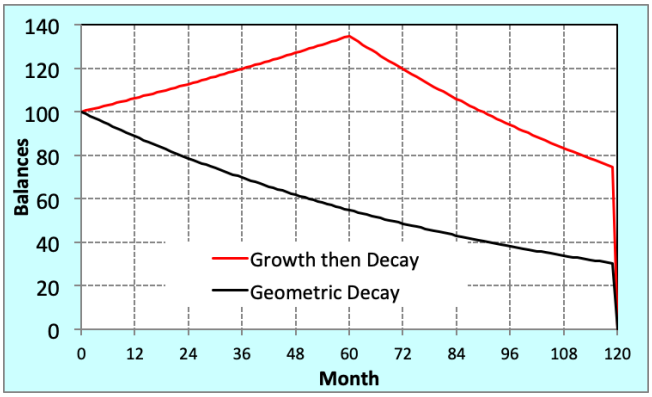
Our first calculation assumes that balances decay, i.e., exit the bank, at the rate of one percent per month. They disappear in month 120. The second simulation assumes balances grow at one-half percent per month for five years and then decay at one percent per month until month 120. Present values of cash flows are discounted at two percent in order to calculate a base valuation period. The discount rates are then shocked one hundred basis points in order to calculate duration. Both are reported in Table 1 below and are meant to be illustrative of the importance of taking into account customer balance behaviors in some of the many calculations employed in the industry.

Table 1:
Present Value and Duration Calculation of Alternative Balance Decay Rates

Calculation	Simulation	
	Constant Decay	Growth followed by Decay
Present Value	89.2	80.2
Duration	5.4	10.7

It should be obvious to the reader that the differences in the present values and duration estimates reported in Table 1 are sensitive to: a) differences in the attrition and growth rates; b) the length of the period utilized for the comparison; and c) the rate adjustment assumptions incorporated in rate

Figure 2: Illustrative Balance Runoff Assumptions



paying deposits. However calculated, the financial math is robust and supports the conclusion that material differences exist between depositor-level measures of actual balances maintained by existing customers and the inferred, but incorrect, assumptions of loss of balances calculated by account attrition. The differences will lead to significant variance in valuations of core deposits, in the maturity assumptions incorporated in EVE calculations, and in schedules utilized in the conduct of FTP and RAROC analyses.

What Does This Analysis Tell Us About Liquidity Risk Regulations?

More accurate definitions and measures of deposit attrition have implications for the various liquidity risk regulations established since the financial crisis. Two sets of liquidity risk regulations are of interest. The fist includes the Liquidity Coverage Ratio (LCR) and proposed Net Stable Funding Ratio (NSFR), which were introduced with the Basel III standards. The second set includes response to the Enhanced Prudential Standards for liquidity stress testing (LST) that arise from the Dodd-Frank Act.

A robust customer-based measure of attrition calls into question the underlying the LCR run-off factors. Largely, the LCR and NSFR treatment of deposits is product-centric. All non-maturity deposits that fall into a given category, e.g. stable deposits, are given a single run-off rate under both the LCR and the stable financing rate under the NSFR. The intent underlying the mandate to calculate these ratios is to provide regulators and market participants with comparability – a standardized view of stressed liquidity for all covered banks. In pursuit of this common standard valuable customer level attrition data is set aside.

To compensate, the LCR and NSFR do attempt, indirectly, to factor in the stability afforded by customer relationships. Historical customer data can be used to assign deposits into categories that have lower run-offs. For example, a customer with multiple products may have his or her deposits classified as stable, rather than less stable deposits. An analogous assessment exists for commercial deposits, which can be classified as operational or non-operational.

However, since historical customer behavior only affects the classification of deposits, and not their run-off factors, the LCR and NSFR do not take into account the full set of available information that drives liquidity risk associated with deposits. Ultimately, the LCR/NSFR factors afforded to each category are prescriptive, are extremely severe or conservative, and are set at levels above those observed even during the financial crisis. This approach was selected, largely, to avoid the several challenges in encounters while developing a standardized modeling approach.

Rather than opine on modeling methodologies, the U.S. regulatory authorities are, as of this writing, adjusting and tiering banking regulations, based on the size and complexity of covered institutions. This affords bank management an opportunity to influence future liquidity regulations to bring them into alignment with the deeper and more fundamental estimates of attrition based on analyses of the behavior of those who control balances: namely customers.

The second set of liquidity risk regulations, Dodd-Frank internal liquidity stress tests, presents another, even greater, opportunity for bank management to work with regulators to refine liquidity risk management guidelines. For LST models, Banks have far more flexibility in defining sources and use of funds and their behaviors under stress. This put the onus on bank management to ensure their approaches are conceptually and empirically sound. Initially, bank management converged on product-centric liquidity assumptions when building these stress scenarios. The result is that internal LST models, and similarly, recovery and resolution planning models, and not the LCR, are the binding liquidity constraints for large banks. Therefore, by adopting customer level attrition analysis, LST scenarios can evolve to more accurately estimate the required levels of liquid buffer assets.

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Notes

[1] This is true whether we are including time deposits or not. Customers that roll time deposits are not counted as closed accounts because their account number is not changed.

[2] This includes clients and other vendors.

[3] Unfortunately our customer ID history only begins after the Great Recession.