

Cash Flows

A Building Block of ALM Forecasts

CHUCK YOUNGMAN, ABRIGO



ABOUT THE EXPERT



Chuck Youngman
SENIOR ANALYST
Abrigo

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Charles "Chuck" Youngman has worked in the financial institution industry for over 16 years, starting in retail banking before joining Abrigo, formerly Farin, in 2002. As a Senior Analyst, Chuck is primarily responsible for providing support and training for Farin Foresight Asset/Liability Management clients. Using the Farin Foresight™ software, he provides consulting and guides clients through database design/layout, education, and troubleshooting. He also consults with clients who outsource their ALM with Abrigo Advisory Services.

Chuck graduated from the University of Wisconsin-Madison with a bachelor's degree in economics

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SUMMARY

Any discussion on Asset/Liability Management (ALM) should begin with a discussion on the underlying foundation required to accurately model forecasts. One of the most important building blocks for that foundation is cash flows. It's crucial to understand the importance of cash flows, the different types, their characteristics, and how they perform or act in a forecast. Cash flows are the foundation of ALM modeling and understanding them helps to understand the results when attempting to model interest rate risk through reporting.

In addition to understanding cash flows, it is crucial to periodically verify that an ALM model is accurately importing data and modeling that data correctly. Regulators and examiners ask or require that ALM models be regularly reviewed, either internally by the financial institution or externally by an outside model validation provider. Some type of model validation should be performed annually.

INTRODUCTION

As ALM professionals, we know that making decisions requires knowledge of our balance sheet and a reasonable understanding of how it will change over time. We also know that ALM software can help us simulate those changes and give us a clearer picture of possible interest rate risk of a financial institution's business plan. Once we have a clearer picture of interest rate risk within a forecast, we can make decisions to minimize those risks and maximize profits.

It's important to consider how any ALM software is able to give us a reasonably accurate picture of how loans, investments, deposits, and borrowings will act or perform in a forecast. We input current data, current rates, and a number of other assumptions into the model and then run reports. However, the imported data is often taken for granted and may or may not be detailed enough to accurately project future cash flows. The data we input is the foundation of the model and has a huge effect on the results we get when running reports. Depending on the complexity of the types of loans and investments making up the balance sheet, we may not be getting the most accurate forecast we can. Poorly projected cash flows

can lead to a misunderstanding of risk, resulting in poor management decisions.

This paper will focus on typical cash flow characteristics that can be found on most balance sheets and how they perform or act in a forecast. Cash flow characteristics haven't changed over time, so the concepts here are not new. However, they will serve as a refresher and an appropriate introduction to any discussion on ALM and interest rate risk in general.

THE IMPORTANCE OF CASH FLOWS

ALM professionals should understand the importance of cash flows, the assumptions used to model them, and the cash flow settings in the model. Armed with this information, ALM professionals will be better able to identify errors in data and reports, explain some of the changes being reported, and in general, better monitor the administration of the model and the analysis of the results.

Understanding cash flows begins with a knowledge of the various types of financial instruments used in banking: investments, loans, NMD (non-maturity deposits), CDs, and other borrowings. Looking at the cash flow characteristics of these different financial instruments from a modeling perspective can be helpful in a number of ways.

Poorly projected cash flows can lead to a misunderstanding of risk, resulting in poor management decisions.

For example, understanding how balloon loans differ from bullet loans is essential in order to be able to find cash flow errors in data downloads by looking at a gap report. (A gap report is used to evaluate the potential effect of rate shocks on income over different time periods by comparing the total quantity of an institution's rate-sensitive assets and rate-sensitive liabilities that will be repricing in multiple periods.) Or, without understanding the effects of the embedded options in Agency callables (assets) and FHLB callables (liabilities) it would be difficult to anticipate, or explain, changes in market value in different rate environments. These examples are just a few of the many types of cash flows that are important to understand and why. The first step to modeling financial instruments is to truly understand the instruments.

In this section, we will review the cash flow characteristics related to the various types of financial instruments and the assumptions that are critical to users when modeling.

"GENERIC" CASH FLOW CHARACTERISTICS

There are certain "generic" cash flow characteristics that are common across all financial instruments.

These characteristics are the basic building blocks for all financial instruments. Their characteristics are universal across the balance sheet. An amortizing MBS investment, an amortizing loan, and an amortizing FHLB advance are basically the same thing. A bullet bond, a bullet loan, a CD, and a bullet FHLB advance produce similar cash flows.

The following is a brief description of various cash flow characteristics that might apply to instruments that we might find on our balance sheets:

Immediate

An immediate instrument is an instrument that can be retired, or "matures," immediately. This instrument has no "term to maturity" – or, when modeling, it can have a very short maturity, such as one day or one week. Since the instrument has no term, it also has no prepayment or repricing characteristics. Examples of immediate accounts are Fed Funds (overnight borrowings), credit cards, and NMDs (non-maturity deposits). When modeling, the user

needs to be concerned about balance, coupon rate, and decay rate. These are the characteristics that create cash flows.

Amortizing

An amortizing instrument is one in which the issuer receives principle and interest payments throughout the life of the instrument. The amount paid to reduce principle each month is the "amortizing amount." The typical loan is an amortizing instrument. The standard amortizing instrument has the same original maturity and amortizing period, but there are amortizing 'hybrid' instruments that have different amortizing and maturity periods. When modeling amortizing instruments, the user needs to be concerned with coupon rate, maturity term, amortizing period, repricing, and prepayments. These are the characteristics that create cash flows

Balloon

A balloon instrument is a subset of the amortizing instruments. A balloon is an instrument with a very short absolute maturity, for example five years, but it will amortize over a much longer period. The balloon allows that lender to lend for a shorter period of time (reducing various risk exposures to the lender) while making it affordable for borrowers to borrow (reducing the payments to synthetically low levels). For example, many borrowers could not afford the amortization on a short-term instrument, so the lender allows the borrower to pay back the instrument (amortize) on a schedule as if it were a longer-term instrument, say 25 or 30 years. Since the amortization is much lower on a 30-year instrument than it is on a 5 year, the borrower will still owe a very substantial portion of the principle at maturity. This final payment is the 'balloon payment'. The user needs to be concerned about coupon rate, maturity term, amortizing period, epicing, and prepayments. These are the characteristics that create cash flows.

Bullet

A bullet instrument is one in which the entire principle amount is paid in one lump sum at maturity, for example a bond. The borrower will pay interest through the life of the instrument and then repay the entire principal amount upon maturity. A variation of the bullet is a discount instrument.

A discount instrument has only one lump payment at maturity which contains both interest and principle. An example of a discount instrument is a US Treasury Strip. The user needs to be concerned about coupon rate, maturity term, repricing, and prepayments. These are the characteristics that create cash flows.

EMBEDDED OPTIONS THAT AFFECT CASH FLOW

Within the generic cash flow characteristics listed above, users will often find additional embedded options. Often, the user will be confronted with repricing, callables, putables, prepayments and CMO options.

Repricing

Variable rate instruments can be found in all areas of the balance sheet. Nearly all repricing instruments reprice through some contractual agreement between the bank and the borrower (loans), the bank and the issuer (investments), or the bank and the lender (other borrowings). To express variable rate cash flows, the data must possess complete detail about the repricing contract for each instrument. Specifically, the data must contain the repricing schedule of every instrument. Contractually, how many months from the origination date is the first reprice date? How often does the instrument reprice after that? With this information, the financial institution can combine instruments with similar repricing characteristics and separate dissimilar instruments.

Callables

The seller of a callable has the right to repurchase the instrument at some point in the future. The buyer has the obligation to relinquish the instrument. For example, a municipal that issues a callable bond has the right to recall that bond in the future, while the buyer (the bank) has the obligation to sell the bond back. This will happen in a falling rate environment. In another example an FHLB that issues callable advances has the right to recall the advance in the future while the borrower (the bank) has the obligation to repay the money on demand. This happens in a rising rate environment. Given these characteristics, one can see that the purchaser of the callable bears the risk

Putables

The seller of a putable instrument has the obligation to repurchase the instrument in some point at the future. The buyer has the right to relinquish the instrument to the issuer at a set price in the future. Given these characteristics, one can see that the seller of the putable bears the risk. Banks typically have very few wholesale putable investments.

Prepayments

Prepayments occur on almost all types of loans. Prepayments affect projected cash flows by speeding up the principle payments and reducing the average life of the instrument. Prepayments occur because of re-financing and early retirement of the loan. Prepayments can have a massive effect on cash flows in changing rate environments.

CMOs

A true collateralized mortgage obligation (CMO) is a unique subset of amortizing mortgage-backed securities (MBS), or ABS (asset-backed securities). A basic MBS pass-through amortizes (pays down principle) through-out the life of the instrument exactly like an amortizing mortgage loan. The investor simply buys a pro rata share of all of the cash flows in the portfolio for the entire life of the portfolio. For example, the investor will get a percentage of interest and principle cash flows each month for the entire life of the 30-year mortgages that comprise the underlying collateral of the MBS pass-through. A CMO is unique in that the buyer purchases a specific set of cash flows rather than a percentage of all the cash flows throughout the life. For example, the buyer of a certain CMO may buy an investment (tranche) that entitles them to principle payments for months 120 through 240 only. They will receive interest payments while other investors are receiving the principle from months 1 through 119. During the principle payments from months 120 through 240, the investor will receive a pro rata share of principle and their interest payment. After the principle payment from month 240 has been paid, the investment is viewed as matured and the investor receives no further cash flows even though the investors holding principle cash flows from months 241 through 360 are still receiving money. CMOs are highly volatile instruments and their exact cash flows are never

known in advance. Cash flows need to be estimated for numerous future rate environments to truly understand the risks related to owning various CMOs.

Since most banks have more of their earning assets concentrated in loans, small errors in assigning cash flow characteristics in this category can have a massive effect on the asset-liability process.

HOW CASH FLOW CHARACTERISTICS IMPACT MODELING DECISIONS

Now that we have identified and categorized the basic financial building blocks, we can begin to look at the specific instruments found on the bank's balance sheet. Below is a listing of the most common combinations of the generic cash flow characteristics separated into the usual balance sheet categories – investments, loans, deposits, and other borrowings. Understanding the generic characteristics outlined previously will help financial professionals employ the details presented below to improve their account settings in their ALM model.

Investments

Investments exhibit three main types of cash flows: immediate (Fed Funds, FHLB stock), bullet (Treasuries, Agencies, Certificates), and amortizing (MBS, CMOs). In addition to these major cash flow characteristics, investments can also have embedded options such as repricing, prepayments and calls.

Amortizing vs. non-amortizing

The first step in projecting investment cash flows is to separate your investments into instruments that amortize and instruments that do not amortize. Let's take two instruments with identical terms, rates, and balances. Both instruments mature in 36 months. Both have a balance of \$1,000 and a rate of 7.5%. In fact, the only cash flow characteristic that separates the instruments is that the

first amortizes and the second does not. The bullet investor receives only interest payments until month 36 while the amortizing investor receives principle and interest during all months. An institution that combines amortizing and non-amortizing instruments into a single account will be misrepresenting future cash flows. For every period except the last, the total cash flows (Interest + Principal) for the amortizing instrument are greater than those for the bullet instrument. Adjusting for various prepayment speeds would only amplify this trend.

Hidden options – CMOs and callables

Next we need to identify the hidden, or embedded, options in our investment portfolio. Think about an MBS with different types of options – basic MBS, CMO and callables. These instruments may also exhibit repricing options that would need to be separated out.

The speed with which the principle is repaid depends heavily on the cash flow characteristic. A CMO might pay nothing for the first five years and then it might pay off very quickly. The speed with which a CMO pays off is related to the payment window. An amortizing MBS or an amortizing MBS callable both begin paying down principle in a similar fashion. However, after 5 years, the callable might be called, causing the entire remaining principle to be paid down immediately. There are endless combinations of the generic cash flows characteristics in real world instruments. Failing to separate instruments into accounts with similar cash flows will have far-reaching effects on the AL manager's ability to perform cash flow analysis.

Loans

There are many different cash flow characteristics attributed to loans. Since most banks have more of their earning assets concentrated in loans, small errors in assigning cash flow characteristics in this category can have a massive effect on the asset-liability process. The asset-liability manager must understand these differences in cash flow characteristics and how they will affect the bank's portfolio.

There are three major types of loan cash flows; amortizing (standard and balloons), non-amortizing (bullets) and immediate (credit cards). In addition to these major cash flow types, loans can exhibit repricing and prepayment options.

Amortizing vs. balloon vs. bullet

The first step to understanding loan portfolio cash flows is to separate instruments into the major cash flow types. For example, let's examine how three loans with the same term, rate and maturity date can have noticeably different cash flows. If a bank or credit union does not separate balloons and bullets from their standard amortizing loans, the institution's cash flows will be 'front weighted.' 'Front weighted' means that in every period, the cash flows will be higher for the amortizing loans than they are for either the balloon or bullets.

Different amortizing terms

The second step in structuring cash flows for the loan portfolio is to separate cash flows by term and amortization period. For example, let's look at a 30-year fixed rate loan and a 15-year fixed rate loan that both have the same balance and coupon payment. In every period, the principle payment is larger for the shorter-term instrument. If the user does not separate instruments of different terms, they will be incorrectly estimating their cash flows.

Repricing options

Next, the user must consider repricing options attached to various instruments. First, not separating fixed rate and repricing instruments will cause the bank to misstate interest income. In a rising rate environment, they will underestimate interest income. In a falling rate environment, they will overstate interest income. Additionally, prepayment speeds are a function of the coupon rate on an instrument. By failing to readjust the ARM coupon in changing rates, the AL manager will be unsure of true prepayment speeds. Interest income will change in an up 100BP rate shock for three different types of instruments. First, the fixed rate will not adjust. The 1-1 ARM adjusts after one year. The 3-1 ARM adjusts after three years, in quarter 12. From this example, the user can see that combining instruments with dissimilar repricing characteristics will create poor cash flow estimations. Combining any of these accounts will cause the ALM model to forecast or calculate less than optimal cash flows.

Prepayment Speeds

The final loan cash flow characteristic the user must be concerned with is the prepayment speed. Prepayment

speeds are either calculated from published averages (mortgage accounts) or can be institution-specific numbers. Prepayment speeds are highly dependent on rate environments, instrument coupon rates and instrument types. 30-Year fixed rate mortgages prepay at a different speed than 15-year mortgages, as do variable rate instruments and balloons. Let's assume a flat rate environment, i.e., no change in market rates, with two instruments that are exactly alike, except that the second instrument has been adjusted for prepayment speeds. Prepayment speeds can drastically increase the speed with which an instrument is paid down.

Non-Maturity Deposits

At first glance, non-maturity deposits seem like very simple instruments. By definition (contractually), they are immediate accounts. The depositors can remove their money from the institution at any time. But theoretically, the NMD is a very complex instrument with complicated cash flows. Many depositors leave their deposits in a bank for a long period of time – regardless of changes in market rates. These are your 'core deposits' and core deposits are the cheapest method for a bank to raise funds. Since the depositors leave the money in the bank for long periods of time, core NMDs are a lot like CDs except they cost much less. For market value and gap reporting purposes, the NMD is not an immediate account. To create a gap report, and to calculate market value, the user must estimate how long the core deposits remain. Specifically, the user is trying to estimate a portfolio of synthetic maturities. This gap/market value portfolio displays the NMD not as an immediate account but rather, it is shown as a set of maturity balances.

Think about the various ways your NMDs can appear on a gap report. For example, let's look at various accounts that have a current balance of \$1,000 and a coupon of 2%. One account has no decay rate characteristics attached. The other employs the decay rate characteristics provided by an internal core deposit study. The estimated, or synthetic, maturity schedule is used in a gap report, liquidity event report and a market value report. For our account with no decay table attached, the gap shows the entire \$1,000 coming off the account in the first month of forecast, and little to no effect on actual vs. shocked values in a market value report. Meanwhile, the account with a decay table

attached shows the gap spreading the starting \$1,000 balance over the number of months based on the synthetic amortization schedule dictated by the decay table. And, as a result of extending these cash flows, there is a much greater effect on the shocked values in a market value report.

CDs

CDs are probably the easiest instrument type to model. They seldom reprice, and they do not amortize. The user need only be concerned about separating CDs into their correct terms. For example, the AL manager should separate 1 month CDs from 5 year CDs – and separating everything in between.

Some institutions create only two CD accounts – short-term and long-term. This is a dangerously low level of cash flow mapping. All users should break their accounts into the same level of detail as they offer to their clients.

Other Borrowings

The three major categories of other borrowings are immediate (Fed Funds), amortizing (FHLB Advances), and bullet (FHLB Advances). The FHLB Advances may also

have embedded options such as calls and repricing. Similar to the cash flow characteristics for loan portfolios, other borrowings require the AL manager to separate cash flows by term, amortization, repricing, calls and amortizing/ non-amortizing.

CONCLUSION

This discussion should provide readers with a better and more robust understanding of the importance of cash flows. As noted earlier, once we have a clearer picture of interest rate risk within a forecast, we can make decisions to minimize those risks and maximize profits. Having a solid comprehension of the different cash flow characteristics of financial instruments and how they can influence a model should provide financial professionals more confidence in their ability to identify and correct any shortcomings in the cash flows present in their ALM modeling. This, in turn, should provide them more confidence in the results of their forecast reporting and the resulting decisions.

Additional Resources

[Whitepaper: The 7-Step Guide to an Effective, Dynamic ALCO](#)

[Webinar: Analyzing Core Deposits for Risk Management & Loan Growth](#)

[Webinar: CECL and Your ALM Model](#)

