

Deposit Duration and the Measurement of Interest Rate Risk

Duration is one of the most misunderstood and misused terms in banking.

Confusion around the meaning of the word *duration* is a frequent source of miscommunication between ALM managers on one hand and finance and business unit representatives (including executives) on the other. The confusion is problematic because duration is a primary determinant of deposit value and *if you don't understand what duration is, then you don't understand what makes one deposit more or less valuable than another and you don't understand what specific deposit characteristics can serve to mitigate interest rate risk (IRR).*

Duration, D , in an IRR context, is a measure of price sensitivity; it indicates how the price, P , of a financial instrument changes in response to a change in market interest rates, r :

$$\% \Delta P = -D * \Delta r.$$

The negative sign denotes an inverse relationship between rate and price - if the interest rate increases, the price decreases.

Adding to the confusion, there are multiple measures of duration, e.g. Macauley Duration and Modified Duration, but the most accurate measure of price sensitivity for most financial instruments is Effective Duration, D_{Eff} . This measure is estimated by directly computing price changes resulting from small changes in market interest rates in either direction:

$$D_{\text{Eff}} = (P_{r_d} - P_{r_u}) / (2 * P * \Delta r)$$

where P_{r_d} is the price resulting from a small downward move in the market rate, P_{r_u} is the price resulting from a small upward move in the market rate, P is the base price and Δr is the magnitude of the rate change.

Duration is a function of the *repricing* cash flows of an instrument, and these may not necessarily be the same as the principal cash flows. While the duration of a fixed-rate instrument is approximately equal to its weighted-average life (WAL), the duration of an adjustable-rate instrument will necessarily be less than its WAL, potentially much less so. In fact, a floating rate instrument which reprices at the same time and by the same magnitude as a change in market interest rates will have a duration that is essentially equal to zero, regardless of how long-lived the instrument.

To be clear, *a long WAL is necessary for a high duration, but a long WAL is not a sufficient condition.* Regardless of the WAL, the more the coupon rate on the instrument fluctuates with a change in the market rate, the lower the effective duration, so *a high duration requires both a long WAL and a relatively fixed customer rate.*

So why does deposit duration matter for the quantification of IRR?

The following equation shows the relationship between the duration of non-maturity deposits (NMDs), D_{NMD} , and the duration of equity, DOE, a primary measure of IRR:

$$DOE = (EV_A * D_A - [EV_{NMD} * D_{NMD} + EV_{TL} * D_{TL}]) / EV_E,$$

where

EV_A	=	economic value of total assets
D_A	=	duration of total asset
EV_{NMD}	=	economic value of non-maturity deposits
D_{NMD}	=	duration of non-maturity deposits
EV_{TD}	=	economic value of term deposits or other term funding
D_{TD}	=	duration of term deposits or other term funding.

For most depository institutions, NMDs are the primary source of funding, usually having a balance many times that of equity. The coefficient on D_{NMD} in the equation above is referred to as the Deposit Multiplier:

$$\text{Deposit Multiplier} = \frac{EV_{NMD}}{EV_E}.$$

For some depository institutions, this multiplier can be as high as 8 or 9, indicating that the risk to equity is highly levered to NMD duration assumptions. While a small overestimate of the NMD duration of only 10 bps will lead to an underestimate of DOE of roughly 100 bps, a material overestimate of NMD duration will lead to an egregious underestimate of the exposure to rising interest rates.

When NMD duration estimates are not linked to meaningful measures of profitability (think FTP), it is very easy to produce values which are extremely high; such values only reinforce preconceptions that *all* deposits are valuable. The persistent low-rate environment following the recent financial crisis also causes many historically-based empirical studies to over-estimate duration; this leaves many institutions unprepared for rising interest rates. Members of ALCO must also understand that duration is not an intrinsic property of NMDs; it results from how they are managed. When rates are increased to grow volume, duration is inevitably sacrificed.



About David Green Advisors

DGA is a boutique advisory firm led by David Green, PhD, CFA. Specializing in risk and profitability management, DGA advises in all aspects of framework development, including policies, quantitative models, operational and management processes and governance structures. A leading provider of risk and profitability workshops around the globe, DGA offers a unique blend of advisory services and educational training that maximizes knowledge transfer and ensures practical consistency throughout the organization.

Areas of Specialization:

- Asset/Liability Management
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- Funds Transfer Pricing
- Behavioral Modeling of Loans and Non-Maturity Deposits
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Dr. Green is motivated by the understanding that key risk and profitability management functions at a depository institution must be fully aligned in order that the story of how the firm makes money be robust to the dynamics of the business cycle; absent proper alignment, measures of business segment- and product-level profitability will be incorrect and unstable, challenging effective management of the organization.



About David Green, PhD, CFA

Dr. Green is a leading expert in risk and profitability management. His expertise derives from lessons learned in a >20 year career spanning banking, bank regulation, consulting and software development. Prior to consulting for the last decade, he served as the Treasurer at BankUnited, the largest bank headquartered in Florida, where he was responsible for ALM, FTP, the investment portfolio, funding and derivatives as well as secondary marketing. Prior to this, he was the A/L Manager at SunTrust Bank in Atlanta; there he built and managed all of the static and stochastic interest rate risk models for the bank and worked to align a number of business functions including budgeting/forecasting, funds transfer pricing and strategic balance sheet management.

Dr. Green is a former Chairman of the Georgia Bankers Association's A/L Management Committee. He served as a Bank Examiner at the Federal Reserve Bank of Atlanta, where he also spent two years in research while completing his Ph.D. He was Chairman of SunGard/Bancware's US Client Advisory Council for many years.

Dr. Green holds a Ph.D. in Economics from Georgia State University, a BS in Applied Mathematics from Georgia Tech and is a CFA charter holder. He is a frequent speaker at banking and risk management conferences.

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