# INTERMEDIATE PUBLIC FUNDS INVESTING

## WEBINAR 3 | UNDERSTANDING & MANAGING RISK IN PUBLIC INVESTING

**Jason Klinghoffer, CFA**
Director, Debt Capital Markets | Mischler Financial Group

**Bret Black**
Principal Treasury Investment Officer | County of Kern

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CDIAC 40 YEARS

CMTA

# Session Objectives:

- Understand what risk means beyond mathematical or analytical measurements.
- Define the types of risk and how they can impact your decision making and outcome for your portfolio.
- Understand different approaches to mitigating risk and optimizing portfolio performance.
- See how to utilize an Investment Policy to guide strategy development and what can go wrong when a policy is not being followed or used.


"Investing consists of exactly one thing: dealing with the future. And because none of us can know the future with certainty, risk is inescapable. Thus, dealing with risk is an essential—I think the essential—element in investing."

*Marks, Howard (2011-04-19). The Most Important Thing: Uncommon Sense for the Thoughtful Investor*

## RISK: Beyond the Measurements

- Risk means more things can happen than will happen. Much of the risk we take is not directly observable or measureable through statistical or mathematical means:

**Underperforming Expectations**

- Falling short of budgetary estimates of income
  1. Minimal haircut or aggressive projections of income estimates during budgeting process.
  2. Ineffective asset allocation to meet income goals.
  3. Failure to deploy and stay invested appropriately.

**Career Risks**

- Selling at a loss to meet operational liquidity needs
  1. Selling at a loss in the portfolio may cause accusations of liquidity mismanagement and violating the SLI mandate (Safety, Liquidity and Income).
  2. Mark-to-Market (GASB 31) can create impressions of undue risk taking and recognized losses becoming realized headaches. Effective communication is necessary to keep constituents informed and understanding of why losses are an important and necessary part of the investing process (remember…bonds mature!).

# RISK: Beyond the Measurements

**Career Risks (continued)**

- Constituents access to information / confidence in your abilities.
  1. If you are afraid of your own abilities, chances are those around you see it too.
  2. Confidence is much easier to ascertain when the information flow is symmetric.
     - Have a plan, run consistent reports, understand your market, ask questions, leverage your resources!
  3. Arrogance and ignorance are the deadliest combination in investing.

**Idiosyncratic / Event Risk**

- Specific events can affect individual credits and sectors with little or no ability to measure impact beforehand.
- Example: EMC / DELL Acquisition
  - Solid fundamentals, A1/A Credit and IG 6 Banding.
  - Dell (BB Credit) announces acquisition attempt.
  - EMC volatility spikes, trades through BB credit in anticipation (4+% Yield).
  - Negative watch initiated, Dell on upgrade watch.
  - Fundamentals unchanged.
  - Diversification only tool to mitigate this risk.

## RISK: Beyond the Measurements

### Systematic Risks

- This risk inherent to the entire market. It is your non-diversifiable, market risk (volatility).
  - Interest rate changes, economic pressures, recessions and expansions, geo-political situations, globalization, integrated markets, etc..
  - Volatility measurements are possible, but are historical in nature.


Credit: Paresh Nath, UAE

## RISKS INHERENT TO BOND INVESTING

- INTEREST RATE RISK
- CREDIT RISK
- REINVESTMENT/PREPAYMENT RISK
- LIQUIDITY RISK
- INFLATION RISK

## RISKS INHERENT TO PUBLIC FUND INVESTING

- POLITICAL RISK
- MISMATCH RISK

# RISK: Interest Rate Risk – Price/Yield Relationship

Understanding interest rate sensitivity is core to both single security analysis and managing your portfolio as a whole.

- At this point, you should understand the basic price/yield relationship.
  - As interest rates decrease, bond prices increase (holding all else constant).
  - As interest rates increase, bond prices decrease (holding all else constant).

*2 Yr Bullet, Price = 100.00 @ 1.00%*

| CUSIP | PP8C1K7Z5 | Price Calc: | | | |
|---|---|---|---|---|---|
| Settlement: | 12/22/2015 | Total Present Value | $1,000,000.00 | | |
| Maturity: | 12/22/2017 | Accrued Interest | $0.00 | | |
| YTW Date | 12/22/2017 | Total Dollar Value | $1,000,000.00 | | |
| Par Amount: | 1,000,000.00 | Price in Convention | 100.000 | | |
| Yield to Worst | 1.00% | | | | |
| Time Period | Cash Flow Date | Cash Flow | PV Factor | Present Value | Weight |
| 180 Days / 0.50 Years | 6/22/2016 | 5,000.00 | 0.99502 | 4,975.12 | 0.498% |
| 360 Days / 1.00 Years | 12/22/2016 | 5,000.00 | 0.99007 | 4,950.37 | 0.495% |
| 540 Days / 1.50 Years | 6/22/2017 | 5,000.00 | 0.98515 | 4,925.74 | 0.493% |
| 720 Days / 2.00 Years | 12/22/2017 | 1,005,000.00 | 0.98025 | 985,148.76 | 98.515% |
| | Total | 1,020,000.00 | | 1,000,000.00 | 100.00% |

*Drop Interest Rates by 50Bp*
*YTW = 0.50%*
*Price increases to 100.994*

| CUSIP | PP8C1K7Z5 | Price Calc: | | | |
|---|---|---|---|---|---|
| Settlement: | 12/22/2015 | Total Present Value | $1,009,937.81 | | |
| Maturity: | 12/22/2017 | Accrued Interest | $0.00 | | |
| YTW Date | 12/22/2017 | Total Dollar Value | $1,009,937.81 | | |
| Par Amount: | 1,000,000.00 | Price in Convention | 100.994 | | |
| Yield to Worst | 0.50% | | | | |
| Time Period | Cash Flow Date | Cash Flow | PV Factor | Present Value | Weight |
| 180 Days / 0.50 Years | 6/22/2016 | 5,000.00 | 0.99751 | 4,987.53 | 0.494% |
| 360 Days / 1.00 Years | 12/22/2016 | 5,000.00 | 0.99502 | 4,975.09 | 0.493% |
| 540 Days / 1.50 Years | 6/22/2017 | 5,000.00 | 0.99254 | 4,962.69 | 0.491% |
| 720 Days / 2.00 Years | 12/22/2017 | 1,005,000.00 | 0.99006 | 995,012.50 | 98.522% |
| | Total | 1,020,000.00 | | 1,009,937.81 | 100.00% |

*Increase Interest Rates by 50Bp*
*YTW = 1.50%*
*Price decreases to 99.018*

| CUSIP | PP8C1K7Z5 | Price Calc: | | | |
|---|---|---|---|---|---|
| Settlement: | 12/22/2015 | Total Present Value | $990,184.72 | | |
| Maturity: | 12/22/2017 | Accrued Interest | $0.00 | | |
| YTW Date | 12/22/2017 | Total Dollar Value | $990,184.72 | | |
| Par Amount: | 1,000,000.00 | Price in Convention | 99.018 | | |
| Yield to Worst | 1.50% | | | | |
| Time Period | Cash Flow Date | Cash Flow | PV Factor | Present Value | Weight |
| 180 Days / 0.50 Years | 6/22/2016 | 5,000.00 | 0.99256 | 4,962.78 | 0.501% |
| 360 Days / 1.00 Years | 12/22/2016 | 5,000.00 | 0.98517 | 4,925.84 | 0.497% |
| 540 Days / 1.50 Years | 6/22/2017 | 5,000.00 | 0.97783 | 4,889.17 | 0.494% |
| 720 Days / 2.00 Years | 12/22/2017 | 1,005,000.00 | 0.97055 | 975,406.94 | 98.508% |
| | Total | 1,020,000.00 | | 990,184.72 | 100.00% |

# RISK: Interest Rate Risk – Effective Duration

**Effective Duration** represents the approximate percentage change in a bond's price for a 100 basis points change in yield.

- Effective Duration takes into account that the bond's expected cash flow's can change when the yield changes.
- This metric works for option-free bonds such as Agency Bullets and Treasuries AND Callable Bonds.
- Effective Duration uses the same theory as Modified Duration, however the discounting of cash flows is estimated at different interest rates and the corresponding changes in those cash flows are taken into account.
- This requires a bond option valuation model to calculate and can not be done simply by hand (remember OAS?).

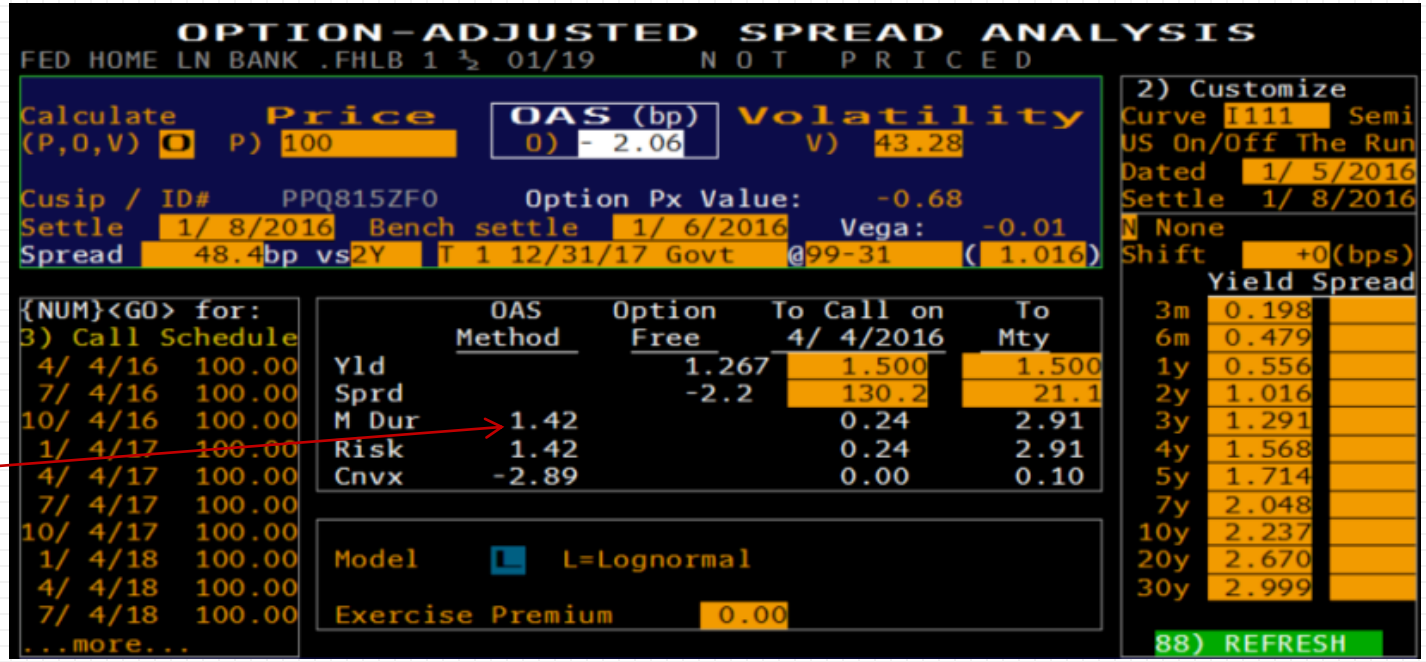
Modified Duration ⇒ Effective Duration

$$\text{Effective Dur} = -\frac{\text{Pup} - \text{Pdown}}{2 * \Delta i * P}$$

Found by bond option model

Pup = Bond's price when yield curve shifted up
Pdown = Bond's price when yield curve shifted up
i = Yield curve shift
P = Current price

**3.00Yr 1.50% Fixed Callable, Callable Quarterly After 3 Month Lockout. Priced @ Par*




*Effective Duration = 1.42*

## RISK: Weighted Average Maturity (WAM)

- WAM is usually applied as the weighted average amount of time until the mortgages in a mortgage-backed security (MBS) mature.
- It is also applied at the portfolio level to describe the weighted average time until the bonds in a debt portfolio mature.
- The higher the WAM, the longer it takes for all the bonds to mature.
- WAM is very easy to calculate and can be applied as a "perceived" risk measure. It is often used to compare and contrast portfolio managers along with their return and benchmark requirements.
- WAM does not measure interest rate risk and can be misleading when option-embedded bonds are present.

**Sample WAM Calculation (Par Value)**

1MM – 5 year GE bonds
2MM – 3 year FNMA Bonds
*WAM =.333*5 + .666*3 = 3.66 Years*

**Sample WAM Calculation (Book Value)**

1.1MM – 5 year GE bonds
1.8MM – 3 year FNMA Bonds
*WAM =.379*5 + .6206*3 = 3.76 Years*

# RISK: Credit Risk – Ratings Matrix

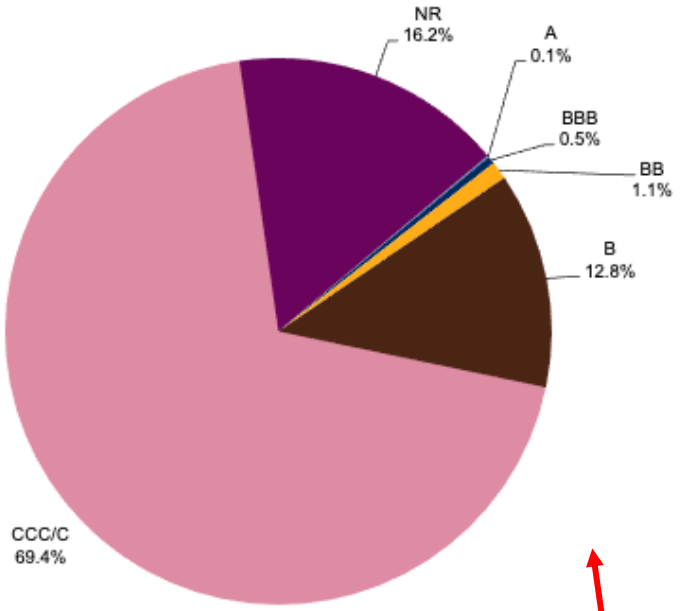
- Credit Ratings: An indicator of credit worthiness of specific debt securities or issuers.
- Credit ratings are typically assigned by one or more of three major credit rating agencies registered with the SEC (there are nine total as of Jan 2022).
- The major agencies, known as Nationally Recognized Statistical Rating Organizations (NRSRO), are Moody's, Standard & Poor's and Fitch Ratings.

| Moody's | | S&P | | Fitch | | Rating description | |
|---|---|---|---|---|---|---|---|
| Long-term | Short-term | Long-term | Short-term | Long-term | Short-term | | |
| Aaa | P-1 | AAA | A-1+ | AAA | F1+ | Prime | Investment-grade |
| Aa1 | | AA+ | | AA+ | | High grade | |
| Aa2 | | AA | | AA | | | |
| Aa3 | | AA– | | AA– | | | |
| A1 | | A+ | A-1 | A+ | F1 | Upper medium grade | |
| A2 | | A | | A | | | |
| A3 | P-2 | A– | A-2 | A– | F2 | | |
| Baa1 | | BBB+ | | BBB+ | | Lower medium grade | |
| Baa2 | P-3 | BBB | A-3 | BBB | F3 | | |
| Baa3 | | BBB– | | BBB– | | | |
| Ba1 | Not prime | BB+ | B | BB+ | B | Non-investment grade speculative | Non-investment grade aka high-yield bonds aka junk bonds |
| Ba2 | | BB | | BB | | | |
| Ba3 | | BB– | | BB– | | | |
| B1 | | B+ | | B+ | | Highly speculative | |
| B2 | | B | | B | | | |
| B3 | | B– | | B– | | | |
| Caa1 | | CCC+ | C | CCC | C | Substantial risks | |
| Caa2 | | CCC | | | | Extremely speculative | |
| Caa3 | | CCC– | | | | Default imminent with little prospect for recovery | |
| Ca | | CC | | | | | |
| | | C | | | | | |
| C | | D | / | DDD | / | In default | |
| / | | | | DD | | | |
| | | | | D | | | |

# RISK: Credit Risk – S&P Default Rates & Transitions

| Global Corporate Annual Default Rates By Rating Category (%) | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2010 | 0.00 | 0.00 | 0.00 | 0.00 | 0.58 | 0.87 | 22.83 |
| 2011 | 0.00 | 0.00 | 0.00 | 0.07 | 0.00 | 1.68 | 16.42 |
| 2012 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 | 1.58 | 27.52 |
| 2013 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 1.65 | 24.67 |
| 2014 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.78 | 17.51 |
| 2015 | 0.00 | 0.00 | 0.00 | 0.00 | 0.16 | 2.42 | 26.67 |
| 2016 | 0.00 | 0.00 | 0.00 | 0.06 | 0.47 | 3.76 | 33.17 |
| 2017 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 1.00 | 26.56 |
| 2018 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.99 | 27.18 |
| 2019 | 0.00 | 0.00 | 0.00 | 0.11 | 0.00 | 1.49 | 29.76 |
| 2020 | 0.00 | 0.00 | 0.00 | 0.00 | 0.93 | 3.52 | 47.48 |
| Sources: S&P Global Ratings Research and S&P Global Market Intelligence's CreditPro®. | | | | | | | |

**Default Distribution By Rating Prior To 'D' (1981-2020)**





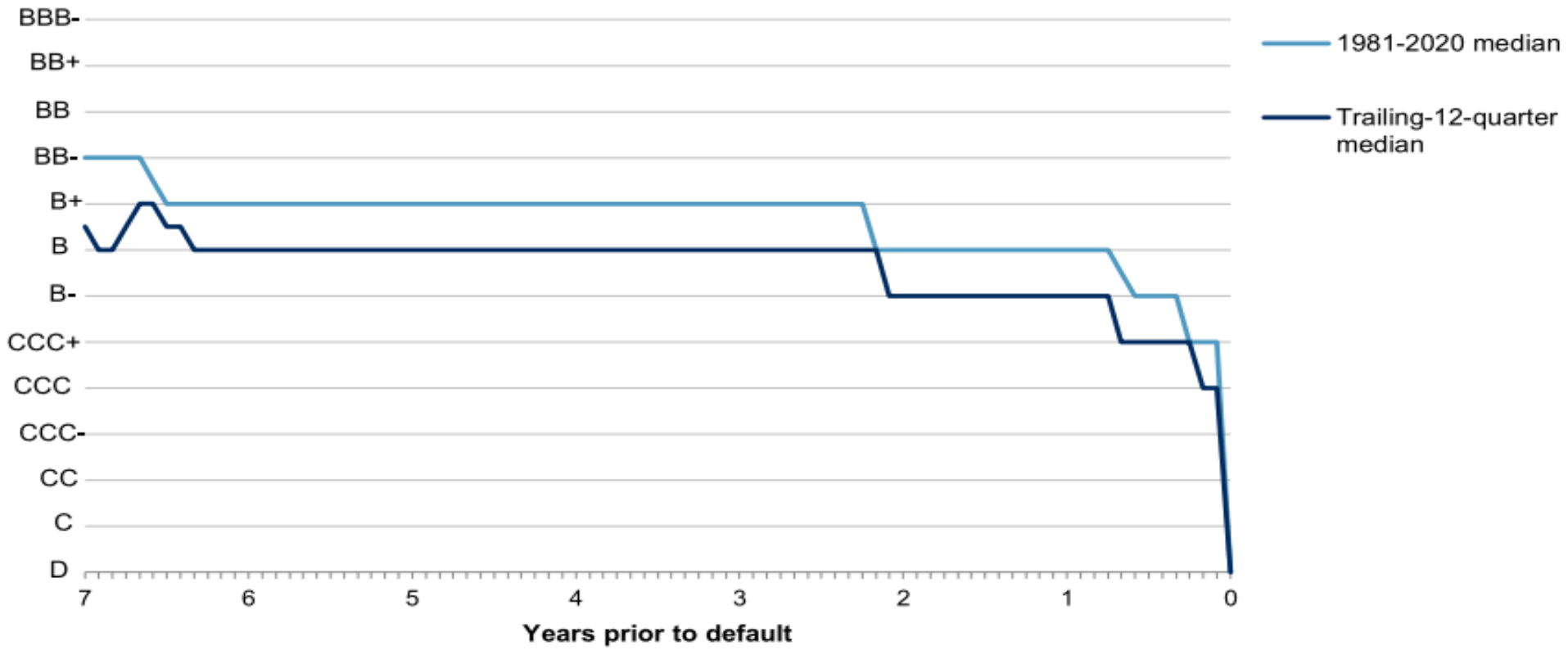

| U.S. Average One-Year Corporate Transition Rates (1981-2020) (%) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *From/To* | AAA | AA | A | BBB | BB | B | CCC/C | D | NR |
| AAA | 87.38 | 8.62 | 0.58 | 0.04 | 0.17 | 0.04 | 0.04 | 0.00 | 3.14 |
| AA | 0.50 | 87.29 | 7.40 | 0.56 | 0.08 | 0.10 | 0.03 | 0.03 | 4.01 |
| A | 0.04 | 1.64 | 88.37 | 5.22 | 0.35 | 0.14 | 0.03 | 0.07 | 4.13 |
| BBB | 0.01 | 0.11 | 3.40 | 86.60 | 3.65 | 0.56 | 0.10 | 0.20 | 5.37 |
| BB | 0.02 | 0.04 | 0.16 | 4.61 | 77.54 | 7.73 | 0.57 | 0.74 | 8.59 |
| B | 0.00 | 0.03 | 0.09 | 0.18 | 4.26 | 75.52 | 5.02 | 3.53 | 11.37 |
| CCC/C | 0.00 | 0.00 | 0.15 | 0.22 | 0.63 | 11.24 | 43.64 | 30.26 | 13.86 |

***99.4% of all defaults had a BB or lower rating prior to defaulting (including NR).***

# RISK: Credit Risk – S&P Default Rates & Transitions

***On average, it takes 7 years for a bond to default AFTER dropping below an Investment Grade Rating (AAA-BBB)!***

**Median Rating Path Of Corporate Defaulters**

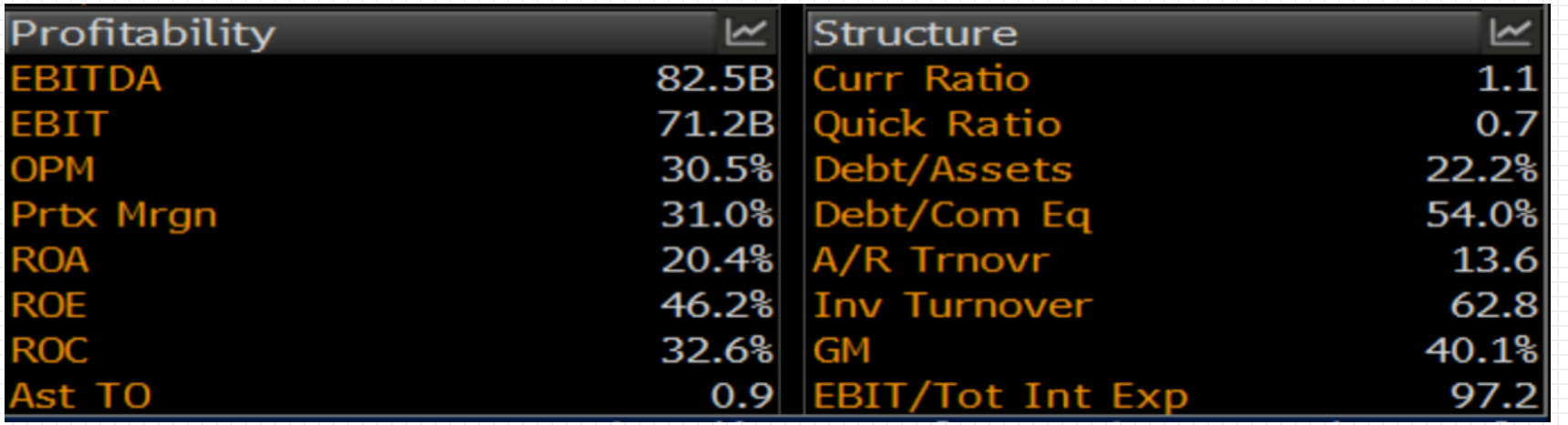



Note: Here, we do not include rating changes to 'NR'. Data through Dec. 31, 2020. Sources: S&P Global Ratings Research and S&P Global Market Intelligence's CreditPro®.

## RISK: Credit Risk – Issuer Analysis

Single security analysis outside of the traditional Treasury/GSE framework can require additional time and effort to understand the risks associated with certain issuers and structures. There are a few areas that public fund managers can focus on to help assess risk in a timely and efficient manner (not comprehensive).

- Solvency/Liquidity Ratios:
  - Current Ratio = Current Assets / Current Liabilities
  - Quick Ratio = (Cash + Short Term Marketable Securities + Receivables) / Current Liabilities
  - Cash Ratio = (Cash + Short Term Marketable Securities) / Current Liabilities
  - Interest Burden = EBT/EBIT
  - Interest Coverage Ratio = EBIT / Interest Payments



| Profitability | |
|---|---|
| EBITDA | 82.5B |
| EBIT | 71.2B |
| OPM | 30.5% |
| Prtx Mrgn | 31.0% |
| ROA | 20.4% |
| ROE | 46.2% |
| ROC | 32.6% |
| Ast TO | 0.9 |

| Structure | |
|---|---|
| Curr Ratio | 1.1 |
| Quick Ratio | 0.7 |
| Debt/Assets | 22.2% |
| Debt/Com Eq | 54.0% |
| A/R Trnovr | 13.6 |
| Inv Turnover | 62.8 |
| GM | 40.1% |
| EBIT/Tot Int Exp | 97.2 |

## RISK: Credit Risk – Issuer Analysis

### Bloomberg DRSK / IG Banding

- The DRSK Function is a fairly new tool from Bloomberg that provides a lot of the data scrubbing and adjustments that credit analysts would typically want to make for accounting differentials and advantageous accounting practices that create less transparency.
- Based on the Merton Distance-to-Default methodology.
- Financials adjusted for OPEB and Operating Leases to fairly evaluate across issuers (debt levels and interest expense understated otherwise).
- Creates longer term implied CDS spreads and IG banding for estimation of default over 1 year.

* Bloomberg DRSK for Apple Inc.

# RISK: Reinvestment / Prepayment

**Reinvestment Risk (Call Risk)**

- Risk resulting from the possibility that a callable bond will be redeemed before maturity. When interest rates decline, issuers are incentivized to call the bonds away and re-issue at lower rates. This leaves investors reinvesting proceeds sooner than expected at lower interest rates.

**Prepayment Risk**

- Similar to call risk, prepayment risk is the risk that the issuer of a security will repay principal prior to the maturity date, thereby changing the expected payment schedule of the bonds. This is especially prevalent in the mortgage-backed bond market, where a drop in mortgage rates can initiate a refinancing wave.

# RISK: Liquidity Risk – Issuer Analysis

**Bid / Ask Spreads**

- The amount by which the ask price exceeds the bid. This is essentially the difference in price between the highest price that a buyer is willing to pay for an asset and the lowest price for which a seller is willing to sell it.
- Larger Bid/Ask spreads indicate additional cushion needed by dealers to maintain positions (axe) in a specific credit or issue. The larger the spread, the less liquidity is associated with it.

**Bid / Ask Spreads can increase or decrease based on:**

- Issue Size - Benchmarks 250MM, GSE's generally relies on MTN market
- Sector Rotation – Specific sectors can go out of favor (in favor) over time
- Dealer Balance Sheets – Dealer's constrained capital minimizes desired axes and bids
- Esoteric Structures: Uncommon structures or unique characteristics can make it hard to bid.
- Thinly Traded Names: Smaller issuers with low visibility may be more difficult to bid.

# RISK: Liquidity Risk – Issuer Analysis

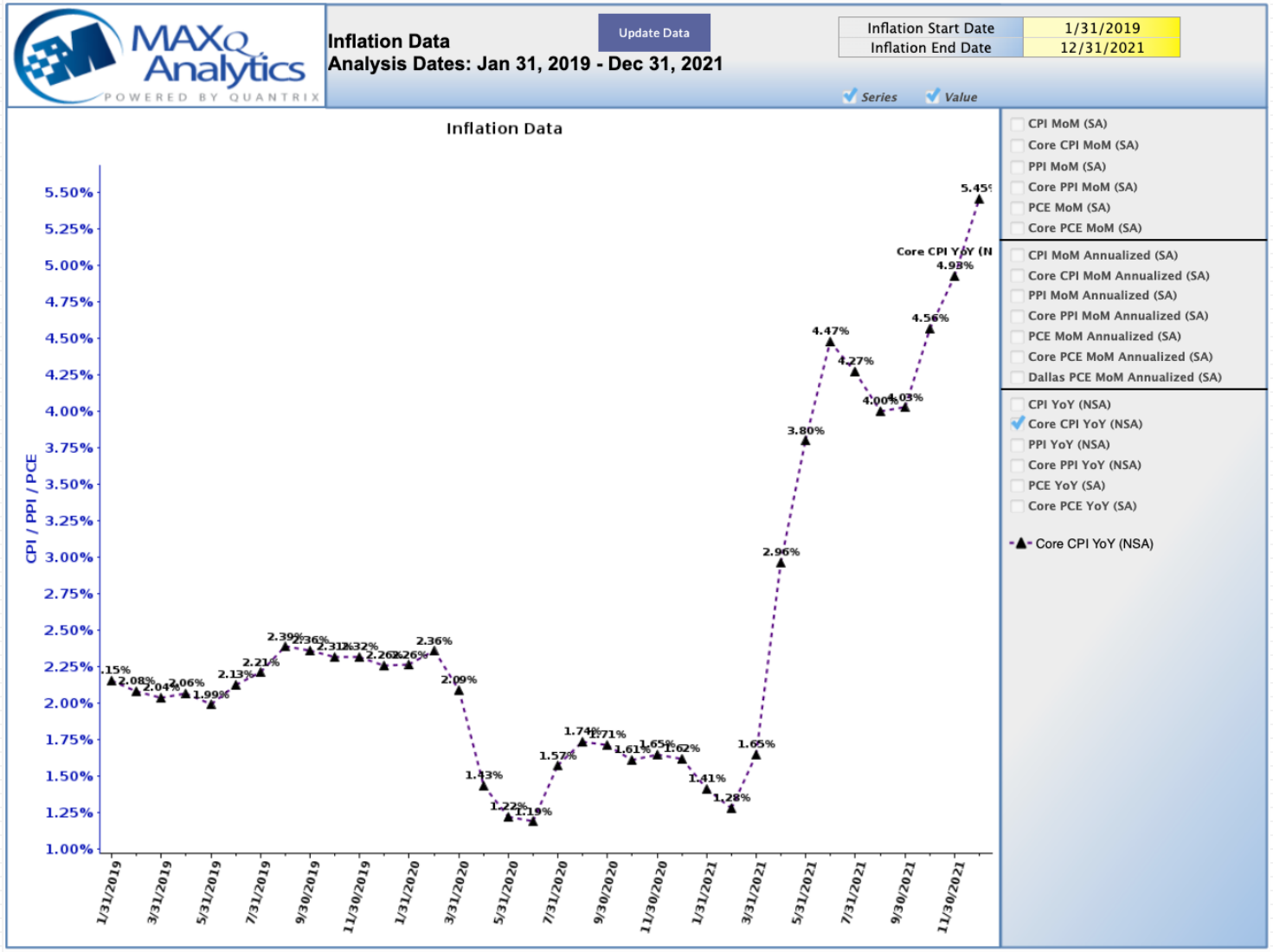
**Benchmark Curves**

- Benchmark Curves are published for many credit rating ranges and sector types. These curves can give you a quick idea where the average benchmark issuers are yielding in the same space in which you are comparing. Since these benchmarks make up the biggest and most liquid securities, any yield differentials for a specific security may give insight into the liquidity and credit premium / discount.

# RISK: Inflation Risk

## Inflation Risk

- Risk that investors earn decreasing (or even negative) real interest rates over time. If inflation in the overall economy increases, the purchasing power of income generated by fixed rate bonds diminishes as the coupons stay the same. This risk can be mitigated through the use of structured bonds like floating rate securities or step-ups.



## RISK: Political Risk

Political risk exists in public treasury management through constituent or supervisory pressures to invest in a certain way. Investment officials can react or bend to these ideas to appease those exerting pressure.

A few examples of this come to mind…

1) Banning U.S. Treasuries due to nuclear proliferation.
2) Removing oil & gas or fossil fuel based corporate debt from being purchased.
3) Hiring an investment advisor to run a one year and in Treasury only portfolio.

Other political pressures can lead to suboptimal behavior by portfolio managers. These pressures can lead to overly liquid or short duration portfolios that underperform their potential returns. The behavior centers around the idea that “no one has ever been fired for being in cash”.

Ironically, on more than one occasion I have seen elected officials lose their next election because the opposing candidate exposed and exploited this behavior.

## RISK: Mismatch Risk

Mismatch risk is not something you will find in textbooks, but it is very real and is the primary reason public entities take losses.

All of the previous risks discussed exert pressure on prices and portfolio performance, but do not cause portfolios to take losses. Credit risk is the one exception, but as shown in the transition slides, it is historically an extremely remote chance given the legal investments public funds are allowed to own.

Losses in reality come from entities not having sufficient liquidity to pay their bills and have to look to the portfolio to raise cash. As cruel as the bond gods are, when in this position it is quite possible you will not have gains to take and have to sell something at a loss.

This risk is significantly mitigated by timing assets to correspond with liabilities (ALM). If assets are maturing in the timeframes most likely to cause cash strain, you in essence create a secondary liquidity and backstop to having enough cash on hand.

# MITIGATING RISK WITH STRATEGY

**Benchmark:**

*A standard or point of reference against which things may be compared or assessed.*

Benchmarks should encompass metrics that help communicate the risk and return profile the portfolio is attempting to achieve.

The benchmark should encompass information that helps the manager ensure that they are achieving the following portfolio goals:

1) Ensuring adequate liquidity exists to pay current obligations
2) An appropriate amount of interest rate risk is being deployed
3) The portfolio is optimal among asset classes, maturities and structures
4) The portfolio is legal as defined by the investment policy to which the portfolio must abide
5) An optimal rate of return is achieved given the risks and constraints of the entity

Generally speaking, market benchmarks DO NOT qualify as adequate standards of measurement for public fund portfolios.

For example, it is highly unlikely that the Merrill Corp/Gov 1-5yr benchmark encompasses the liquidity requirements, interest rate risk, asset allocation and optimal return desires of a specific public fund once the appropriate analysis has been done to establish those standards.

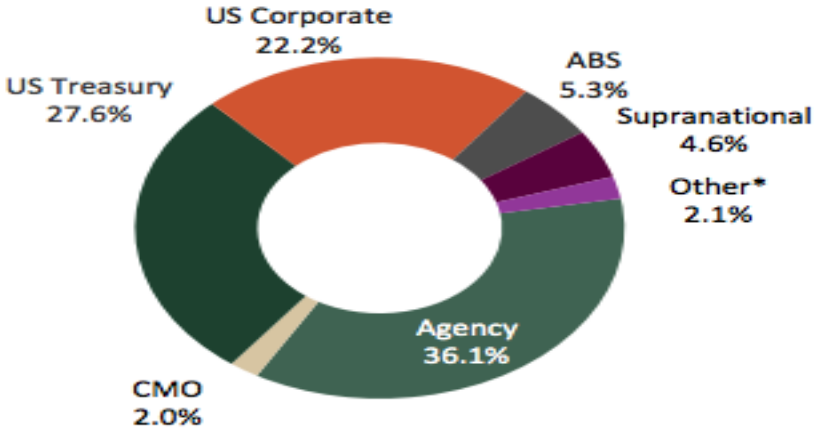
# Market Benchmarks

| CHARACTERISTICS | Chandler Short Term Bond | ICE BAML 1-5 Year US Treasury & Agency Index |
|---|---|---|
| Average Maturity | 2.53 | 2.67 |
| Average Duration | 2.31 | 2.54 |
| Yield-to-Maturity | 2.71% | 2.52% |
| Average Quality* | AA | AAA |
| Average Coupon | 1.99% | 2.18% |

*Composite quality based on S&P ratings. Index quality reflects S&P equivalent of composite/average of S&P, Moody's and Fitch ratings. Composite characteristics are supplemental information under GIPS and supplement the composite presentation herein.

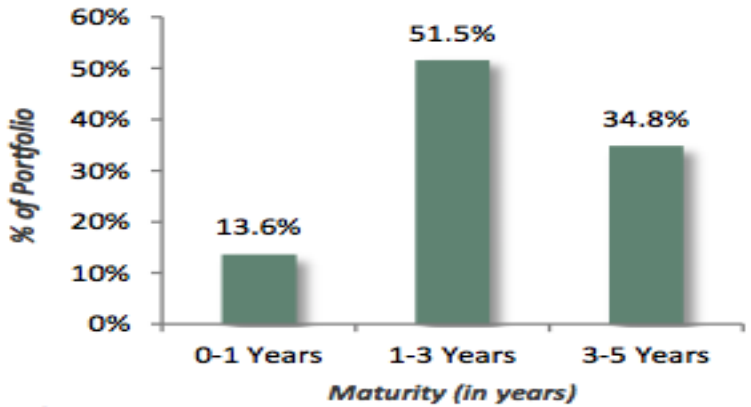
*Treasuries represent 97.5% of this index as of January 2022*

**ASSET ALLOCATION**




**Other includes Cash, Commercial Paper, Foreign Corporate, Municipal Bonds and Negotiable CD.*

**MATURITY BREAKDOWN**



## Market Based Approach – Single or Multiple Curve Approach

- Uses simple methodology by utilizing a single or multiple curves that are easily accessible.
- Risk/Reward is measured through principles like the Sharpe Ratio or a duration modified Sharpe Ratio and are relatively simple calculations.
- Does not capture true portfolio exposure (single curve used to measure duration, but portfolio is allocated across different sectors).
- Multiple curve approach requires sector allocation desires before duration established (chicken vs. egg).
- Mean-Variance Analysis possible, but requires sophistication and still optimizes market-based volatility to expected returns.
- **Does not** account for liabilities or cash flow needs of portfolio.

# Market Based Approach – Index Sets

- Manager uses a set of indices and measures risk/reward profiles accordingly (ICE/BAML, Lehman/Bloomberg, etc..).
- Like multiple curves, the manager could weight their preference of sectors and structures and determine the optimal blended duration for the portfolio.

| Family | U.S. High Grade | Currency | USD | Maturity Band | 1 - 5 Year |
|---|---|---|---|---|---|
| Sector | All | Rating | Investment Gr | Weighting Method | All |

| | Index | Index Name | Inception Date | Launch Date |
|---|---|---|---|---|
| 2) | GVPB | ICE BofA 1-5 Year US Bullet Agency Index | 12/1998 | |
| 3) | CVJ0 | ICE BofA 1-5 Year US Insurance & Financial Services Index | 05/1991 | |
| 4) | EVAG | ICE BofA 1-5 Year Eurodollar Globals Index | 03/2000 | |
| 5) | CVAB | ICE BofA 1-5 Year US Bullet Corporate Excluding Yankees Index | 04/2000 | |
| 6) | GVPC | ICE BofA 1-5 Year US Non-Bullet Agency Index | 06/2000 | |
| 7) | UX0V | ICE BofA 1-5 Year US Broad Market Non-Sovereign Index | 12/1996 | |
| 8) | CVCH | ICE BofA 1-5 Year US Corporate Index CHF Hedged Index | 12/1996 | 03/07/2015 |
| 9) | BVAY | ICE BofA 1-5 Year US Corporate & Government Excluding Tier 1 & Junior | 12/1996 | 12/07/2009 |
| 10) | BVA0 | ICE BofA 1-5 Year US Corporate & Government Index | 04/1986 | |
| 11) | CVC0 | ICE BofA 1-5 Year A-BBB US Corporate Index | 01/1977 | |
| 12) | C1Y0 | ICE BofA 1-5 Year A-BBB US Banking and Brokerage Index | 12/1987 | |
| 13) | C65M | ICE 1-5 Year US Corporate, Yankees & Taxable Muni Index | 12/1996 | 05/11/2020 |
| 14) | GVA0 | ICE BofA 1-5 Year US Treasury & Agency Index | 02/1988 | |
| 15) | CI0V | ICE BofA 1-5 Year US Industrial Index | 12/1996 | |
| 16) | GVAB | ICE BofA 1-5 Year US Treasury & Bullet Agency Index | 12/1996 | |
| 17) | UAGV | ICE BofA 1-5 Year US Composite Agency Index | 02/2001 | |
| 18) | CVA0 | ICE BofA 1-5 Year US Corporate Index | 12/1975 | |
| 19) | CY0V | ICE BofA 1-5 Year US Corporate & Yankees Index | 12/1996 | |
| 20) | CVCS | ICE BofA 1-5 Year US Corporate Excluding Subordinated Financials Index | 12/1996 | 10/10/2013 |
| 21) | EVAX | ICE BofA 1-5 Year Eurodollar Excluding Globals Index | 12/1982 | |
| 22) | CPSX | ICE 1-5 Year US Senior Banking Index | 12/1996 | 09/22/2020 |

# Market Based Approach – Index Sets

**0 – 1Yr Agy Composite = .53**
**1 – 3Yr A-AAA Corporate = 1.93**
**Blended 50/50 Duration= 1.23**

MAXQ Analytics
POWERED BY QUANTRIX

**Static Index Stats**
**Analysis Dates: Nov 30, 2007 - Nov 30, 2019**

| INDEX DATES | |
|---|---|
| Start Date | 11/30/07 |
| End Date | 11/30/19 |

| INDEX STATS 0-1 | Annualized Total Return | Annualized Price Return | Annualized Income Return | Annualized Std Dev Total Return | Avg Yield to Worst | Std Dev Yld | Avg Eff Dur | TR Sharpe Ratio | Yld Sharpe Ratio | Main Street Ratio | Weighted Rank |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0-1 Treasury | 0.925% | (1.137%) | 1.843% | 0.375% | 0.767% | 0.844% | 0.515 | 0.644 | 0.180 | 0.296 | 4.0 |
| 0-1 Agy Composite | 1.105% | (1.385%) | 2.178% | 0.469% | 0.915% | 0.965% | 0.530 | 0.899 | 0.310 | 0.565 | 3.0 |
| 0-1 Supranational | 1.395% | (1.565%) | 2.553% | 0.413% | 1.315% | 0.941% | 0.539 | 1.724 | 0.743 | 1.298 | 2.0 |
| 0-1 A-AAA Corp | 1.848% | (2.162%) | 3.300% | 0.841% | 1.782% | 1.508% | 0.525 | 1.385 | 0.773 | 2.221 | 1.0 |

| INDEX STATS 1-3 | Annualized Total Return | Annualized Price Return | Annualized Income Return | Annualized Std Dev Total Return | Avg Yield to Worst | Std Dev Yld | Avg Eff Dur | TR Sharpe Ratio | Yld Sharpe Ratio | Main Street Ratio | Weighted Rank |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1-3 Treasury | 1.629% | (0.396%) | 1.948% | 1.125% | 1.051% | 0.784% | 1.865 | 0.841 | 0.556 | 0.234 | 6.0 |
| 1-3 Agency Blt | 1.993% | (0.587%) | 2.440% | 1.251% | 1.233% | 0.886% | 1.835 | 1.047 | 0.697 | 0.337 | 4.0 |
| 1-3 Agency Clb | 1.515% | 0.052% | 1.471% | 0.662% | 1.279% | 0.895% | 1.169 | 1.257 | 0.742 | 0.568 | 2.0 |
| 1-3 Municipal | 1.902% | (2.674%) | 3.614% | 1.115% | 1.159% | 0.649% | 1.805 | 1.093 | 0.838 | 0.301 | 5.0 |
| 1-3 Supranational | 2.329% | (0.411%) | 2.636% | 1.166% | 1.576% | 0.801% | 1.935 | 1.412 | 1.200 | 0.497 | 3.0 |
| 1-3 A-AAA Corp | 2.682% | (1.089%) | 3.419% | 2.570% | 2.318% | 1.592% | 1.930 | 0.778 | 1.070 | 0.882 | 1.0 |

## Market Based Approach – Index Sets

- Again uses simple methodology by utilizing a single or multiple indices that are easily accessible.
- Risk/Reward is measured through principles like the Sharpe Ratio or a duration modified Sharpe Ratio and are relatively simple calculations.
- Single Indices like the ICE BofAML 1-5 Tsy / Agy can be heavily weighted in one sector.
- Does not necessarily capture liquidity needs or actual allocation exposure of your portfolio (unless several indices are used with actual exposure weights).
- Multiple index approach requires sector allocation desires before duration established (chicken vs. egg).
- **Does** not account for liabilities or cash flow needs of portfolio.

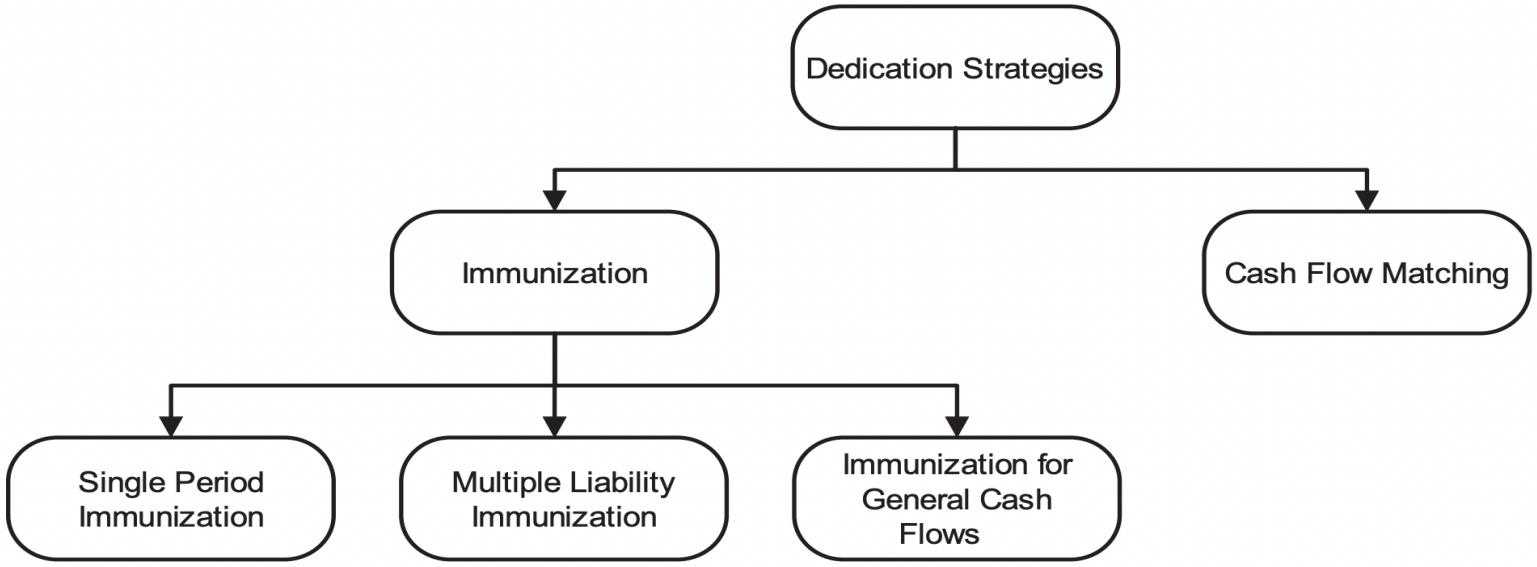
# Cash Flow Based Approach – ALM

- Utilizes cash flow analysis to measure the timing and magnitude of liabilities.
- Uses immunization techniques utilized in the insurance and pension world to measure individual liability streams.
- These liability streams are combined and weighted to derive a total portfolio duration that will suffice to match the liability needs.

## Cash Flow Based Approach – ALM

**Dedication Strategy**: Specialized fixed-income strategy designed to accommodate specific funding needs of the investor. They generally are classified as passive in nature, although it is possible to add some active management elements to them.

***Exhibit 6*** **Dedication Strategies**




**CFA Instititute, Fixed-Income Analysis 3rd Edition*

# Cash Flow Based Approach – ALM

**Immunization:** Aims to construct a portfolio that, over a specified horizon, will earn a predetermined return regardless of interest rate changes (duration focused). An increase in rates and the corresponding drop in investment value partially offset by an increase in re-investment rates (and vice-versa).

**Cash Flow Matching:** Provides the future funding of a liability stream from the coupon and matured principal payments of the portfolio (not duration focused). A simple accumulation of the coupon, reinvestment return and value at horizon will offset liability in full.

***Neither strategy perfectly fits public treasury as public entities must focus on Duration as a primary risk metric and typically spend coupons as anticipated by their budget.***

**CFA Instititute, Fixed-Income Analysis 3rd Edition*

## Cash Flow Based Approach – ALM

**Combination Matching (also called horizon matching):** Popular variation of multiple immunization and cash flow matching to fund liabilities by combining the two strategies. A portfolio is created that is duration-matched with the added constraint that it be cash flow-matched in the first few years, usually the first five years.

***Since most public entities are policy constrained to five years and in, we can combine the strategies for the entire legal timeframe of the portfolio.***

**CFA Instititute, Fixed-Income Analysis 3rd Edition*

# Cash Flow Based Approach – ALM

## ALM Analysis

## DCF/Duration Analysis of Cash Flows

Year 1 Modified Monthly Duration = 5.815/(1+(Wtd Avg Tsy yield/12))=5.810
Year 1 Annualized Modified Duration = 5.810/12 = .484

| Duration Optimization Calcs | | NetFlow | NegNetFlow | Hedge Security | PV Rate | Period | PV NegFlow | PV Factor | Weight | PeriodWt |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | August | ($2,816,016.20) | ($2,816,016.20) | 3Mo Tsy | 0.946% | 1 | $2,813,797.84 | 0.999 | 4.08% | 0.041 |
| | September | ($5,986,214.20) | ($5,986,214.20) | 3Mo Tsy | 0.946% | 2 | $5,976,786.48 | 0.998 | 8.67% | 0.173 |
| | October | ($8,049,693.21) | ($8,049,693.21) | 3Mo Tsy | 0.946% | 3 | $8,030,684.44 | 0.998 | 11.65% | 0.349 |
| | November | $24,131,838.28 | | | | | | | | |
| | December | ($11,818,508.50) | ($11,818,508.50) | 6Mo Tsy | 1.040% | 5 | $11,767,443.55 | 0.996 | 17.07% | 0.853 |
| | January | ($14,084,082.35) | ($14,084,082.35) | 6Mo Tsy | 1.040% | 6 | $14,011,089.19 | 0.995 | 20.32% | 1.219 |
| | February | ($3,068,198.25) | ($3,068,198.25) | 9Mo Tsy | 1.101% | 7 | $3,048,568.85 | 0.994 | 4.42% | 0.310 |
| | March | ($14,099,122.36) | ($14,099,122.36) | 9Mo Tsy | 1.101% | 8 | $13,996,081.63 | 0.993 | 20.30% | 1.624 |
| | April | ($8,639,622.84) | ($8,639,622.84) | 9Mo Tsy | 1.101% | 9 | $8,568,621.70 | 0.992 | 12.43% | 1.119 |
| | May | $47,707,704.62 | | | | | | | | |
| | June | $3,713,671.46 | | | | | | | | |
| | July | ($732,993.54) | ($732,993.54) | 1.00Yr Tsy | 1.162% | 12 | $724,530.44 | 0.988 | 1.05% | 0.126 |
| 2 | August | ($2,816,016.20) | ($2,816,016.20) | 1.25Yr Tsy | 1.193% | 13 | $2,779,866.49 | 0.987 | 4.09% | 0.531 |
| | September | ($5,986,214.20) | ($5,986,214.20) | 1.25Yr Tsy | 1.193% | 14 | $5,903,497.88 | 0.986 | 8.68% | 1.215 |
| | October | ($8,049,693.21) | ($8,049,693.21) | 1.25Yr Tsy | 1.193% | 15 | $7,930,578.28 | 0.985 | 11.66% | 1.748 |
| | November | $24,131,838.28 | | | | | | | | |
| | December | ($11,818,508.50) | ($11,818,508.50) | 1.50Yr Tsy | 1.225% | 17 | $11,615,346.67 | 0.983 | 17.07% | 2.902 |
| | January | ($14,084,082.35) | ($14,084,082.35) | 1.50Yr Tsy | 1.225% | 18 | $13,827,863.69 | 0.982 | 20.32% | 3.658 |
| | February | ($3,068,198.25) | ($3,068,198.25) | 1.75Yr Tsy | 1.256% | 19 | $3,007,817.97 | 0.980 | 4.42% | 0.840 |
| | March | ($14,099,122.36) | ($14,099,122.36) | 1.75Yr Tsy | 1.256% | 20 | $13,807,209.12 | 0.979 | 20.29% | 4.059 |
| | April | ($8,639,622.84) | ($8,639,622.84) | 1.75Yr Tsy | 1.256% | 21 | $8,451,898.98 | 0.978 | 12.42% | 2.609 |
| | May | $47,707,704.62 | | | | | | | | |
| | June | $3,713,671.46 | | | | | | | | |
| | July | ($732,993.54) | ($732,993.54) | 2.00Yr Tsy | 1.287% | 24 | $714,372.32 | 0.975 | 1.05% | 0.252 |

Macaulay Dur = Sum PeriodWt = 5.815

Macaulay Dur = Sum PeriodWt = 17.814

Year 2 Modified Monthly Duration = 17.814/(1+(Wtd Avg Tsy yield/12))=17.795
Year 2 Annualized Mod Duration = 17.795/12 = 1.483

## Cash Flow Based Approach – ALM

**ALM Analysis**
**DCF/Duration Analysis**

Once the annualized duration's are calculated, we now weight each year based on our preference of coverage of each year's total liabilities.

| Duration Optimization Values by Year | | |
|---|---|---|
| 1 | *Annualized Duration* | *0.484* |
| 2 | *Annualized Duration* | *1.483* |
| 3 | *Annualized Duration* | *2.481* |
| 4 | *Annualized Duration* | *3.480* |
| 5 | *Annualized Duration* | *4.477* |

# Cash Flow Based Approach – ALM

## ALM Analysis
## DCF/Duration Analysis

The total immunization weights for each year should create a portfolio that is 100% immunized relative to the portfolio size.

| | |
|---|---|
| Portfolio Size | $300,000,000.00 |
| Immunized Portfolio | $299,992,155.11 |
| Percent Immunized | 100.00% |

| Immunization Weight | |
|---|---|
| Year 1 | 90.00% |
| Year 2 | 70.50% |
| Year 3 | 70.00% |
| Year 4 | 70.00% |
| Year 5 | 70.00% |

| Duration Optimization Values by Year | | |
|---|---|---|
| 1 | Sum Present Value of Outflows | $68,937,604.13 |
| | Sum of Asset Matched Present Values | $62,043,843.72 |
| | Asset Matched Weight in Portfolio | 20.681% |
| | Annual Total Liquidity Coverage Required | $6,893,760.41 |
| | *Annualized Duration* | *0.484* |
| | *Weighted Duration* | *0.100* |
| 2 | Sum Present Value of Outflows | $68,038,451.40 |
| | Sum of Asset Matched Present Values | $47,967,108.24 |
| | Asset Matched Weight in Portfolio | 15.989% |
| | Annual Total Liquidity Coverage Required | $20,071,343.16 |
| | *Annualized Duration* | *1.483* |
| | *Weighted Duration* | *0.237* |
| 3 | Sum Present Value of Outflows | $66,942,361.12 |
| | Sum of Asset Matched Present Values | $46,859,652.79 |
| | Asset Matched Weight in Portfolio | 15.620% |
| | Annual Total Liquidity Coverage Required | $20,082,708.34 |
| | *Annualized Duration* | *2.481* |
| | *Weighted Duration* | *0.388* |

# Cash Flow Based Approach – ALM

## ALM Analysis
## DCF/Duration Analysis

| Duration Estimation and Allocation Bucket Approximation | |
|---|---|
| Starting Liquidity | $52,500,000.00 |
| 1Yr Min Liquidity | $47,360,819.51 |
| Weighted Average Cash Flow Duration | 1.92 |
| Cash (Liquidity Profile) | 17.50% |
| 0-1Yr | 20.68% |
| 1-3Yr | 31.61% |
| 3-5Yr | 30.21% |

*Sum of Weighted Durations (4 & 5 Year Not Shown)*

| Duration Optimization Values by Year | | |
|---|---|---|
| 1 | Sum Present Value of Outflows | $68,937,604.13 |
| | Sum of Asset Matched Present Values | $62,043,843.72 |
| | Asset Matched Weight in Portfolio | 20.681% |
| | Annual Total Liquidity Coverage Required | $6,893,760.41 |
| | *Annualized Duration* | *0.484* |
| | *Weighted Duration* | *0.100* |
| 2 | Sum Present Value of Outflows | $68,038,451.40 |
| | Sum of Asset Matched Present Values | $47,967,108.24 |
| | Asset Matched Weight in Portfolio | 15.989% |
| | Annual Total Liquidity Coverage Required | $20,071,343.16 |
| | *Annualized Duration* | *1.483* |
| | *Weighted Duration* | *0.237* |
| 3 | Sum Present Value of Outflows | $66,942,361.12 |
| | Sum of Asset Matched Present Values | $46,859,652.79 |
| | Asset Matched Weight in Portfolio | 15.620% |
| | Annual Total Liquidity Coverage Required | $20,082,708.34 |
| | *Annualized Duration* | *2.481* |
| | *Weighted Duration* | *0.388* |

# Cash Flow Based Approach – ALM

## ALM Analysis
## DCF/Duration Analysis

| Duration Estimation and Allocation Bucket Approximation | |
|---|---|
| Starting Liquidity | $52,500,000.00 |
| 1Yr Min Liquidity | $47,360,819.51 |
| Weighted Average Cash Flow Duration | 1.92 |
| Cash (Liquidity Profile) | 17.50% |
| 0-1Yr | 20.68% |
| 1-3Yr | 31.61% |
| 3-5Yr | 30.21% |

*Sum of Asset Matched Weights (4 & 5 Year Not Shown)*

| Duration Optimization Values by Year | | |
|---|---|---|
| 1 | Sum Present Value of Outflows | $68,937,604.13 |
| | Sum of Asset Matched Present Values | $62,043,843.72 |
| | Asset Matched Weight in Portfolio | 20.681% |
| | Annual Total Liquidity Coverage Required | $6,893,760.41 |
| | *Annualized Duration* | *0.484* |
| | *Weighted Duration* | *0.100* |
| 2 | Sum Present Value of Outflows | $68,038,451.40 |
| | Sum of Asset Matched Present Values | $47,967,108.24 |
| | Asset Matched Weight in Portfolio | 15.989% |
| | Annual Total Liquidity Coverage Required | $20,071,343.16 |
| | *Annualized Duration* | *1.483* |
| | *Weighted Duration* | *0.237* |
| 3 | Sum Present Value of Outflows | $66,942,361.12 |
| | Sum of Asset Matched Present Values | $46,859,652.79 |
| | Asset Matched Weight in Portfolio | 15.620% |
| | Annual Total Liquidity Coverage Required | $20,082,708.34 |
| | *Annualized Duration* | *2.481* |
| | *Weighted Duration* | *0.388* |

# Cash Flow Based Approach – ALM

## ALM Analysis
## DCF/Duration Analysis

| Duration Estimation and Allocation Bucket Approximation | |
|---|---|
| Starting Liquidity | $52,500,000.00 |
| 1Yr Min Liquidity | $47,360,819.51 |
| Weighted Average Cash Flow Duration | 1.92 |
| Cash (Liquidity Profile) | 17.50% |
| 0-1Yr | 20.68% |
| 1-3Yr | 31.61% |
| 3-5Yr | 30.21% |

| Duration Optimization Values by Year | | |
|---|---|---|
| 1 | Sum of Asset Matched Present Values | $62,043,843.72 |
| | *Weighted Duration* | *0.100* |
| 2 | Sum of Asset Matched Present Values | $47,967,108.24 |
| | *Weighted Duration* | *0.237* |
| 3 | Sum of Asset Matched Present Values | $46,859,652.79 |
| | *Weighted Duration* | *0.388* |
| 4 | Sum of Asset Matched Present Values | $45,889,528.29 |
| | *Weighted Duration* | *0.532* |
| 5 | Sum of Asset Matched Present Values | $44,732,022.07 |
| | *Weighted Duration* | *0.668* |

# Cash Flow Based Approach – ALM

## ALM Analysis
## Establish Allocation of Assets

| Duration Estimation and Allocation Bucket Approximation | |
|---|---|
| Starting Liquidity | $52,500,000.00 |
| 1Yr Min Liquidity | $47,360,819.51 |
| Weighted Average Cash Flow Duration | 1.92 |
| Cash (Liquidity Profile) | 17.50% |
| 0-1Yr | 20.68% |
| 1-3Yr | 31.61% |
| 3-5Yr | 30.21% |

| MODEL WEIGHTING | | Target Allocation | Agy and Credit | Agency Portfolio | Treasury Portfolio |
|---|---|---|---|---|---|
| L0US | OVERNIGHT CASH | 17.50% | 17.50% | 17.50% | 17.50% |
| G0QA | Treasury 0-1Yr | | | | 20.68% |
| H541 | Agy Composite 0-1Yr | 10.68% | 10.68% | 20.68% | |
| C01A | US Corp A-AAA 0-1Yr | 10.00% | 10.00% | | |
| G1O2 | Treasury 1-3Yr | | | | 31.61% |
| G1PB | Agy Bullet 1-3Yr | 11.61% | 21.61% | 31.61% | |
| G1PC | Agy Callable 1-3Yr | 10.00% | | | |
| C110 | US Corp A-AAA 1-3Yr | 10.00% | 10.00% | | |
| G2O2 | Treasury 3-5Yr | | | | 30.21% |
| G2PB | Agy Bullet 3-5Yr | 15.21% | 25.21% | 30.21% | |
| G2PC | Agy Callable 3-5Yr | 10.00% | | | |
| C210 | US Corp A-AAA 3-5Yr | 5.00% | 5.00% | | |

| MODEL STATS | Annualized Total Return | Annualized Price Return | Annualized Income Return | Annualized Std Dev Total Return | Avg Yield to Worst | Std Dev Yld | Avg Eff Dur | TR Sharpe Ratio | Yld Sharpe Ratio | Main Street Ratio | *Weighted Rank* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Target Allocation | 2.372% | (0.252%) | 2.548% | 1.091% | 1.719% | 1.417% | 1.576 | 1.207 | 0.545 | 0.490 | 1 |
| Agy and Credit | 2.594% | (0.219%) | 2.743% | 1.275% | 1.712% | 1.410% | 1.809 | 1.207 | 0.543 | 0.424 | 2 |
| Agency Portfolio | 2.452% | (0.076%) | 2.506% | 1.284% | 1.491% | 1.387% | 1.802 | 1.087 | 0.393 | 0.302 | 3 |
| Treasury Portfolio | 2.218% | 0.090% | 2.151% | 1.350% | 1.337% | 1.306% | 1.839 | 0.861 | 0.300 | 0.213 | 4 |

**ICE/BAML Index Data - July 2006 to July 2021*

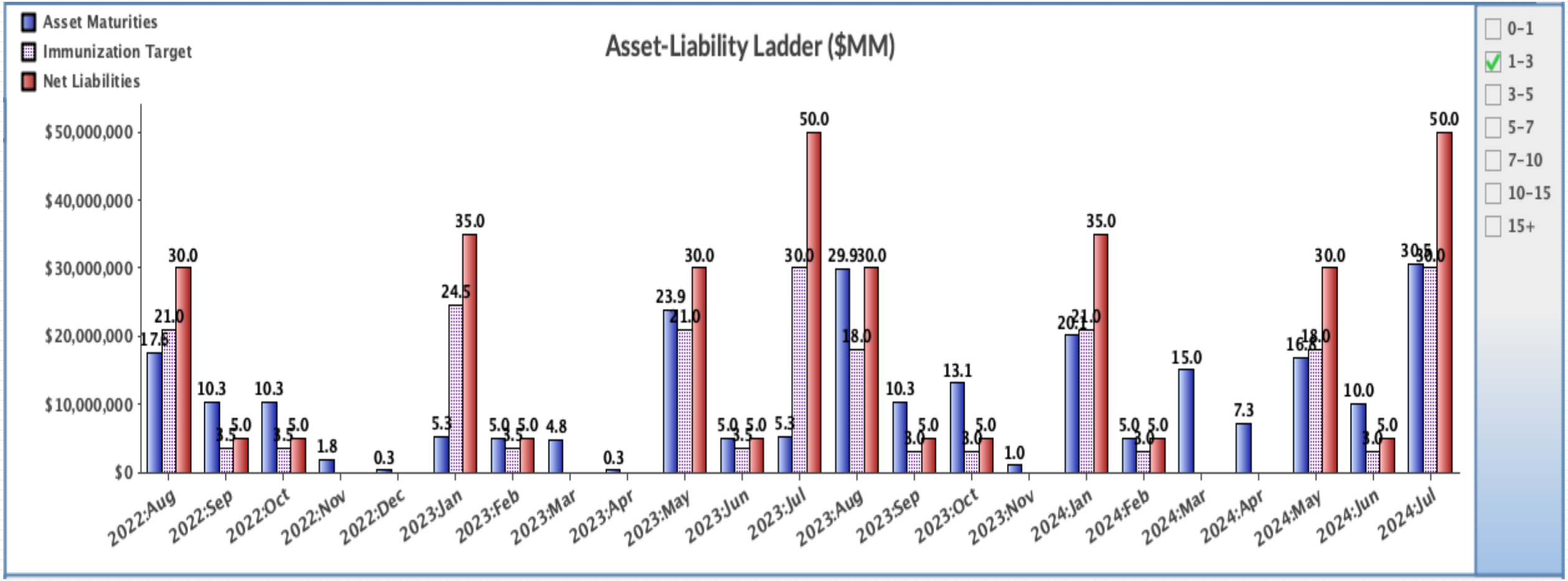
# Cash Flow Based Approach – ALM

*(4 & 5 Year Not Shown)* **Timing of Assets**

| | | NetFlow | PV NegFlow | Assets Needed | 1Yr Liquidity Change | 1Yr Liquidity Rolling Balance |
|---|---|---|---|---|---|---|
| 1 | August | ($2,816,016.20) | $2,813,797.84 | $2,532,418 | ($281,380) | $52,218,620 |
| | September | ($5,986,214.20) | $5,976,786.48 | $5,379,108 | ($597,679) | $51,620,942 |
| | October | ($8,049,693.21) | $8,030,684.44 | $7,227,616 | ($803,068) | $50,817,873 |
| | November | $24,131,838.28 | | | $1,682,127 | $52,500,000 |
| | December | ($11,818,508.50) | $11,767,443.55 | $10,590,699 | ($1,176,744) | $51,323,256 |
| | January | ($14,084,082.35) | $14,011,089.19 | $12,609,980 | ($1,401,109) | $49,922,147 |
| | February | ($3,068,198.25) | $3,048,568.85 | $2,743,712 | ($304,857) | $49,617,290 |
| | March | ($14,099,122.36) | $13,996,081.63 | $12,596,473 | ($1,399,608) | $48,217,682 |
| | April | ($8,639,622.84) | $8,568,621.70 | $7,711,760 | ($856,862) | $47,360,820 |
| | May | $47,707,704.62 | | | $5,139,180 | $52,500,000 |
| | June | $3,713,671.46 | | | | $52,500,000 |
| | July | ($732,993.54) | $724,530.44 | $652,077 | ($72,453) | $52,427,547 |
| 2 | August | ($2,816,016.20) | $2,779,866.49 | $1,959,806 | | |
| | September | ($5,986,214.20) | $5,903,497.88 | $4,161,966 | | |
| | October | ($8,049,693.21) | $7,930,578.28 | $5,591,058 | | |
| | November | $24,131,838.28 | | | | |
| | December | ($11,818,508.50) | $11,615,346.67 | $8,188,819 | | |
| | January | ($14,084,082.35) | $13,827,863.69 | $9,748,644 | | |
| | February | ($3,068,198.25) | $3,007,817.97 | $2,120,512 | | |
| | March | ($14,099,122.36) | $13,807,209.12 | $9,734,082 | | |
| | April | ($8,639,622.84) | $8,451,898.98 | $5,958,589 | | |
| | May | $47,707,704.62 | | | | |
| | June | $3,713,671.46 | | | | |
| | July | ($732,993.54) | $714,372.32 | $503,632 | | |
| 3 | August | ($2,816,016.20) | $2,738,872.78 | $1,917,211 | | |
| | September | ($5,986,214.20) | $5,815,759.42 | $4,071,032 | | |
| | October | ($8,049,693.21) | $7,811,797.51 | $5,468,258 | | |
| | November | $24,131,838.28 | | | | |
| | December | ($11,818,508.50) | $11,430,879.00 | $8,001,615 | | |
| | January | ($14,084,082.35) | $13,606,489.65 | $9,524,543 | | |
| | February | ($3,068,198.25) | $2,957,182.76 | $2,070,028 | | |
| | March | ($14,099,122.36) | $13,572,833.72 | $9,500,984 | | |
| | April | ($8,639,622.84) | $8,307,243.38 | $5,815,070 | | |
| | May | $47,707,704.62 | | | | |
| | June | $3,713,671.46 | | | | |
| | July | ($732,993.54) | $701,302.90 | $490,912 | | |

# Cash Flow Based Approach – ALM

*(4 & 5 Year Not Shown)* **Timing of Assets**



## Cash Flow Based Approach – ALM

### ALM Analysis

- Uses institution's actual cash flow data to measure future liabilities and derive duration needs
- Eliminates bias and idiosyncratic problems that public entities can have with market based approaches (liquidity, sector and structure differences).
- Ensures each institution's duration is unique and not peer or market related.
- Places emphasis on timing and magnitude of investments relative to liabilities versus market based optimizations for the masses.
- Does require more data and effort to establish the projected liability stream and involves calculations that may not be familiar.
- There are opportunity costs associated by limiting the investment universe to any particular timeframe, however it can be argued that maintaining a stable duration and limiting cash balances can more than offset any costs associated with security selection constraints (without this process, cash balances tend to be higher and more conservative securities are purchased due to uncertainty).

# MITIGATING RISK WITH AN INVESTMENT POLICY

**Investment Policy:** Per the GFOA, an investment policy describes **the parameters for investing government funds** and identifies the investment objectives, preferences or tolerance for risk, constraints on the investment portfolio, and how the investment program will be managed and monitored.

By definition, the investment policy creates a "rule" book for investing government funds. It is important to distinguish this from a "play" book that would come from an appropriately designed strategy. The strategy has to abide by the rules, but can be very different fund to fund, even with similar policies in place.

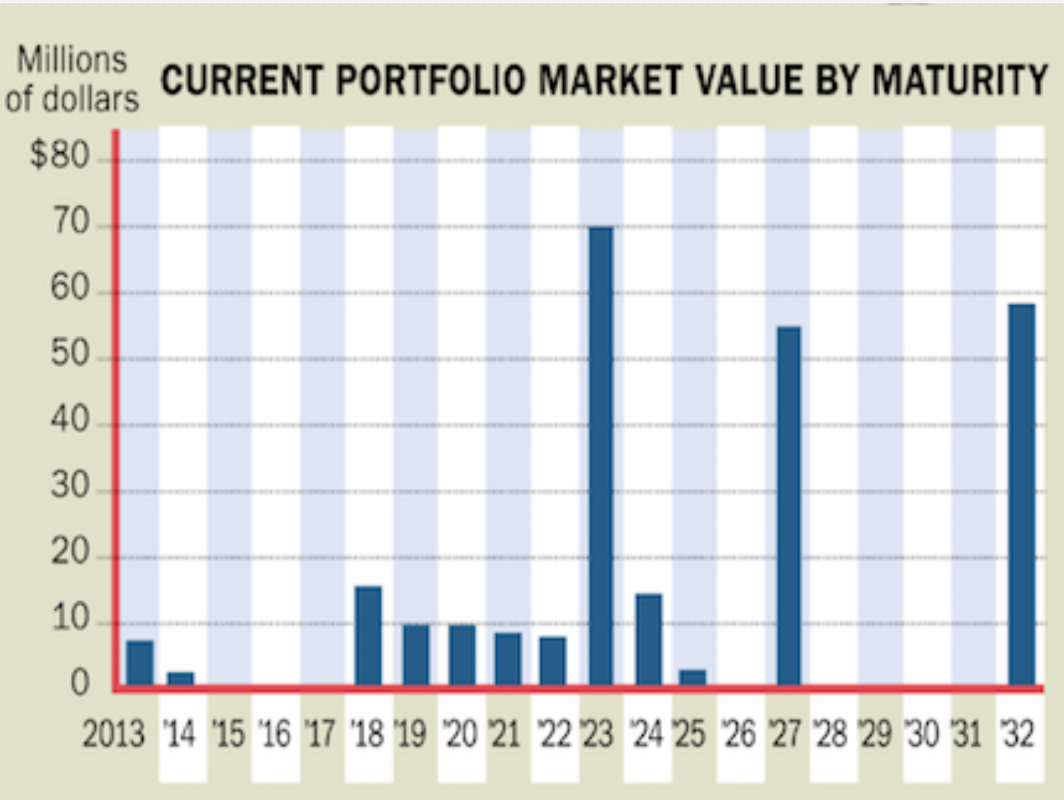
An investment policy exists to ensure that inherently risky behavior doesn't occur regardless of manager abilities, desires or actions. It creates a constrained universe of investments that are typically conservative and fall into the "investment-grade" category.

## What Can Go Wrong?

**Orange County Bankruptcy – Bob Citron (1994)**

- $7.6Bn portfolio ballooned to $20.6 through leverage.
- Many investments were tied to interest rates going down (inverse-floaters). The Fed however kept raising rates.
- Citron had lost $1.64 billion before the county declared bankruptcy and froze all participant funds.
- Citron served one year of work release and 5 years probation as punishment.

# What Can Go Wrong?




**Bernallilo County – Treasurer Manny Ortiz (2013)**

- Majority of portfolio was invested in 5 to 20 year bonds.
- Ortiz spent tens of millions of critical operational liquidity in long callables with the expectation they would be called in a short-time frame.
- Strategy backfired leading to $17 million in losses.
- Was also accused of pay-to-play scheme with his advisor and brokerage coverage.

## What Can Go Wrong?

**Alcona County, MI – Treasurer Thomas Katona (2006)**

- Treasurer for 13 years, Invested $1.2 million in Nigerian e-mail scam. This sum accounted for around 25% of the annual budget of the county.
- Katona was warned multiple times by the bank that his wire-transfers were a scam and to stop sending them.
- Katona invested $72,500 of his own money and even flew to London to meet the scammers to ”finalize” the transaction.
- Was found guilty of 9 counts of embezzlement and 2 counts of forgery. Katona spent 10 years in prison.

# Investment Policies – Practical Applications

**Investment Policy vs. Internal Limits**

- Consider structuring a policy that allows flexibility while maintaining tighter internal policies. Keep yourself out of compliance jail.
  - Effective Duration vs. WAM and Limits
  - Credit Rating Minimums
  - How to Handle Downgrades – process for reporting
  - Lower Policy Liquidity Requirements
  - Improve or Implement Robust Compliance Forecasting
  - Consider Clarifying "Time of Purchase" (Don't assume auditors understand anything)
  - Know your audience – be aware of sensitivities of Treasurers, Supervisors/Council, Constituents etc.

**Safety, Liquidity, ~~Yield~~**

- No one has gotten fired for having too low of yield (probably true).
- The greatest risk we face (most likely) is not from a credit event but selling securities at a loss due to miss-managed liquidity.
- Never factor in expected call dates to fill cash flow needs.

# Investment Policies – Practical Applications

Month End Projections

| | | January | February | March | April |
|---|---|---|---|---|---|
| Expected WAM | | 644 | 646 | 627 | 602 |
| Projected Month End WAM | | 1.76 | 1.77 | 1.72 | 1.65 |
| Expected Book Yield | | 0.95% | 0.96% | 0.96% | 0.95% |
| Expected Portfolio Value | | 4,924,236 | 4,983,021 | 5,172,316 | 5,377,911 |
| Aging | | | | | |
| 0-366 Days | | 39.62% | 42.57% | 45.18% | 47.27% |
| 367-1097 Days | | 37.29% | 35.84% | 34.60% | 33.28% |
| 1098-1827 Days | | 23.09% | 21.59% | 20.22% | 19.45% |
| Sector Distribution | | | | | |
| | Max | | | | |
| Agency | 75% | 19.27% | 19.04% | 18.34% | 17.27% |
| MTN | 30% | 13.05% | 12.50% | 11.69% | 11.24% |
| CP | 40% | 3.55% | 2.50% | 1.45% | 1.39% |
| YCD | 30% | 11.29% | 9.15% | 8.82% | 8.48% |
| Supra | 10% | 4.59% | 4.34% | 4.18% | 4.02% |
| Callables | 20% | 3.47% | 3.43% | 3.30% | 3.18% |
| JPA | 10% | 4.74% | 3.98% | 3.16% | 0.53% |

## Internal Controls – Best Practices

# Treasurer: More than $19 million stolen from schools

BY JAMES BURGER jburger@bakersfield.com Mar 7, 2017 Updated Oct 12, 2018

A staggering $19 million was stolen from clearing accounts owned by the Kern Community College District and the Kern County Superintendent of Schools office, Kern County Treasurer-Tax Collector Jordan Kaufman announced Tuesday.

## Internal Controls – Best Practices

**What went wrong?**

- Personnel changes at outside agency were not communicated to Treasurer resulting in new employees not having access to statements.
- Failure out outside agencies reconciling their ZBA accounts – assumed it was being done by someone else.
- Vulnerability in bank accounts due to product change.
- During annual audits involving all parties, fingers were pointed and blame was shifted while outside auditor looked away (not auditors because it was the same firm!). The County thought the Schools were reconciling, the Schools thought the County was reconciling…

## Internal Controls – Best Practices

**Improvements we implemented and other best practices**

- Semi-annual review of all accounts and services with our bank, ensuring all products are appropriate and no vulnerabilities exist or any changes were made (more frequent and more detailed).
- Semi-annual list is sent out to each department/agency listing their accounts, services, users and their access as well as any changes we suggest.
- Now require monthly reconciliations by outside agencies – don't assume or leave it up to auditors (internal or external).
- New (and different) outside Auditors were hired by all parities.

# Internal Controls – Best Practices

**Other Best Practices**

- Ensure that all accounts have appropriate fraud prevention products and services.
  - Positive Pay and Payee Validation or $0 threshold.
  - ACH Fraud Filter with dual control needed for exception items and independent verification on ACH Company ID.
  - Dual Control for all functions for both outgoing payments, template creation/maintenance as well as online user access for all accounts (operating, custody, JPAs, MMMFs etc.) and payment systems.
  - Be aware of business compromise email attempts. Independently verify wire instructions for all vendors/debt service.
  - Routinely verify that proper staff have access to required reporting.
  - Be aware of SFTP payment processes and vulnerabilities, both administratively and technologically. The less time the file sits on your servers the better and be sure to immediately terminate access for employees who are resigning.
  - Have policy in place for last minute/emergency payments – don't get tricked by urgency.
  - Lastly….RECONCILE, RECONCILE, RECONCILE – NACHA rules only give commercial accounts 24 hours for reclamation of funds. If you only reconcile once a month, it's already too late.
  - If possible, have separate auditing firm for County and outside agencies.

# Questions?

**Jason Klinghoffer, CFA**

Director, Debt Capital Markets, Mischler Financial Group

jklinghoffer@mischlerfinancial.com | (913) 244-7101

**Bret Black**

Principal Treasury Investment Officer, County of Kern

blackb@kerncounty.com | (661) 868-3415

# THANK YOU

We look forward to your participation in the next webinar in this series:

***Developing a Benchmark***