

## California Debt and Investment Advisory Commission

### Webinar Transcript *Understanding Benchmarking* February 28, 2019

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#### **Title Slide – Understanding Benchmarking**

**ROBERT BERRY:** Good morning, everyone and welcome to the California Debt and Investment Advisory Commission's webinar, *Understanding Benchmarking*. My name is Robert Berry, and I'm the deputy director here at CDIAC. Before proceeding further, if you experience technical difficulties, please contact GoToMeetings at 1-877-582-7011 or you can try their website at the address on the screen. They have some troubleshooting tips there that could help you if you're having technical problems.

*Understanding Benchmarking* is a webinar built from a well-regarded session presented at CMTA and CDIAC's *Fundamentals of Public Funds Investing* program we had back in January in Riverside. Our presenter today will cover the purpose, development, and use of benchmarks; their benefits; and the evaluation of a portfolio against a benchmark developed in an Excel model that you can use.

The presentation slides for today's webinar, which include the Excel workbook files that our presenter will be using today, are available in the Handout section of your control panel, and we will also post them on our website following the webinar for download. If you would like to review the webinar at a later date, a replay will be posted in our library of webinars on the CDIAC website in about two to three weeks.

Now, benchmarking was a single subject among 14 sessions that we covered over the two-day *Fundamentals of Public Funds Investing* program. If you were not able to attend the program back in January, all of the presentations, including part of the presentation today, are available for download from the CDIAC website. CDIAC also has a variety of other public investment management resources available to you on our website. Some of the most notable include the updated 2019 Edition of CDIAC's *Local Agency Investment Guidelines* and the *California Public Fund Investment Primer*. Both are currently linked on CDIAC's main web page in the lower left column under Featured Publications. There are also quite a number of investment-related topics covered in our webinar library, including most notably our 2015 webinar series on each investment permitted in the California public investment portfolio. It's called *A Step-by-Step Examination of Public Investment Securities*.

If you would like captioning during the program, click on the link in the Chat section at the bottom of your control panel. Also if you would like a certificate of attendance for CPE credit, you must be registered and logged into the webinar under your own name, and a certificate will be emailed out to you in about a week.

Now, we encourage you to submit questions during the webinar using the box in the control panel marked Questions near the very bottom of the panel. You may submit questions at any time, and we will address them periodically during the session, or we may hold them until our question and answer session just prior to conclusion of the webinar. If we run out of time for all the questions, we will follow up with responses on the CDIAC website.

## Slide 2 – Welcome

03:31

**ROBERT BERRY:** So before I introduce our presenter today, I would like to introduce a special guest that has joined us this morning to make some welcome remarks. That would be CDIAC chairperson and Treasurer of the State of California, Fiona Ma. Treasurer Ma.

**CALIFORNIA STATE TREASURER FIONA MA:** Thank you, Robert. It is my honor to be here, and I look forward to meeting you all in person at future CDIAC educational events. I started in public service in 1995 as a staff to former California State Senator John Burton. In 2002, I got elected to the San Francisco Board of Supervisors and then served in the State Assembly from 2006 to 2012, and then in 2015 was elected to the State Board of Equalization, where I worked closely with assessors in 23 counties in my district. So as you can imagine, I have a soft spot for local government. Prior to being elected to treasurer, it was one of my top priorities to have an outreach in education program to local governments around public finance and investing public funds. So I was excited when I was briefed by Mark Campbell and Robert Berry and his team on all the work they do here in CDIAC, and I would like to thank Kevin Webb, our expert here today, who let us know – let me know – that CDIAC is a great resource for the state of California.

So I am very happy that we are all here today and that the Treasurer's Office is actively interfacing with local governments. It's our duty to be accessible to you and support you in whatever we can. Again, I want to thank Kevin Webb for his time today as our expert talking about understanding benchmarking, and I want to thank you, the participants, and commend you on your commitment to continuing education. If you need to reach me, my phone number is 916-653-2995 or my email is [fiona.ma@treasurer.ca.gov](mailto:fiona.ma@treasurer.ca.gov). Thank you very much, and I hope you have a successful webinar.

## Slide 3 – Understanding Benchmarks

05:46

**ROBERT BERRY:** Thank you very much, Treasurer Ma. Now, I would like to introduce our presenter for today, Kevin Webb. Kevin is a CFA and principal at Piper Jaffrey. Kevin joined Piper Jaffray as a principal in 2018. With over a decade of experience, Mr. Webb has been a guest lecturer and speaker at several fixed income workshops and conferences, including our recent investment fundamentals course in January. He holds dual degrees in computer science and finance, a master's in business administration, and the Chartered Financial Analyst designation. Mr. Webb is a member of the CFA Institute and the Global Association of Risk Professionals. So here we have *Understanding Benchmarking* with Kevin Webb.

**KEVIN WEBB:** Thank you, Treasurer Ma and CDIAC, for hosting this and good morning, everyone. For those that attended the conference in Riverside, this first portion of this presentation is going to be a 50,000-foot overview of the material that we did in the first session of the two sessions on understanding benchmarks at the conference last month. What we're going to do in this webinar is what we couldn't do live at the conference with everyone, and that is, delve into some spreadsheet solutions that can flesh out some of these concepts. So this first part is going to

be 30-40 minutes of a review, so if you didn't attend the conference in Riverside, it should give you enough material to see exactly what is it that we're trying to get Excel to help us solve, what questions are we getting it to answer. And if you were, it won't be so long that you fall asleep and wonder when we're going to get to the good stuff.

#### **Slide 4 – Philosophy, Strategy & Tactics**

**07:26**

**KEVIN WEBB:** So first off, I like beginning every one of my presentations with this slide, whether I'm the presenter or if I'm attending a conference or a webinar like you are today, or reading a book or a magazine article. I want to know where it fits in the scheme of things and I love visualizations. And who doesn't love a great Venn diagram? And I believe the subject matter when it relates to portfolio management, whether it's in the private sector or a public fund, can be divided into three spheres. Philosophy: this is just the big picture and most important of these three spheres. What's your definition of risk, what's your definition of return, how do you view market efficiency, investor behavior. These are the big picture concepts that will affect everything you do. If you don't decide them for yourself and educate yourself to them like you are by attending this webinar and the various CDIAC conferences, then it's likely someone will decide them for you.

And once you have an investment philosophy, there are Strategies and Tactics, where strategy is a plan of action or policy designed to achieve one or more goals almost always under conditions of uncertainty, and tactics would be the resources and the methods used to achieve that goal or strategy. The difference between tactics and strategy is, strategy is done above the shoulders and tactics are done below the shoulders.

Now, this session here is going to involve heavily the philosophy, and then when we get to the spreadsheet portion, I'm going to show some tactics – how you would use certain resources, in this case Excel, your access to Internet and publicly-available data to help you hone in on your own risk-reward preferences made manifest in your suitability benchmark.

But before we begin, what I want to do is – I told you what we're going to talk about – I want to learn a little bit about who I'm speaking to today, and this webinar has a great facility for taking polls where we can ask you in the audience questions. So the first question and poll – this will pop up on your screen...

#### **Poll Question Open for Responses**

**09:41**

**KEVIN WEBB:** ...and you will be given an opportunity to choose one of the answers – is: do you budget gains or losses? And there's three options there, yes, no, and not sure. I'll give everybody a second to respond to that. I see all of you filling in the answers there.

#### **Poll Results**

**10:15**

**CALIFORNIA STATE TREASURER FIONA MA:** What was the question again?

**KEVIN WEBB:** Do you budget gains or losses? What I mean by that – do you budget gains or losses in the portfolio? You have the portfolio of securities in your general fund. If there are losses, do you budget those losses and take account for them through the income statement? Or do you budget the gains? Can everybody see the results? Okay, so I'm seeing the results – 27% said yes,

they do; and 60% said no; and 13% are not sure. Oh, perfect. Excellent. The second question I would like to ask is, do you spend the income from the portfolio?

**Poll Question Open for Responses** 11:04

**KEVIN WEBB:** Give everybody a second to answer that question. We'll give everybody one second more to answer that one, and I promise one last polling question after this.

**Poll Results** 11:32

**KEVIN WEBB:** Here we go. We have 65% saying yes, 29% say no, and 6% not sure. The last question to open up this talk is...

**Poll Question Open for Responses** 11:57

**KEVIN WEBB:** ...do you manage the portfolio externally? That is, do you have a money manager/investment advisor, or do you manage it internally, or are you not sure? We'll give everybody one second to answer that.

**Poll Results** 12:20

**KEVIN WEBB:** Excellent. Thank all of you for participating in the polls. All right.

**Slide 5 – Understanding Benchmarks -- Concepts** 11:33

**KEVIN WEBB:** So what will we cover today? Well, this is what's on the agenda. We're going to talk about a few assumptions and definitions. It's always good to define our terms to make sure we're all on the same page. Then, I'm going to give some examples of benchmarks and indexes, and that will be very brief. And then, we're going to ask the question: what should I be benchmarking? I'm going to go to some source materials that all of you are familiar with and have access to and offer some suggestions and recommendations on that. Then, how should I benchmark? So after I figure out what I'm going to benchmark, how should I do it? And then finally, we're going to go to the spreadsheet workshop – the real reason for doing this particular webinar – so we can delve more deeply into an example of how this can be made manifest by using Excel and resources you have at your fingertips.

**Slide 6 – Warning: Assumptions Ahead** 13:25

**KEVIN WEBB:** Warning – some assumptions ahead.

**Slide 7 – Risk Defined** 13:30

**KEVIN WEBB:** Now, my favorite definition of risk is in a little bit of a witty book, *The Devil's Financial Dictionary*. There's a lot of wisdom there in the humor, and this one on risk just means more things can happen than will happen. And I like this definition because it reminds us that when you are dealing with investments, you're taking risk for a reason. If risk just meant loss, of course, no one would do it. People take risks, put principal at risk – whether it's in your retirement portfolio and you do equities, or if it's a general fund like public funds are allowed to do here in fixed

income – you’re taking risk because there's some upside. No one is just putting their money at risk with the assumption of a loss. If you know statistics, think of a histogram and there are some returns that are greater than others. And that's the point – we hope to earn more on the upside than we put at risk and lose on the downside, although there are no guarantees.

#### Slide 8 – Risk & Return are Related

14:28

**KEVIN WEBB:** And then my favorite definition of risk and return comes from a book by Peter Bernstein called *Against The Gods: The Remarkable Story of Risk*. Many people learn in different ways. One is how ideas have developed, and Peter Bernstein in this book talks about the development of the idea of risk all the way from the Greeks, through the Renaissance, up to today. But he opens the book in a way that you probably should never open up any presentation, and that is, with a quote from an obituary. This one is Arthur Rudolph’s. He was one of the scientists who worked on the Saturn 5 rocket program, and this a quote from his obituary in '96 from *The New York Times*. And I think he phrased it in a way using an analogy that just works for me, and it describes, really, the dilemma facing every portfolio manager, and that is: you want a valve that doesn't leak and you try everything possible to develop one, but the real world provides you with a leaky valve. In the end, you have determine how much leaking you can tolerate. And that's really the dilemma that faces those of you who manage your portfolios.

#### Slide 9 – Definitions

15:30

**KEVIN WEBB:** So let’s begin with some definitions. Now, this is from my mother: “Knowledge is knowing a tomato is a fruit. And wisdom is not putting it in a fruit salad.” So we want to define our terms, know what they are and then make sure we're using them correctly.

#### Slide 10 – Benchmark

15:44

**KEVIN WEBB:** The first term I want to look at, which is the root of the title of this talk, and that is, a benchmark. What is a benchmark? The working definition I’m going to use is “a standard by which something can be measured or judged.” I think that's fair and the standard understanding of what “benchmark” means. Now, this is *Understanding Benchmarks* and what happens and what we will discuss is flesh out where “benchmark” and where “index” differ.

#### Slide 11 – Index

16:13

**KEVIN WEBB:** Well, what’s the definition of “index?” So as you can see “index” has a lot of definitions. I’m going to use a combination of a couple here. The first one I like, it’s “a numerical scale used to compare variables with one another or some reference number.” And then looking at the second one, “usually to track relative changes as a function of time.” So benchmark, that's how we can judge something, and then an index will be a numerical value that compares one variable to some reference number and usually across time.

#### Slide 12 – Benchmark/Index Examples

16:46

**KEVIN WEBB:** So when we look at the terms – now, this is not to scale but “indices” is an older word and has more uses and “benchmark” is a newer word with fewer definitions – and where we

run into a problem is where these two come together. When benchmarks are used as indices and indices are used as benchmarks. And I want to flesh that out with a few examples.

### Slide 13 – Pure Benchmark Example – The Taylor Rule

17:13

**KEVIN WEBB:** So I want to look at an example of a pure benchmark. The one that comes to mind as the most popular is the Taylor Rule. A professor from California, John Taylor, introduced this in 1993. If you're having trouble sleeping, that blue underlined link is a link to his original paper, which is fascinating and makes for great bedtime reading. But what the Taylor Rule does is, it's a benchmark that says what ought to be. And the Taylor Rule describes what the Federal funds rate should be. It is not an index in the sense that you're comparing it to a basket of goods or values across time, although you can see in this graph here, we compare in the blue the Taylor Rule prescription, prescription meaning if you use the Taylor Rule, what the Taylor Rule says Fed funds should be, and then the green line down here, where the Fed funds rate is at. And the Taylor Rule just recently said that the Fed funds rate is too low, if you believe in it. Now, this is not an argument that the Taylor Rule is a great benchmark for Fed funds. This is only to show you of something that acts as a pure benchmark. It really doesn't act as an index that compares a set of values numerically to themselves across time. Now, what's an example of something that I think would be just a pure index?

### Slide 14 – Pure Index Example – Christmas Price Index

18:33

**KEVIN WEBB:** Well, one of my favorites – and a shout-out to our friends at PNC Bank – they have something called the Christmas Price Index, and what this does, and it's like any index, is it takes a basket of goods, in this case the goods are every item that appears in “The Twelve Days of Christmas” song, from the pear tree all the way to the swans-a-swimming. And what they've done is they've priced all those items up in the Christmas index song, “The Twelve Days of Christmas,” producing this Christmas price index and track the value of it over time. So as an index, it tracks a basket of goods over time. You can see that the value in the Christmas Price Index – and this is the core one, we'll explain the difference here really quickly – it tracks it over time.

Now, I don't think this would be a great benchmark for anyone on their Christmas spending. Maybe if you're extremely wealthy or you won the Powerball, you could benchmark your Christmas spending to the increase in value in the Christmas Price Index. And like any good index – you're probably familiar with the CPI and how the Fed uses the CPI, the Consumer Price Index, as a gauge for tracking inflation. They use something called the Core CPI. There is also a Core CPI for the Christmas Price Index, where there is apparently a problem pricing the twelve swans-a-swimming, and so they reduce it. This one here without the swans is just the value of each item once as it appears in the song. And of course, this one here is all the items along with the number of times it appears in the song. This is the one example I could find that I thought was a great example of an index that tracks the value of a basket of goods over time that probably is not practical for anyone to use as a benchmark.

And by the way, if you have any questions as I am talking, please submit them and we will try to address them.

### Slide 15 – Index as Benchmark Example – Big Mac Index

20:34

**KEVIN WEBB:** And the last one is an index that also works well as a benchmark. And in 1986 the economists created something called Big Mac Index. It discusses a theory called purchasing power parity. The idea that if you have the same good with the same inputs in different places, it should cost the same theoretically to do it. This is a great tool that a lot of people use to answer questions. Is a, for example, currency overvalued or undervalued? So in this example here from *The Economist* website, and the link is down here if you want to go look at all the details and the data, it's asking the question: is, for example, the Chinese yuan overvalued or undervalued? So what they do is they take the goods, and you can see that the price is \$3.17 at this time in January 2018. In yuan, that's 20.4 yuan. So the raw index is saying it looks to be undervalued by 40 percent because the actual exchange rate is 6.43. But the implied exchange rate using the Big Mac Index with the theory of purchasing power parity behind it is really 3.86 yuan per dollar.

So those are the three examples there: a pure benchmark, the Taylor Rule; an index that that doesn't really work well as a benchmark for anything, the Christmas Price Index; and then the Big Mac Index, an index that also does work well as a benchmark.

### Slide 16 – What Should I Benchmark?

22:14

**KEVIN WEBB:** So the question is for us: what should I benchmark? And I told you I love visualizations, so I took the GFOA sample investment policy and produced a word cloud for it where the size of each word, not articles and everything, is directly proportional to the number of times it appears in the document. It's a great way to analyze important themes across books or speeches. And what I have here is the general objectives from that GFOA sample policy. My assumption is that most of you have an investment policy that looks something like the GFOA sample investment policy. So this will be a link right here – if you are not familiar with it, we can go to the GFOA website and pull up that sample investment policy. But most of you probably have a section under General Objectives that states something to the effect that the primary objectives of investment activity are safety, and that is, that the objective will be to mitigate credit risk and interest rate risks – and that's mitigate, not eliminate. Then liquidity – an investment portfolio should remain sufficiently liquid to meet all operating requirements. In other words, you don't want to be selling bonds to pay an obligation. And then the third and final one is usually labeled “return” or “yield” or “income,” but the idea there being that you need to earn a market rate of return throughout budgetary and economic cycles. More on that in a minute. There's a lot of wisdom in that one statement.

And so we're using the prudent investor standard now, and many people may still have the prudent person standard in their investment policy. Quick differentiation, a prudent person looks at each individual investment. A prudent investor looks at the overall portfolio. But they both have one thing in common and that is to be prudent. And so if these are the general statements from our governing documents, whether it's state code as made manifest in an investment policy and the idea we should be prudent investors and use the prudent investor standard when making decisions about the portfolio, what I think we are looking at are five points of suitability, where I think suitability should act as the benchmark.

### Slide 17 – What Measures to Benchmark?

24:31

**KEVIN WEBB:** What do I mean by that? The first point is liquidity. We want to have a responsible amount of liquidity to reasonably ensure that the bond gods are neutered. Now, what

do I mean by that? If you're not familiar with the bond gods, the bond gods hate a lot of people. They hate public fund portfolio managers more than most, and they think they can get you coming or going. What they want to do is to make sure that if you're aggressive and always counting on selling a bond to pay an obligation – as soon as you have to do that, you didn't maintain your liquidity, in this case, cash. Notice that in the investment policy, in the GFOA sample, it means something different by liquidity – it means cash – than what on my side of the Street we would mean, which is a type that offers spread. So what we mean here, liquidity, we mean cash. And to the bond gods, if you don't keep enough cash on hand to pay obligations and are counting on selling that bond when you have to, they're never going to let you sell it at a gain. They're always going to make sure you sell it at a loss.

And the other side is, if you think that you have them that way and you are going to keep a lot of liquidity so you never have to worry about paying an obligation by selling a bond, they want to make sure that you lost income that could have benefitted your stakeholders, your citizens and your constituents. So we want to have a responsible amount, enough to reasonably ensure we have enough money to pay ongoing obligations. And to do that, we want to have the appropriate level interest rate risk. The term we use in the fixed income markets is duration. Duration is a risk term. It's not how much longer is this talk going to go. It's how much interest rate risk is in my portfolio given changes in the level of interest rates in the market.

So back of the envelope – if I have a \$100 million portfolio and a duration of one, and Fed Chairman Powell walks across the street and says, “All hope is lost” and rates rise instantaneously one percent, or 100 basis points, and my duration is one, I would assume I was going to lose one percent of my value with a duration of one. If I had a duration of two, I would assume I was going to lose two percent of the value instantaneously. And vice versa. If rates dropped 100 basis points or one percent, I would assume the duration would indicate the market value of our portfolio would rise one percent. That doesn't mean anyone's going to write you a check. It's just the market value on your reports, and the change in market value from the moment that rates rose from where they were unchanged, they rose or from when rates were unchanged to when they dropped.

The third thing we want to make sure is we have the appropriate level of credit risk. There are a lot of great talks that CDIAC has where they've done on credit analysis and advanced credit analysis. I would encourage you to check those out. We will use right now as a level of indication of credit risk, weighted average, and we will get to that when we get to the spreadsheets – a weighted average credit risk on the portfolio. In California, the state code dictates any bond you buy from any issuer has to have at least an A2 rating by one of the nationally recognized statistical rating organizations. But what we are concerned about here is, what do we want the overall credit rating of the portfolio to be?

Next, we want to make sure that we're earning a market rate of return through budgetary and economic cycles. Now, I said there's wisdom in that statement. The wisdom in that statement is that most investment policies don't say you always have to have a gain, or you can never have a loss, or you always have to meet X. You just says that you need make sure that you're earning a market rate of return through the cycles, whether it's in the economy or your budget, by the explicit recognition there's going to be ups and downs in the market and your job is not to out-predict it. If you could do that, you wouldn't be on this call and I would be serving you lattes on your private island. Since you can't do those kinds of things, you want to manage the portfolio in a way that ensures that you have sufficient liquidity, you have appropriate interest rate risk as manifest in



duration, you have an appropriate level of credit risk, and that you're earning that market rate of return through budgetary and economic cycles. And of course, the fifth one is – it goes without saying, this is either on or off – you can't have illegal investments in the portfolio, so you need to be familiar with state code. As Robert pointed out, CDIAC has some great documents, investment guidelines you should look at, and there's tables in there to give you an indication of allowable investments. Any questions there?

**Slide 18 – How Should I Benchmark?****29:15**

**KEVIN WEBB:** Okay. Moving on. So how should I benchmark? Well, what I want to look at here is a couple of things. 1) Use an index or benchmark individual risk-reward measures. And before I do that, I wanted to ask two more polling questions to get a sense of where you as an audience are already, and managers, if you touch the portfolio tangentially, where your institution is at.

**Poll Question Open for Responses****29:46**

**KEVIN WEBB:** So the first one I want to ask is: what kind of benchmark are you currently using? And the options are a) LAIF – that's the Local Agency Investment Fund. Maybe you're using that return as a benchmark; b) U.S. Treasury. Maybe you're using a U.S. Treasury like the three-month T-bill or the two-year Treasury, or a 12-month moving average; c) or maybe a fixed income index as provided by one of the index providers. For example, the one-to-five government index; d) Maybe you're using something else; or e) nothing at all or you're not sure. We'll give everybody a moment to answer this.

**Poll Results****30:33**

**KEVIN WEBB:** Excellent. And they can see the results on the screen? Excellent. So everybody sees this. So 31% of you answered LAIF; 27% Treasury; 13% said you're using some kind of fixed income index; 4% of you said something else; and 25% none/not sure. Excellent.

**Poll Question Open for Responses****31:01**

**KEVIN WEBB:** Second question is: of the following metrics that I went over on the things that we should benchmark, which one do you believe is most important? Liquidity; interest rate risk (duration); credit risk (credit rating); market rate of return, in this case book yield; or none of the above. We'll leave that open for a minute.

We'll give everyone one more second, and then we'll move on.

**Poll Results****31:45**

**KEVIN WEBB:** Excellent. Thank you. So how should I benchmark? Well, there's prevailing in the markets – I'm coming from Wall Street and have a CFA – and...

**Slide 19 – Markets: Equities = Indices / Bonds = Yields?****32:02**

**KEVIN WEBB:** ...one of the answers is to use a fixed income index as representative of how we're going to benchmark our risk-reward preferences for our portfolio. And before I get into that, I want to make a distinction here because when we all talk indices, there can be some confusion, especially if we're dealing with equities or we're dealing with bonds. I got my start in the business at Lehman Brothers, which had the old Lehman indices, but the problem is that most don't have that background. This is from the *Financial Times* the other day, but if you watch the evening news when they talk about the markets and they talk about equities, they use indices. Notice at the top here, when they're talking about the equity indices – the S&P 500, that's an index; the FTSE 100 – but when we talk about bonds, that tends to happen in the common vernacular is they talk about the yield, usually specifically, the yield on a ten-year Treasury, and there's a reason for this. Mortgages in our country are tied to the ten-year Treasury or you hear about the Fed funds rate, but they don't talk about a basket of goods – an index, if you will – like they do with the S&P 500 or the Dow Jones Industrial Average or an equity index.

### Slide 20 – Bond Market Indices Overview

33:16

**KEVIN WEBB:** But when you manage a portfolio like many of you are doing and you're using a fixed income index as a benchmark, or there's an advocate saying that you need to or there's a push to do that, or your portfolio is being compared, it's not usually compared to the ten-year Treasury or a specific yield. It's compared to a fixed income index. Now, this is an old page from one of the last publications I got before Lehman Brothers went under, and that is from one of their great publications they put out every quarter on fixed income indexes. And this is a map of the fixed income index universe. There will be a quiz on this afterward. Please memorize it quickly. Just kidding.

What it shows here is that there's a lot of different ways to think about the fixed income markets, and the point is not that we need to know anything particular here, but that these fixed income sectors can tend to be specialized. So which one you pick to manage your portfolio against or compare your portfolio to can have significant implications on 1) how you are doing and 2) then what kind of investment style you will engage in.

### Slide 21 – Bond Market Indices are Rule Based

34:25

**KEVIN WEBB:** What I would like to point out and really the important page – and this goes all the way back to the philosophy, strategy and tactics that I had at the very beginning – is that Lehman had at the beginning of their global family of indices something that you learn in the CFA or you learn in graduate school, and that is, every fixed income index is rule-based. That means there's a set of rules that decide which bonds are included in the index and which aren't. And that can have profound implications. I mean, we could create a fixed income index that's the bonds that Kevin likes, and every month at the end of the month, I decide I like these bonds and I don't like the other ones, and that would be a valid index. The rules aren't very precise, though, and it would be hard to manage against it.

What happens here is we end up with rules that say things like bonds from one-to-five years whose outstanding value is above a certain amount, usually 250 million or greater; that it has a certain credit rating; that it is either a U.S. domestic or foreign; and so one and so forth – there is a set of characteristics that will be defined by these rules, and if the bond doesn't meet it, it doesn't get included. If it does, it's in. And what happens is, that rebalances at the end of each month, and then

your portfolio is compared against that index if you are using this fixed income index as a gauge and as a benchmark for your portfolio.

### Slide 22 – Problems Using Bond Indices as Benchmarks

35:53

**KEVIN WEBB:** I think there are several problems in using a fixed income index as a benchmark, and I want to go through those very quickly. They devolve down into what is called the “bums” problem and the duration problem.

### Slide 23 – The Duration Problem

36:09

**KEVIN WEBB:** And the duration problem means.... Let me ask you this: how many of you were on the call that Apple held asking you what bonds you would like them to issue and in what amounts and at what maturities? Well, probably not many of you – not that they don't care but Apple in particular, companies in general, including our agencies – Fannie, Freddie, Home Loan Bank, Federal Farm Credit Bank, all the way to the U.S. Treasury – issue debt in amounts and maturities that in the companies’ terms minimize their cost of capital. It's not to optimize your portfolio's risk-reward preference. It's to minimize their cost of capital and issue debt that's to their benefit. So when you look at fixed income index, if every bond issued by all these different companies in that index have this property that these bonds were issued in a way to optimize something, whether it's the cost of capital or whatever it is for that particular company or entity, then the entire index with all those bonds has that same property. So what do I mean by that?

“Because the benchmark duration is a historical accident, the optimal portfolio for an investor with no defined time horizon should be set by that investor’s risk tolerance rather than by matching the duration of the benchmark,” because the duration of the benchmark is what was optimal for the issuers of the bonds.

### Slide 24 – The “bums” Problem

37:43

**KEVIN WEBB:** The second problem is the “bums” problem. What do I mean by that? So when you're comparing your portfolio to a fixed income index, you are usually either comparing your differences in sectors, whether it's corporates or callables or bullet agencies or Treasuries, your portfolio's allocations of sectors is being compared to the sectors that are in that index. But the problem is that the index sectors – in this case, think of the corporate allocation or agency allocation or Treasury allocation – is the biggest because it's who has borrowed the most money and “because the issuers who manage to go the deepest into debt – the biggest bums – have the largest weights in a cap-weighted benchmark,” – this is a technicality – “such a benchmark is not likely to be mean-variance efficient.”

Now, before your eyes glaze over and you go to sleep, when I'm saying “mean-variance optimal,” what this means is.... Let me give you an analogy. If I won the lottery and was going to distribute a portion of the winnings across my relatives, I probably would not apportion the highest amount to the relatives who borrowed the most from me. But that's what you are doing when you match your sector weights in a fixed income index. So for example, I used Apple earlier. We weren't on the call because they issued the bonds and amounts and maturities optimal for them. But the downside to a fixed income index vs., let's say, the Dow Jones Industrial Average, which Apple is part of, or the S&P 500 or the NASDAQ, is Apple's relative weight in those equity indexes is

much higher than the relative weight in a fixed income index. And that's because there's a difference between ownership in equity and debt, and it manifests itself known as the “bums” problem and the duration problem.

I'm not saying it's bad objectively if you're running your portfolio against a fixed income index. I'm only saying that you have to realize if you're using a fixed income index as your benchmark, you have outsourced your risk-reward preferences to the borrowers of money, and I think that there's probably a better way to do it, and that's using that suitability benchmark with those four points of suitability that I mentioned earlier.

#### **Slide 25 – Suitability Benchmark Process**

**40:07**

**KEVIN WEBB:** So that process looks something like this. You determine liquidity by examining your historical cash flows. Then, you look at interest rate risk and decide what interest rate risk you find optimal and tolerable, not one that's in an index because an index's duration will change based on the amount of borrowings and who has done it and what the average maturity is. Then, you determine the appropriate level of credit risk, not based off of who's borrowed the most money or what the credit risk of the index is, but off what credit risk your institution feels comfortable with. And then, of course, determine what market rate of return you would like to see in the portfolio. And I think that's a circular process that gets revisited at least once a year, and you create a benchmark with the numbers for these four items, and that becomes your suitability benchmark. You don't use these risk-reward metrics from the fixed income index to decide that for you. You decide it yourself and then manage your portfolio accordingly around it.

#### **Slide 26 – Visualizing the Portfolio versus the Benchmarks**

**41:10**

**KEVIN WEBB:** So how would you view that, though? The problem is, the benefit to a fixed income index is it's easy, you know. There are index providers – they provide you the total return, they provide you all the allocations, you compare your allocations against those allocations and those total return numbers, and it's easy to produce a report like that. I have a visualization that I like using, and I believe in attribution, so I got that visualization from this graph that appeared in the *American Journal of Clinical Nutrition*. And each dot represents a medical study. You often hear that there's one study shows that coffee causes cancer, one shows it prevents cancer, same thing across a whole bunch of food groups. For your benefit, I left bacon out because it's not good news for bacon. But each dot represents... when I looked at this graph, I thought I probably would not understand any of the individual studies if I read them, but I worked out visually where the preponderance of evidence was across all these studies for each of these items. To the left, it reduces the risk of cancer. And to the right, it increases the risk of cancer. And so I thought that's a great visualization for a suitability benchmark.

#### **Slide 27 – Suitability Benchmark Visualization Analysis**

**42:26**

**KEVIN WEBB:** So this is an example of a suitability benchmark where the vertical line represents the persistent strategic long-run goal of the portfolio manager across these metrics where liquidity has been divided into three parts: primary, being cash; secondary, being any hard maturity that has a maturity greater than cash and less than one year for a total liquidity number; then the duration of the portfolio; the composite credit rating – more about the composite credit rating in a minute; and then the market rate of return. And not to go too much into it because I want to move to the

spreadsheet part, but you can see if you were looking at this, and you were a consumer of financial information and you sat on this council or board and are involved with this entity, and you knew the vertical line represented the persistent strategic long-run goals, the benchmark, what we're going to judge ourselves by and what you wanted, you would see that we have more cash we thought, than we want to have in primary liquidity. And because we have more cash, our duration is lower than what we wanted. We have a slightly higher credit rating than what we anticipated, and at this time, they were earning higher market rate of return than their market rate of return goal. It's a separate set of discussions on how you would derive at each one of those, but once you derived through examination of your own cash flows and your own risk-reward preferences at what your numbers should be for this, you could look at this and go "Hah! Here we go." I can at once understand where we're at vs. where we said we wanted to be. Is there a question?

**ROBERT BERRY:** Yes. What is the difference between duration and weighted average maturity? Is one preferable for a benchmark than the other?

**KEVIN WEBB:** That's an excellent question. So weighted average maturity and duration, of course, are highly correlated. The longer the duration of the bond, the longer the maturity of the bond, the more interest rate risk it will have. But the preference would be to use duration than to use something like I have here. Notice I have the term "effective duration," and there are many types. There's Macaulay duration, which is modified by dividing it by the yield to maturity and turned into modified duration. Then there's effective duration. Duration, whether modified or effective is preferred over the years to maturity, but especially if you have callable bonds in your portfolio, you would want to use effective duration. Or if you have any bonds whose maturity could be either called away before the final maturity date, and that's usually manifested in callable bonds by the agencies – Fannie, Freddie, Home Loan Bank, Federal Farm Credit Bank, and so on for public funds – and what an effective duration does is it measures the interest rate risk realizing that yield, price and duration are all related and that as interest rates change, the potential cash flows, which all these numbers are off the cash flows, and when you know the cash flows, you can calculate all this on all these bonds. But effective duration would be preferred because it takes into consideration the likelihood that the maturity of the bond will change as interest rates change. And effective duration would give you an indication of at least at any point in time what the likely interest rate risk is in the portfolio, especially if it contains callable bonds. Now, if you have no callable bonds, then effective duration and modified duration will be close to each other, but I would prefer to use either one of those over final maturity when I'm measuring interest risk.

Now, if you have policy constraint that said the weighted average maturity of the portfolio can't be beyond X, then of course, you might want to add that as well to the duration measure here to make sure the weighted average of the policy is not violating your investment policy. I hope that answers the question.

#### **Slide 28 – A Note on Total Return / Market Rate of Return**

**46:28**

**KEVIN WEBB:** So, moving on. We're fixing to get into the spreadsheet portion of the talk, and I wanted to do a quick note on total rate of return and market rate of return. Where those first couple of questions that I asked all of you through the poll was: do you budget gains and losses? Most people said they don't. And then do you spend income from the portfolio? Most people said they do. Where that is relevant is that there is a debate on whether you should use total return or

book yield, and neither is evil or all good. It's only appropriate depending on what your needs are. What do I mean by that?

Well, you could write a book with a can opener and open a can with a pencil. You're just going to be unhappy with the results. The right metrics should be used for the right job. If you are not budgeting gains and losses, you're not trading the portfolio – if I were to ask all of you if you were investors or traders, most of you would designate yourself as an investor – and you are spending the income from the portfolio, total return may not be satisfactory for you. And why is that?

### Slide 29 – What are your Return Preferences?

47:42

**KEVIN WEBB:** Because for total return, it assumes in the calculation that there's two parts. There's the source of return coming from any price gain or loss, and the source of return from income. Most public funds, as you guys have answered, are income-oriented and put more weight on the income, and you don't budget the gains and losses, and you're not trading the bonds. You're not a trader in the sense where someone buys a security with the intention of selling it before maturity to profit from a price gain.

So if you heavily weight income as most public fund portfolio managers do, total return is going to not really represent what you are looking for. Both for a budgeting purpose and a performance measure purpose, you might be happier with book yield. Now, if you do have a mandate and you are using total return, the total return is going to be the metrics you want to use. But if you answered those questions where you don't budget gains/losses and you do spend the income from the portfolio, probably going to be book yield oriented.

Now that third question I asked: how many of you are internal vs. external? If you are using an external money manager with or without discretion, and they're running you against a fixed income index, if you also don't budget gains/losses and you spend the income on the portfolio, you might want to have a conversation with your advisors and money managers or your brokers, what have you, and have a discussion about how these two different measures are being used and how they can profoundly affect the sector allocations that would be manifest in the portfolio.

### Slide 30 – What about GIPS?

49:20

**KEVIN WEBB:** One quick note about GIPS. GIPS is just a standard developed by at the time the CFA Institute and it's a good set of standards. It is calculation, it is total return, but what it was primarily developed for was to allow performance information when it's being communicated with an investment firm and prospective institutional investors to keep everybody on the same playing field, to make sure they all did the calculations the same way. It doesn't mean do you have run your portfolio that way.

### Slide 31 – The first thing I get asked about the portfolio is....

49:55

**KEVIN WEBB:** And the last thing I'd like to do is a quote from one of my favorite books by Charles Ellis, *Winning the Loser's Game*. It makes a couple points in this book. It's great. But even though return is the third objective, it's usually the first thing that gets asked of you when you are at a meeting. What is our portfolio earning? They don't want to ask if you have sufficient liquidity or if we have an appropriate level of interest rate risk and credit risk. They usually ask what you

are earning, and then if you're not earning what the market is earning, the idea being you can't out-predict it, and he makes an assumption – not just an assumption – he makes a statement here in this book that if you could follow someone and you could hire someone, and they could out-predict the market, to be reasonably assured that what they were doing or what you were doing were anything better than random chance, you would need so many observations to be comfortable with the fact that it was skill and not random, that after all the observations that confirmed it, the time had passed you by to take advantage of it. So that's the wisdom in that statement – to earn a “market rate of return throughout budgetary and economic cycles.”

So when that next person at the cocktail party, the councilmember, board member asks you why you have a loss in the portfolio, say “The investment policy mandates it. I'm to earn a market rate of return throughout budgetary and economic cycles, meaning there's going to be ups and downs. But I have ensured I have an appropriate level of liquidity, I have an appropriate level of interest rate and credit risk, and we're paying our obligations without having to sell bonds to do so.”

### **Slides 32 and 33 – Contact Information and Disclaimer 51:33**

**KEVIN WEBB:** So that's a quick review.

### **Slide 34 – Bond with Excel before Excel'ing @ Bonds 51:38**

**KEVIN WEBB:** What I'm going to do now is move to Excel. And you're going to see my screen, and the spreadsheets, I believe, are out there for all of you to download them. Before we do it, before we Excel at bonds, I want to do a little bonding with Excel. And as I get my screen ready here, I have two more polling questions – three more, excuse me – and the next two will relate to the Excel part. I want to get a sense of what version of Excel many of you are using.

### **Poll Open for Responses 52:12**

**KEVIN WEBB:** So you're going to have a question pop up, and it says: what version of Excel do you use regularly? And what I mean by this is, if you don't use your work computer a lot, which version is predominantly the one you use, especially to do work? Is it 2003, 2007, 2010, 2013, or 2016? So take a second to answer that question as I get my Excel ready here. If you are viewing this webinar and you have dual monitors, you may want to on one monitor follow along by doing some of these things on your own screen.

### **Poll Results 52:56**

**KEVIN WEBB:** But if you don't, I encourage you to stay in and view this and you can always go back and watch the webinar later after CDIAC has posted it. So excellent. Most are using 2016 and 2010, 2013 and a few in 2007. Excellent.

### **Poll Open for Responses 53:18**

**KEVIN WEBB:** Now, the second question is – and there's no right answer for this one either. This is this is a self-assessment – what level do you consider your Excel skill set to be at right now? You can be new to Excel, you're a beginner, you're intermediate, you're advanced, or what is Excel? I'm not following along here.

We'll give everybody a second to answer that one. If you said "What is Excel?" – those two percent of you – Sandra and Robert are going to call you out publicly, and we're going to post your picture online. Just kidding.

## Poll Results

53:48

**KEVIN WEBB:** Excellent. What I expected. Most consider themselves intermediate, with a few considering themselves advanced, and two percent are not sure what Excel is.

## Open Excel Application

54:06

**KEVIN WEBB:** I want to show here on my screen some basic Excel housekeeping. And Excel is a powerful tool. It's evolved a long ways from VisiCalc and everything else that preceded it. It is a powerful problem-solving tool, but it needs to be set up correctly. So one of the things I want to show you if you go into your Excel – this is 2013 that we have on the machines here at CDIAC. I will go to File, I'm going to go to Options, and I'm going to go to Add-Ins. We'll give you a second to catch up. So I went File, Options, then Add-Ins. In the bottom of this dialog box, there's an option that says Manage: Excel Add-Ins. You want to click on that, and you're going to have a dialog box. We made sure these were unloaded here. They were already loaded, but we wanted to show you what is often the case.

In firms that I have worked for, when I go to the trading floor and they pop up Excel, or I imagine what most of you will encounter if you're not familiar with these add-ins, is they won't be turned on, not because someone is trying to do you any harm. It's just no one has a vested interest in turning these on. And there are three in this list that are very important and can be very useful for you: the Analysis ToolPak options and then one we will take advantage of in this webinar for problem-solving is the Solver Add-In. I wish we could do a whole talk on how to leverage technology and what the Solver Add-In is and who Frontline Systems is that does it, but suffice it to say, it comes with your copy of Excel. If you don't see it on your work machine and they don't have those add-ins out there, you will need to talk to your IT, but these four add-ins come by default with every professional and home version of Excel. So you want to click those and hit OK, and make sure that they're loaded up.

And what I'm going to do now is, I'm going to minimize Excel and I want to show you an example of – I mean, I want you to bond with Excel first, and the first thing is to make sure you have the really powerful tools that are available in Excel loaded up so you can take advantage of them. And another one is to see before I get to the suitability benchmark, the kind of things that you can have Excel do for you change and another one is to see the kind of things you can have Excel do for you that could just make your job easier. So one of the things that we have is, we often have to go out and fetch data.

## Open LAIF Historical Data Web Query Excel File

56:35

**KEVIN WEBB:** So I'm going to load a spreadsheet up here – this is in the Downloads section of GoToWebinar – and what it does is it uses a powerful... it went by quickly down there. It uses a powerful feature called a web query. This table should look familiar to you. I'm going to pull up my browser here.



**Open [PMIA Average Monthly Effective Yields](#) Website****56:48**

**KEVIN WEBB:** And there is a link on the California State Treasurer's website that shows all the average monthly yields for the PMIA, the Pooled Money Investment Account, and of course, LAIF is a subset of that. And you don't want to have to highlight and copy and paste – and you could do that; there could be some formatting problems and other things. But if you have a well-defined table on a web page and you want to get that data into Excel on a regular basis, you can do that by creating a web query.

**Return to LAIF Historical Data Web Query Excel File****57:22**

**KEVIN WEBB:** And the web query will fill that in here. And what I did is, I used some formulas, and I will let you go in there and look at some of these formulas beyond the scope of the time we have left here. But what this does is, this takes the data from the table which was pulled through the web query, so every time I load it up, it's going to go out there and query that data. And by the way, if you invest in agency securities or you want to know where Treasury rates are at or corporate rates or muni rates, there are web pages out there. Just contact CDIAC or myself, or you could google it, and there are ways to set up spreadsheets that pull in all the Home Loan Bank new issue offerings, all of the bonds that have been called by the agencies, what Treasury rates are doing, what corporate rates are doing, and so on and so forth, and do it in a way where you don't have to go out and fetch it. So it's a very nice capital for labor substitution. So that's that spreadsheet.

And the second one I want to show you is how I have used that to solve a particular problem. So this spreadsheet I'm going to pull up, the Inverted Yield Decision Cost Analysis spreadsheet, is going to go out and use a bunch of web queries to get some data on interest rates and then put it together in an analysis data table, and you can play with this to your heart's content. And it's designed to answer a question.

**Open Inverted Yield Decision Cost Analysis Excel File****58:54**

**KEVIN WEBB:** And where Excel can be really powerful is how we set up and phrase the question. If you load up the spreadsheet and there's a security warning, that's just saying this is going to go out and query data. And once I hit this Enable Content, you should see some stuff here at the bottom where it's going out and it's pulling data from various places on the web, running background query. You see that right there. So what it's doing is it's filling in data on these various tabs, getting Fed funds rate, three-month T-bill rate, and other Treasury rates. And so it's done. These don't look like they're formatted very pretty, but what it did is, it went to the Federal Reserve economic database hosted by the St. Louis Fed and pulled the raw data for all of these Treasuries. And then, of course, there's another one for the one we just saw by itself for LAIF.

So I had it go out there and pull all this data, and then I use some named ranges and other really good Excel model spreadsheet techniques – named ranges, formatting data correctly – and I had it put together a data table that answers the question: if I was faced with a three-month T-bill and a two-year Treasury, and the curve was inverted and I held myself to that decision, what would the results be? [See *3Mo TBill Analysis Chart worksheet*.] The graph is self-explanatory in the sense that the blue line is the spread between the three-month T-bill right now and the forward-looking, 24-month moving average of the two-year Treasury, and then it shows did you win or lose. And the gray areas show when the curve was inverted, in other words when the three-month T-bill was

actually above the two-year Treasury rate. And if the blue line is above it, that means you won by buying the two-year instead of the three-month Treasury. But what you can do here, you can go and use a web query, you can have it fetch all the data so you are not doing it manually. So every time you load this up, it's going to load it with all the updated data, and the whole thing will update.

So that's another way of using web queries and I'm not going to save this here because it updated the data. And now I want to get to is the point: how could we use something like a suitability benchmark? How could I create it in Excel? Because part of the problem is, how do you create these graphs?

### Open Suitability Benchmark Simulator Excel File, Simulator Worksheet

1:01:17

**KEVIN WEBB:** And how could I use the powerful features of Excel to help me solve problems? So I want to describe how this spreadsheet is laid out. This graphic will look familiar to you. Here are the goals, the plan definitions. So this vertical line, the extent that these dots deviate to the right or left of it, the line itself will be determined by these values here. [See Column M] So if I have something other than 15 percent for primary liquidity and I put it down to zero, then what I would expect is this dot to move all the way – I'll do it to five – I expect the dot to move to the right because if I'm at 15 percent in the portfolio then I have more than that. So if I do that, you can see that it's so much more that it moved off. It's just that I have the axis here where it's only 100 percent more. So let's say we moved it to 10 percent, you will see it pop back up. You can go into these graphs here and modify the axes so it can show more than that deviation.

So each of these numbers here, each of these values, decides what this vertical line, which is our strategic long-run persistent allocation across these measures of the suitability benchmark for primary and secondary liquidity; what's our effective duration – 1.8 tends to be about the average effective duration of a two-year Treasury; what our weighted average composite credit rating is, and I'm going to speak on that here in a minute – that's a drop down menu, and yes, it is very hard to compute a difference in a value that is based off of a letter. I'm going to show you how I solved that quickly here inside this spreadsheet; and then, what is our goal for our market rate of return.

These top lines here [rows 33 and 34] deal with what is cash yielding – I just put 2.35 at the time. That's kind of where LAIF is at. What duration do I want to assume cash is at – I'm going to say zero. What is my cash weight? And secondary liquidity will be what the allocation of the portfolio that will be to bonds whose final maturity is less than one year but greater than cash. And then, what I have here are some common sector allocations across different maturities [rows 38 to 43], across different maturities – one-to-two year, two-to-three, three-to-four, and four-to-five – across U.S. Treasuries, agency bullets, callables. And I divided corporates up between three sectors. The reason I did that is beyond the scope of this topic, but suffice it to say that Industrials, Financials, and Utilities are very different from each other, and you may want different allocations across those vs. just a general sense of corporates in general, but just know that in California, no matter what they are, you can't have more than 30 percent of your portfolio in corporates. And so we have this here [cell A41]. More about these additions here, and then Industrials, Financials, and Utilities.

And what I've done is, we will be typing in and I will be showing you how you type in your portfolio's allocation to try to meet these suitability benchmark numbers over here that I've typed in column M. What's important to note is that this is the only thing you need to type in. You type here [cells B38:E43], here [cells B 33:J34] and then, this is our plan definition [column M].

So what these others are – this is each of those sectors, U.S. Treasuries from one to two years, all the way to Utilities from four to five years – and this is their credit rating [*cells G38:J43*].

Now, you notice that there's not letters there. There's numbers. Now, why am I doing that? Well, I can't graph and compute a weighted average of a [*letter*] so I use a methodology. This is not my own. There are many people that use it, and it usually goes under the title of composite rating algorithm. But what it does is it takes the letter, the values from each of the credit rating agencies, and assigns to each of those a number. [*See Credit Ratings Matrix worksheet.*] Now, I used the zero to 21 – you could use whatever you want – where 21 represents AAA and zero represents Default. And then I created a composite credit rating. And if you go and watch those talks that CDIAC has posted on credit analysis and advanced credit analysis, or if you attended the sessions when they've held them in Riverside or Carmel, it's always better if there's multiple ratings on a bond, if you look at the composite credit rating rather than just any single rating by any agency. So what you would do is if you had three – I've tried to show this here – if I had a AAA by S&P, an Aa3 by Moody's, and a AAA by Fitch, I would end up with an average or composite rating of AA1. So what I want to do over here in the simulator [*return to Simulator worksheet*] is I wanted to take you to those, compute them for each of the individual bonds that were in the market that day, and come up with a weighted average numerical rating.

So when you see AA3 here, what that means is my target credit rating is AA3. It's an 18, and so I have that right here [*cell L38*]. And then what I've done is I've computed the median value for the effective duration for each of these maturity buckets across each of the sectors and then the offered yield in the market across each of these maturity buckets for each of these sectors.

Now, that spreadsheet is one that we looked at briefly and broke out in groups to do. The modifications that we're going to do here – that we talked about in Riverside, and I want to go over with you in our remaining time here together – are how you could use the power of Excel using that Solver Add-In and some other features to answer some really important questions. So I want to go over a couple of things. We clicked on the Solver Add-In. I'm quickly going to remind you where that was at. We went to File, Options, we did Add-Ins, go to Manage: Add-Ins, and then we made sure that Analysis ToolPak, ToolPak VBA and Solver Add-In were checked. Then we hit OK. And so those are loaded so that when I go to the Data word on our ribbon here, I should see at the very end the Solver Add-In. Now if you try to do this on your own and you don't see it, it means you don't have the Solver Add-In loaded. Maybe you shut down Excel and you reload it. If it doesn't show up, you may need to contact IT, but it should show up once you add it.

And what the Solver Add-In will do is it will allow you to set up a problem. So real quick before I show you how I set it up, one of the additions I made to the spreadsheet that was different from what we looked at in Riverside, I added a couple things. I added the corporate maximum. And you notice here when I click on cell A40 with the word Corporate Max., up here in our name box, it tells us the location in the spreadsheet. It just says hey, that's cell A40. A very good convention, especially when you're trying to understand what you did in the spreadsheet and you're revisiting it later and you're looking at formulas, is to use named ranges. So I took cell A41 and I renamed it to Corporate Max and I added a cell for Corporate Total. And all that is, is a sum of these values here [*cells B41:E43*] which itself is a named range. So a named range can be single cell or it can be a group of cells.

So when I highlight all of those and type Corporate Total up there in the name box, now if I go here and type Corporate Total, notice how it highlights all of it and lets me know what that named range references. So now I can say sum of Corporate Total, and I know that that is this range right here because I want to know that and I want to make sure that I haven't violated the 30 percent state code, or you may have your own corporate max. If it's zero, you type zero right here [cell A41] and then the solver will make sure that no allocation goes to these corporate sectors across these maturities.

Now, I've done the same thing. I want to know what the weighted average effective duration is once I start adding in my allocations, the weighted average effective duration, the weighted average purchase yield, and the weighted average credit rating. Now, that's a lot right there and I use the term "weighted average." Since I have percentages here, I'm going to use the SUMPRODUCT. But a real quick note, there is no weighted average formula in Excel. So let's say I have five bonds that I have a million allocated to each, and harkening back to the question that the person asked about weighted average maturity, if I had five at 1 million each in a one-year, two-year, three-year, four-year, and five-year maturity, then I know that the average – it's a simple average – is going to be the average of all those, and I have a three-year weighted average maturity. But let's say I have different allocations. I put 5 million here and 5 million here. Simple average isn't going to work. So using named ranges, I'm going to call this Amounts so the formula makes sense, and then I'm going to go over here and call these Maturities. And I'm going to show you quickly how to do a weighted average formula in Excel. It's a very important formula. Unfortunately, it is not a native weighted average function. You're going to use a combination of SUMPRODUCT and SUM.

How does that work really quick? If I want to know what my weighted average maturity is. This is my simple average right here, this three. I want to know what my weighted average is. So I'm going to go right here and use SUMPRODUCT. And SUMPRODUCT says, "What is it? What is it that you want to weight?" Think about it that way. What are the weights? Put them together like that and then you want to divide the SUMPRODUCT by the sum of the weights. And then we do that so we have SUMPRODUCT where we take the maturities, we're going to take the amounts and then divide the sum of the amounts. I know it may not seem intuitive, but this is how you do a weighted average where you have one column that's the weights and you have another column that's the thing you want the weighted average of. And we can see that the weighted average because I did a five and a five, it should be a three. Now, let's say I did one. Well, now it's 3.88 but the simple average is the same. If I had one across it, it should equal the simple average is. So that's what a SUMPRODUCT is, and I'm using that methodology to compute the weighted averages of each of these metrics – credit rating, purchase yield and effective duration – once we started getting into our allocations.

So quickly I want to delete that. And the other thing I want to show you is that once we fill in these examples – let's say I take five percent or I do a quick method – what we will try to solve is what allocations in these sector weights across these maturities and sectors can get us closest to meeting our planned definitions for a suitability benchmark. Let's say I already have 15 percent in cash, 15 percent in secondary, so I'm going to put 70 percent in the one-to-two year Treasury. Well, what happens here is, you can see the weighted average has computed all of them. I'm short duration and short everything else as made manifest in the graph. I've got my liquidity but I'm under on my duration, I have a higher credit rating than I thought, and of course, because my duration is lower, my credit rating is higher, I'm not quite earning the market rate of return I wanted.

But let's say I go in and I'm filling this in a lot, and I don't want to have to go back and type zeros each time. If you go to the Data name on your ribbon and you go to What If, and you do Scenario Manager, I have set up a scenario manager that if you spreadsheets where there is a lot of different inputs and lots of different versions, this is so effective. All I have to do is double-click here and no matter what I type here and here, it goes back to my initial values of all the sector weights zero, with cash being 15 percent and secondary liquidity being 15 percent. And I don't have to go back in and type everything back into normal. Or if you have different scenarios and want to look at them, you could do that.

So how can we use Solver to find out what allocations we could use to get us closest to this answer? Let's kick the tires a little bit. Go to Data in the data ribbon, Solver if you have the add-in loaded will be all the way to right, and we're going to hit Solver. And now I set this up and this is, again, where named ranges are very important. Let me just go through this. There's different Solver methods. Just leave all of this the same. If you do change them, you can get slightly different answers. That's beyond the scope of this webinar. But what I have set here is I want to set an objective of maximizing the weighted average purchase yield. In other words, I'd like to earn as much as possible, subject to some constraints. That's what an optimization is.

What are the constraints? Well, what values am I going to be changing? I'm going to be changing these [*cells B38:E43*]. All of these zeros here are the weight matrix, the simulation weight matrix subject to some constraints that my corporate percent has to be less than the corporate max. I need to spend 100 percent. I want it to spend all the money. The weights have to be greater than zero. I can't short anything. The weighted average credit rating needs to be greater than or equal to my credit target rating in the plan which is right here [*column M*], and my weighted average effective duration across this once I know my weights has to be less than or equal to my suitability benchmark's target effective duration, and that my weighted average purchase yield has to be greater than or equal to what my market rate of return is.

Now, when I hit Solve here – it's going to go by quickly, but you'll see it running through iterations down here on the bottom – but it will also tell us whether it can or can't solve the problem. So I'm going to hit Solve, and it's running through. It ran through a bunch, and notice that it said "Solver could not find a feasible solution." So we're going to ignore all these outlined reports and everything else right now. You can play with that on your own. But the important thing here is that from a suitability benchmark perspective and from a practical, pragmatic perspective using Excel, it said it couldn't find a solution. Now, I'm going to hit OK and see what solution it did find. Notice it got close. It got us a market rate of return at 2.70, not quite the 2.75. Our duration is 1.80. We have our liquidity right where we want it, and the credit rating is a little higher than we anticipated. And here are the allocations: it put 6.6% in the two-to-three year agency callable, it put 33.4% in the four-to-five year agency callable, and then it put 30% in the one-to-two year financial corporate sector. So it didn't get us what we wanted.

What I want to do is our final polling question.

### Poll Question Open for Responses

1:17:13

**KEVIN WEBB:** I want to ask you in the audience, if you are still with me and you're still awake, what suitability benchmark value should be changed first to get the optimizer to achieve the desired market rate of return along with the constraints? It's just which one do you think would

be the one, realizing you could change some combination of all of them, but if you could only change one and change it first, which one should be changed to get us closest where all the dots are lined up? We'll give everybody a second. If you are still with us, submit an answer even if you think it's none of the above or not sure. Take your best guess.

## Poll Results

1:18:08

**KEVIN WEBB:** Okay, of the 61% that voted, 17% said lower liquidity, 19% said credit rating lower, 39% said duration increased, 17% said duration lowered, and 8% said none of the above.

So let me address those answers quickly. So we could get there by doing all those except lowering the duration. If we lower the duration target that means we're going to earn less. Remember on one of the first slides, that leaky valve, risk and return are related, you never get more of one without getting more of the other. That's what got us in the financial crisis because we thought we could get risk-free returns. So you would want to increase the duration. Increasing the duration would be one of the first steps, although if we lowered the credit rating, that would also increase the market rate of return. It would allocate a higher..., but that duration constraint alone is going to be the main one. And we're going to take a look at that real quick, and I'll show you how that works.

## Return to Suitability Benchmark Simulator Excel File, Simulator Worksheet

1:19:11

**KEVIN WEBB:** I'm going to go to Data. I want to reset the answer because I don't want to type zeros into everything. I'll go to my Scenario Manager, which is the Data ribbon tab; What If; then Scenario Manager. In this spreadsheet, I've already built it in up here, but you could look up online or YouTube or whatever and figure out how to create a scenario manager for your spreadsheet. I'm going to double-click on it and notice that it reset all my weights to zero so I don't have to type those in. And then, I'm going to change one thing. I'm going to raise that effective duration to 2.80 and see if it's possible to meet everything else.

So I will go to Data in the data ribbon, I'm going to do Solver, and then I'm going to hit Solve. And you'll notice it's running through the iterations down here once I do it. And it says it couldn't find solution. Now, I increased the duration just like we said, but what happened? So we had a 2.80, we had 15 percent, 15 percent, we had a 2.80 with a AA3, and what it's telling us is that when we increased the duration by that amount, we still couldn't quite get there and that's because we have too much liquidity. In other words, with the 70 percent remaining, it's not possible for it to find a solution.

Now, where an optimizer differs from – I'm going to go back real quick to What If Analysis and zero that out. This is an important point: when you have a lot of moving parts, unlike a standard mathematical function, where you have one set of inputs and then one unique set of outputs, when you're dealing with an optimization with a lot of moving parts like this, there could be multiple answers that get you there. I think at the CDIAC conference I said that the ladies at CDIAC wanted a three-month duration and a five percent return and wanted a AAA rating. Well, what the Solver can be telling you in its own words sometimes is, given what's available to you – and that's right here represented by the opportunity set of things it could be invested in and by the constraints that you want to do, you may be asking something that's not possible and it constant solve. I mean, you can't, for example, get to that required rate of return given the constraints you have. You can't get to the credit rating in the benchmark given the constraints that you have.

So you want to go through and make sure it be and this is a very good iterative process you can use in this spreadsheet to do that. So I'm going to go back, I'm going to put a 1.80, I'm going to go back to the 2.80 that I increased it to, and now as many of you answered, lower liquidity. So let's do that. Let's lower the secondary liquidity to zero percent. We'll keep our cash, so we're going to go down here and change this to zero percent to make sure that that's the case, and then we're going to ask the optimizer again, "Hey, is it possible to get there now?"

So I'm going to go to Data in the data ribbon, I'm going to go to Solver, and when I hit Solve, it says it couldn't find a solution this time. But notice what it did find. It did get us our 2.75 weighted average purchase yield, but it didn't quite get us there on the weighted average credit rating. So to the computer, a deviation of 0.6, almost 0.5, from the credit target is considered not an optimal solution, even though it meets the criteria of what we're looking at. It's not too far off. So if I went back in and I set this to the AA3 that we had before – and I just want you to see what it looks like – and I set it back and I go to the scenario manager and said, "Okay, now solve it." You do Data, Solver, and I hit Solve. Notice what it did. It got a little bit confused.

So this is to show you that Solver on its own with a lot of moving parts often cannot get at an answer for which there isn't a one-to-one relationship, and what's fun to do if you're using Scenario Manager is to save the different results. So let's say we are typing one in like I did at first, and I do 70 percent and I wanted to call that in the Scenario Manager... I wanted to add a scenario to it where I said okay, this is All Treasuries. I can hit it, and notice what it's done. It has gone through and it saved all our answers for all the weights here across this, and you hit Add and now you have All Treasuries, and you have the initial values.

So what Solver allows you to do, along with the Scenario Manager, is to come through and kick the tires, not just on this spreadsheet but any other spreadsheet, and what I want to do right now is open the session up for any questions that any of you may have.

**ROBERT BERRY:** If anyone has a question, go ahead and type that into the Question section at the bottom of your control panel and get those in to Kevin and talk about those.

**KEVIN WEBB:** While they're doing that, what I'm going to show you as you're thinking of some questions are some additional resources that are available on the web that you should take advantage of.

Open [FRED Add-In for Microsoft Excel](#) Website

1:25:49

**KEVIN WEBB:** The first one I want to show you is our friends at the Federal Reserve Bank in St. Louis have developed a very powerful data aggregation add-in. It's free to taxpaying citizens. To install on Excel, you will need to get the approval of your IT to do this, but you can download the add-in. They have all kinds of stuff on it. There are YouTube videos on installing it and adding it in, but you can fetch a lot of data from how much alcohol sales there are in a particular county or across counties, to population, to economic and financial data. There are literally are as they say here 520,000 data series from all kind of sources. This is worth checking out as long as you have 2010 or later of Excel.

Return to [Suitability Benchmark Simulator Excel File, Simulator Worksheet](#)

1:26:39

**ROBERT BERRY:** We do have a question here. For the yield on secondary liquidity, wouldn't this be hard to control as investments from years ago start to mature?

**KEVIN WEBB:** Yes, it would, but if you have an investment plan process and you track the portfolio where you always have a certain amount of money rolling off, then you could forecast that out. These metrics here when you decide on secondary liquidity – and what is really the function of secondary liquidity? I didn't clarify that. Secondary liquidity is that extra insurance that if there was an unexpected obligation – listen, I'm sure none of you have ever had this happen where a councilmember or a board member tell you, "I forgot to tell you but I need X number of dollars tomorrow. We didn't think we were going to need it. We did." Or, "We lost a lawsuit." Or it could be a number of things, and that happens. Secondary liquidity can be that portion of the portfolio where if you had to liquidate it to pay an obligation, you could do it probably with the least chance of selling it at a loss, and it also is that portion of the portfolio that is consistently rolling into primary liquidity. So this is the portion of the portfolio that you can manage by making sure that you have purchases, especially June liquidity if your liquidity model and you're matching your cash flow needs and you forecasted that out, you would have an idea of what you always wanted this to be for the next year. Any other questions?

All right. There are no other questions. I appreciate your time. I hope you found this useful. If you have any questions about these spreadsheets, about the suitability benchmark, please don't hesitate to contact CDIAC or myself, and we'll try to get the answers back to you. Or if you have any suggestions or recommendations for us, we'd always like to hear them. I appreciate your time. Everybody have a great weekend. Thank you.

**ROBERT BERRY:** There was a question that came in from one of the attendees that was related to a specific version of Excel, and we will follow up with you after the webinar because that's probably a unique question.

In closing, on behalf of CDIAC, I would like to thank Treasurer Ma for joining us today and, of course, Kevin Webb for the dedication of a lot of time and a great deal of expertise and, of course, these terrific Excel models. This program was a success and a big thank you. Also a big thank you to our CDIAC education team, especially Sandra Kent. She does a great job and a lot of hard work goes into producing these webinars. Before we sign off, a reminder that the entire presentation, including the Excel files, will be available on our website after we conclude, as soon as we can get them loaded up to the website. And the webinar replay in its entirety will be available in about two to three weeks, once we get the transcription done and posted.

And lastly, to stay up to date on CDIAC's upcoming educational programs and any of our new publications, please sign up for CDIAC's Listserv on our website. If you go to our website in the top left-hand column in the Quick Links section, you click there and can sign up for our Listserv and can get notification of everything coming out of CDIAC. So with that, thank you, everyone, for joining us this morning, and we really look forward to you joining us for future programming. So long.