11/30/11 CDIAC "Swap Math" Webinar Transcript

Slide 1

Welcome to today' webinar this program is going to be focusing on swaps math, what are your swaps worth. We recognize that swaps have some negative connotations in the market recently, but we also recognize that they still provide a financial tool for local governments to manage interest rate risk. So CDIAC wanted to provide some training and background on the use of this financial tool as it still adds value in today's marketplace.

Slide 2

We have two speakers with us today. First I will introduce Eric Chu, Managing Director of the BLX Group in Los Angeles. He has been head of the BLX Group practice since 2004. He has over 19 years of public finance experience including substantial experience in all facets of implementing swap transactions from structuring and pricing to documentation to post trade monitoring and accounting compliance. He is the lead author of be BLX Groups Booklet Rates Swaps Application for Tax-Exempt financing. In addition, presenting with him is Nat Singer, Partner with Swaps Financial Group. Prior to joining Swaps Financial Group, Mr. Singer spent 21 years at Bear Stearns where he was the head of the Bear Stearns Municipal Derivatives Products Group, chief operating officer for the Municipal Bond Department from 1998 to 2007. He is a frequent speaker on topics relating to both the municipal cash market as well as the derivatives market. He has authored numerous papers focusing on financing and trade opportunities in the municipal market.

Slide 3 & 4

Before we begin I want to go through a couple of housekeeping items. If anybody has participated in seminars previous to this one, you already know about these helpful tools that I am about to show you. On the top right-hand side of your screen is a bar with a feedback, so if you have problems at any point with the presentation either you need help, you can't hear, the pace of the presentation is too fast, or you have questions, you can use this feature by selecting that color that indicates your problem. Also, towards the left you've got a Q&A button or feature if you will. This provides you the participant an opportunity to directly pose questions to the speakers. The questions will not be viewed by any other participants but by the speakers directly, and we will try and manage those questions throughout the presentation. If we do not get to all of the questions during this webinar we will cover them at the end of the presentation, so, throughout the presentation feel free to present questions to the speakers.

Before we start and turn the time over to our presenters we want to ask the participants some polling questions in order to help the speakers to understand who is in the audience today.

Question: Are you a representative of public or private entity?
Okay, 87% of our audience at this point is public.

Question: What type of public agency do you represent? State and City?
I see that most of you are representatives of Cities.

Question: In order to understand what our actual attendance and participation rate is we would like to know whether there are others in your office connected through the same terminal. So if you could indicate whether there are one or more individuals listening at your location, please let us know.

Question: What is your current understanding of Swaps, or Swaps Math?

Question: Have you ever utilized or considered an interest rate swap. Eric and Nat, it looks like you've got a balance in the audience of participants that have either considered this as an option, or utilized this type of transaction.

Question: Lastly, do you currently subscribe to any market dated data services such as Bloomberg? Again, a fair balance in the audience.

Slide 5 & 6

Eric will start with a couple of comments about page 5, as I think it is just repeating some of what we hear about interest-rate swaps, and the way we generally look at swaps is that it's not the end-all be-all, it's not the answer to all of your problems, but it is another arrow in the quiver so to speak. It is another tool that you could potentially have to use both to manage your asset and liability portfolio, although today we are going to focus more on the liability side of the equation. So today the point that we would to make (even if you don't understand all the math by the time we are done with this presentation), is the price setting of interest-rate swaps is not a black box. There is an objective methodology that dealers use to come up with the pricing of an interest rate swap. When you hire a financial advisor and your financial advisor works with you, we are using virtually almost identical tools to price the swaps and that while we all have systems to come up with the swap pricing it is based on the same identical math. Therefore, our presentation today is designed to give you some sense of where the opportunity comes from. Why swap pricing is at times better than bond pricing, and I am going to go through that while Eric is going to go through some of the actual math concepts of the swap pricing and at the end I am going to come back and give a brief explanation of how does a dealer actually hedge their position once you execute your transaction with the dealer. Then finally, how does that hedging influence the market to market value or the pricing of the swap after you've executed.

Eric is there anything you wanted to add before we get started.

Yes, maybe just to expand on the math concept part of the presentation, I think the objective here is to provide some context and some background as to how the math works behind the swaps and the objective is not so much to have you walk away with the ability to price the swap yourself, but to be empowered in such a way as to ask the questions and be able to make sense of why you're swap rate is what it is, as Nat was mentioning. For example, why is the value of your swap changing in the direction it is, and by the orders of magnitude that it is. So other than that, Nat I think we are ready to go.

Slide 7

So let's start off with why are we looking at swap file? And talk about a world where an issuer has two general choices, when selling a fixed rate debt.
Option A: is either to sell traditional fixed-rate bonds as most issuers have done in the past and most still do. You sell fixed-rate bonds you've got an amortization schedule, typically you will make semi-regular payments on those bonds, and the interest rates are determined by market forces.
Option B: is the swap-based alternative that we talk about most of the time, where you would be issuing variable-rate bonds and then using an interest rate swap to convert the variable-rate exposure to a fixed rate, and if the market was truly efficient there really shouldn't be any difference in the fixed

rates that you could attain through option A or option B. For instance in option B, provided a lower yield you would expect issuance of traditional fixed-rate bonds and more issuance of variable-rate bonds and swaps which, over time would force the rate higher and bring it closer to the traditional fixed-rate scale. But what we see consistently in the municipal market is that this is not the case. The municipal market or the tax-exempt municipal market is not efficient and as a result of this we see consistently lower yields, lower fixed-rate deals associated with option B versus option A. Why does that happen? The best explanation for why there is an inefficiency associated with selling short-term bonds and swapping versus selling traditional fixed-rate long-term bonds is what is referred to as "the neighborhood theory", and in the neighborhood you could say that we have got a structural imbalance. Let's think about the projects that we are financing here in the municipal market. We are financing very long life assets for example toll roads, airports, office buildings, power plants, stadiums, so these types of liability structures have average lives that go out to 30 and 40 years, and as a result the bonds that we sell for them, have maturities that are 30 and 40 years long, so it is predominantly long dated. However, if you look at the demand side of the equation we see a very different picture as traditionally the biggest buyers of long-term fixed income products, meaning longest term bonds (I'm not talking about tax-exempt bonds here I am talking about any bonds), are pension funds. Pension funds have very long liabilities and as they are disbursing out payments to pensioners over a very long period of time, so they need to purchase bonds that also will exist for a long period of time so that they can match their liabilities and their assets. On the other hand, if you remember pension funds don't pay taxes and as a result they traditionally don't buy tax-exempt debt. So you've got your biggest buyer of long-term fixed income products and they do not buy tax-exempt bonds. So who does buy tax-exempt bonds? The biggest buyer of tax-exempt bonds are, Mr. Pop and Mrs. Mom known as retail investors which are individuals either purchasing for themselves or purchasing through a mutual fund or an investment advisor and their focus is traditionally on short maturities.

Slide 8 & 9

On page 8 I took a typical tax-exempt bond amortization and I went into the Bloomberg system and found a deal that was priced last week for Healthcare facilities. It was a $100 million transaction, the final maturity was in 2041, and if you look at the amortization schedule the actual bonds that were offered for sale, if you look at the front end of the yield curve in the first 5 or 10 years, are at very small par amounts, may be 1.5 million up to $2 million of bonds per year. So there was very little supply at the front end of the yield curve, but at the long end of the yield curve out 20 and 30 years you've got the majority of the supply. Over 70% of the bonds being sold are from years 22 to years 30. So, a very small amount of supply at the beginning and very large amount of supply at the long end, but the demand from retailers focused at the short end, with less demand at the long end.

Slide 10 & 11

What is the impact that this has on the yield curve? Well, if you look at the chart on page 10, and what I have done is try to graph first, the taxable yield curve, and if I were to ask you if you didn't know anything about municipal bonds does the solid line at the top represent the taxable yield curve? Where would you expect tax-exempt bonds to trade?
A good guess would be if the maximum corporate tax rate and the maximum individual tax rate is 35%, I would expect tax-exempt bonds, where you don't pay federal taxes, to trade at about 65% of the yield of the taxable curve which is represented by the dotted line on this chart. If that was your guess you would be right, especially at the front end of the yield curve where tax exempt bonds tend to trade efficiently at the after-tax equivalent you would be wrong at the long end of the yield curve. At the long end of the yield curve, traditionally municipal yields are significantly higher than the efficient curve

and this is precisely due to that supply and demand imbalance, where most of the supply is at the long end of the yield curve as you've got less demand, and as a result yields need to go higher. So, that is precisely what is causing the opportunity in the swaps market. If you can issue efficiently priced bonds at the short end of the yield curve like floating rate debt, and then use a swap to convert to a fixed rate, you're going to end up with a fixed rate that looks more like this efficient yield curve, versus a fixed rate in the traditional bond market which is higher.

Slide 12

So the question, moving on to page 12 is why a swap? Well, the numbers prove that if you issue the traditional fixed-rate bonds based off of the traditional yield curve in today's market you may end up with a yield of somewhere around 4 .5%. But if you were to issue efficiently priced floating-rate bonds and then use an interest rate swap to convert the floating-rate to a fixed-rate, even including all of the associated costs with selling floating-rate debt, you are all in a fixed-rate is going to be lower using a swap then selling traditional fixed-rate bonds. So we want to use that is somewhat of the backdrop to talk about why are we even talking about this? Where does this opportunity come from? Why is there an opportunity? Now Eric is going to get more into the essence of the presentation in terms of the actual swap pricing.

Great, thank you, Nat, so in the section 2 or part two of this presentation, we said we are going to take a look at where does this taxable swap curve come from? And as I think we are all familiar with treasury rates and what we call a term structure for treasuries (which also applies to swaps), is really just identifying that these instruments have different rates for different maturities. So, just like when we have treasuries with 30 year rates and 10 year treasuries have different rates (usually lower), that is referring to the term structure as swaps are similar to treasuries in that swaps trade or price throughout the day so their prices are continuously changing. You may have heard from a swap provider or an advisor talk about mid-market rates or the ten-year swap rate etc., and I just wanted to highlight on this page where that information is actually coming from.

Slide 13

So the first thing is swaps are what we call an over-the-counter market and really the point of that is the actual pricing comes from participating broker dealers that are illustrated just as a sample over on the right side of this slide, and that they are published through real-time services such as Bloomberg or other services. The quotations that you see here on page 13, are what we call bid-ask quotations and, just by way of background, these are for what we call “vanilla transactions” which are subject to standardized documentation between broker-dealers including what we call fully collateralized transactions, which essentially takes away, in theory, the credit risk that occurs as a result of swaps if there was no collateral posted by the counterparties. However, this is kind of getting into the background that we are not going to focus on today but, the point here is that the quotations provided by broker-dealers are essentially homogenous and they are all based on different points along the term structure. They are all for pay fixed and received three months LIBOR rate that is the floating reference index for the standard swaps and you can see on this page we have a variety of different entities on the right-hand side that are providing their quotes, and at the very top you can see something called the composite, and the composite is simply an average of all the participating broker dealers which is compiled by this Bloomberg data.
On the left-hand side you can see all of the data points and on the right-hand side is the ten-year swap specifically, but on the left-hand side you can see all of the composite rates for the term structure of the entire swap going out to 50 years. So, this is a large mix up of what I would refer to as our ingredients

if you will, for pricing and valuing a swap transaction. In addition and as a side note, there are other pieces of data that are necessary for structuring certain kinds of swaps such as these market-based swaps or swaps that use the one month LIBOR rate as the reference index as well as for options, however we are going to set those aside for today and just focus on your “vanilla” three month LIBOR swaps because we are going to be looking at the fundamentals of the mathematics that apply to any and all swap transactions.

Slide 14

On this slide what I wanted to illustrate is, how is it that all of those ingredients are combined to come up with the next step in valuing our swaps?
In this screenshot also taken from Bloomberg data sources, and I think there were several people participating today that actually subscribe and use Bloomberg, so I will go ahead and mention that you can pull this screen about SWTFS in the command line in Bloomberg, and what this graph shows us is that the LIBOR swap curve in its entirety is really made up of three different things. The LIBOR fixings, the Euro-dollar futures, and the quoted swap rates that we saw in the previous slide, but there are also portions of the overall curve that are derived from what we call Euro-dollar futures, which are contracts that are exchange traded and really important as the futures contracts can replicate the economics of the swap but these contracts are only traded in sufficient volume, usually out to about three years. Therefore that's how far they are used to develop our curve, and you can see that in the purple area in the middle, for the first three months of our curve which is this green part we use what are called LIBOR fixings. LIBOR fixings are actual rates that go from one day all the way up to 12 months, but for the purposes of the curve we are using just up to three months and LIBOR fixings you may be familiar with what is called London Interbank Offer Rate which are rates that are determined once per day, I think precisely at 11 am by virtue of the sampling of participating banks, who are submitting their rates and the rates that they would equal either borrowing or lending to other banks of similar credit quality. Therefore you often hear about the three month LIBOR and it is a static rate for a particular day and it doesn't move throughout the day the same way as swap rates do, but these three things together are used to build a curve that we use to value both existing swaps as well as price and use swaps. The curve that you see here is what we call a zero coupon or a spot rate curve. What does that mean and why? Well, a spot rate or a zero coupon rate is very similar to a treasury strip if you will, which is a rate that implies a yield to maturity, but without any coupons and between. So, by having a curve where we have identified the zero coupon rates for the entire term structure it allows us to present value any cash flow from any date precisely back to today and put it into today's dollar.

Page 15

The other thing that the curve allows us to do which we are going to talk about a little bit more on the next page is that forward rates can be extrapolated or what we call bootstrapped from the zero coupon curve. I want to also mention that swaps are very much like bonds in that they are cash flow instruments. As a cash flow instrument the valuation technique is called the “present value” cash flow method, and all that is telling us is that if I have an instrument that has future cash flows its value to me today is going to get a “present value” of all those cash flows, so the concept of “present value” is simply that a dollar a year from now is not worth the same amount to me as a dollar that I'm going to receive 10 years from now, of course I'd rather have the dollar that I would get a year from now quote and unquote in “present value” terms it has a higher value than the same dollar that I will receive in 10 years. So when we think about a swap I think most of you, if not all of you, know that a swap really consists of two legs. There is a fixed cash flow leg, and a floating cash flow leg, and as a governmental entity typically you are entering into swaps where they will pay a fixed cash flow and receive a floating

cash flow.
So in that regard, the value of a swap on any given day is simply the “present value” of all those fixed cash flows, minus the “present value” of all of those floating cash flows, (and it would be floating minus fixed depending on the perspective if you are paying fixed or receiving fixed or vice versa). So, this brings together the curve that we had on the previous slide which is that in determining the value of the swap what we are going to do is we're going to simply “present value” all of those future cash flows for the fixed and floating legs at the zero coupon spot rates, and we are using all those zero coupon rates to present value cash flows.
So now here comes perhaps the tricky part if you will, for valuing the swap.
For the fixed leg that seems fairly straightforward, just like a fixed rate bond, I know what my fixed leg payments are as of the date I entered into the swap which is simply the coupon on the swap multiplied by the outstanding notional at any given date, so I can project that out for the life of the swap and “present value” those.
The floating value is a little trickier because the floating leg involves all of these future cash flows that are based on the floating rate that is not yet determined as floating rates are set as I mentioned once per day, usually the LIBOR rate, if the swap is based on three month LIBOR and we won’t know the three month LIBOR rate for January of 2012, until January of 2012. However what the curve does imply is that because we know the term structure we can actually extrapolate or bootstrap the rates from this curve.
Let us go back to the curve for just a second, as an example if we know the 4 year rate and we also know the 5 year rate you can from these two rates, determine the rate that is 4 years from now which covers this 1 year period, and the efficient market theory would tell us that I should be able to invest in something that is 4 years and invest in something that is 1 year from now, and achieve the same result as if I had the same purchase and invested in something with a 5 year term, and we apply that concept to all the periods in which we need forward rates for our swaps. So, for example if one month rates today are .26% and a two-month rates are .37% than if the objective is to determine what the one-month rate is one month from now we can use this formula.

Question: Seth asked the question on the prior page. Can you explain the future seen on slide 13, and how they interact with the swap curve? And I just wanted to point out as I don't know if you wanted to add to it that the Euro-dollar futures contracts that are represented by the purple portion of the curve are actually telling us, like you had mentioned we know where LIBOR is today, but we don't know where LIBOR is going to be 2 years from now in terms of where are floating cash flows going to be, but that is what the Euro-dollar futures contracts tell us. It tells us what the market is determining for LIBOR rates that we can base the value of those futures contracts. So, for instance the December of 2012, Euro-dollar futures contracts we can derive from that contract, where the market is predicting LIBOR is going to be in December 2012, and we can use those values to determine the forward LIBOR rates as you see that in the purple portion of the curve.

Thank you, Nat.

So, Seth I hope that answers your question..

So, to pick up where I left off, what we are computing in terms of this bootstrapping technique if you will is that this first portion of the formula here represents what you would receive back if you invested one dollar for a one-month period of time, at a rate of .26%.
On this side of the formula, we have how much you received on a one dollar investment if invested as a two-month rate .37 for two months. Over here on this portion of the equation is the unknown because this here represents the one-month forward rate that we are trying to determine by virtue of this other

data and you can see that this equation is solvable if you will, by doing the math and solving for X. By doing the math you will find that X equals .48%, and as you know, that's generally how a forward rate is determined for purposes of our swap valuations we are computing. This process will be repeated over and over again to compute all of the forward rates under the term of the swap for the entire term of the structure. This relates to what Nat was explaining about the futures contracts because the futures contracts actually remove the need in some ways to do this type of math because the futures contracts are actually defining the price today, by virtue of the price of the contract. So the big picture if you will is we have the swap value being driven by the present value of the fixed and floating legs.

Slide 16

On this slide I just wanted to illustrate and again this is another Bloomberg screenshot that was taken from SWPM or the swap manager module in Bloomberg and this is just an example of a 10 year, $10 million swap and what is illustrated on this page are the fixed and floating rates over time, so you can see here the horizontal line or yellow line is the fixed rate of the swap and the orange line is the floating rates over time, which here ends up being the last rate determined as 3.31%. On the bottom half of the graph we have the net cash flows under the swap and you can see the relationship between these net cash flows under the swap in the coupons, by the fact that during the first part of the swap you are a net receiver, (this is set up as a fixed receiver paid floating rate swap) so the cash flows are positive because you will be a net receiver. Then you will see here at some point there's an inflection point, or a point at which you become a net payer, and the way that this swap was set up was such that the "present value" of the fixed cash flows is equal to the "present value" of the floating rate cash flows and that's what we call in this context an "on market swap", so what we did is we solved the rate at which those two legs equal each other which is 2.17%.

Once again, I would say to the audience if there's one thing that you take away from the presentation today I would really focus on this page in that determining the fixed swap rate in this case, the yellow line, it is pretty much the fixed rate if you were to move that yellow line up and down horizontally where the scale on the right is determining the fixed swap rate, your positioning that yellow line so that the positive cash flows from the perspective of the dealer who is receiving the fixed rate, and paying the floating rate is equal to the negative cash flows, on a "present value" basis. So the area above the line is about the same as the area below the line and if you think about it what Eric just explained in the prior pages is that there is an objective method of determining the forward LIBOR rates. So, essentially we can at any point in time determine these forward rates, Eric can determine these of forward rates, the traders at Goldman Sachs can determine the forward rates, you can even determine these forward rates and that is a given where the forward LIBOR rates are. So if I was to say for a 10 year forward swap which has a maturity out here, what is the fixed swap rate such that the cash flows on the fixed side equal the cash flows on the floating side on a present value basis? It is this level here which pretty much cuts them in half. Let's say for instance, I want to determine the fixed swap rate on a 5 year swap. I don't know if you can see this on the chart but if I was to in the cash flow here at 5 years, my fixed swap rate would be somewhere around this point here although it is hard to see, but again it is the fixed rate that cuts that orange line in half. So my fixed rate on a 5 year swap might be somewhere around 110, but I think however, it is a really important concept for you to get, in that the fixed rate, the fixed swap rate is nothing more than a point that cuts those forward LIBOR rates in half. So the "present values" of the fixed yellow line is the same as the "present value" of the Orange line.

I think that is another really good take away from this is that you can really visualize the "on market" rate regardless of the term by moving that horizontal line up and down such that those two areas more or less offset each other.

Slide 17

What we also wanted to address in this presentation was to the extent that you have a swap outstanding you know how that affects the changes in the market; will it affect the value of your swap? So what we've produced on this page is also from the Bloomberg data YCRV in the command line, to produce these LIBOR swap curves from different periods of time as you can see over time these snapshots, so to speak, indicate that the LIBOR swap curve definitely changes. Right now in November 2011, we are at historic lows and if we look at 3 years ago or even 6 years ago, you can see that the curve was higher as well as flatter especially during 2005.
Typically, when you enter into a new swap we are generally talking about what we call an “on market” swap described as one where the value is zero upon execution. An “off market” swap would then be a swap where the value is not equal to zero upon execution and from time to time you see these kinds of swaps where there may be an upfront payment made by the swap counterparty to the governmental entity, and as a result the fixed rate on the swap is higher than it would have been had there not been an upfront payment. The point I want to make is that while you can enter into a swap on day one and it is by definition “on market” like our 10 year swap example of 2.17, almost by definition as time goes on your swap becomes “off market” because interest rates will either rise or fall one way or the other and your existing swap will change accordingly.

Slide 18

What we wanted to try to highlight here is when rates do change, how does that really impact the value of your swap? So as a start we wanted to look at those 3 dates from the prior page 2011, 2008, and 2005, so let's suppose our swap was the one from 2011, and it is a pay fixed in 2.17 rates and it is receiving a three month LIBOR. So, if we just put that swap into these different dates such as in November 2011,and we don't have any change in rates so there is no change in value, but if we have the same swap and enter in the year of 2008, where we see in the curve that rates are higher and the change in value is computed to be $1 million, which is 3818 positive and the “on market” rate, would be the rate at which the curve on that date implied a value of zero of the swap which would be 3.818% and our actual swap has a rate of 2.173, so we call the “off market” portion or the difference between those rates of 1.645. If we look at the same swap, but in November 2005, it is yet higher and flatter on that date and we can see that the changing value is also greater as a result with an “on market” rate of 501 and 2.837.
Hopefully this will frame some of the next slides in our discussion as we talk a little bit more in detail on this changing value and how you might be able to estimate changing values of your swaps.
Obviously if rates had dropped in our examples, we would have a change in values that were negative, but as it turns out there are no examples to give because rates haven't actually been lower than today.

Slide 19

One of the things that is really important, is to know be familiar with, is the concept of PV01. The PV01 is a very revealing and important data point and it's defined as the “present value” of one basis point coupon, fixed leg of your particular swap. So the PV01 will be different for every swap and is also dependent on the curve as of the date of valuation, because the discount rates in discounting, determining “present value” as you recall are based on swap rates or the zero-coupon rates. The PV01

in our example is actually equal to $9193 and as you can see the PV01 on those prior dates are different, and smaller. They are smaller because rates are higher causing the discount factors to be smaller, therefore the PV01 of every cash flow will be a smaller value today. The really important thing to know about PV01 is that it allows you to relate the market value of your swap to the actual fixed rate and the "on market" rate by this simple set of formulas which is on any given day if you take the mark to market of your swap and you divide it by the PV01, that will give you the "off market rate" of the transaction. That may be fairly obvious, but what is important is that then you can determine the "on market" rate here by virtue of the actual fixed rate and the "off market" rate. So if we just look at our example on November 2008, then do the math all does work out where we take the mark of 1.388 million, we divide it by the PV 01 we get 164.5 which is in percentage terms 1.645 to achieve the "on market" rate on that date of 3.818. So, if the mark to market was negative the "on market" rate would be less than the fixed rate because this number would be negative.
The other important value of PV01 is knowing that PV01 can provide you to convert any increase or change in your fixed rate, whether it is on a new swap or an existing swap into real dollars so if there is a dealer spread and the dealers going to charge you let's 15 basis points on your swap, and you know what that is in real dollars which in this case is equivalent to $137. So, in this case it's helpful to know what you will have to pay at a rate that is 15 basis points higher than the bid which is helpful in and of itself.

Slide 20

On this slide here this is simply an illustration of a PV01. The PV01 on this particular swap as you can see is the cash flows are quarterly; they are amounts that are declining over time because the PV01 of every cash flow is smaller as you move through time because the rates get higher and this on a summing basis will equal our $9193.

Slide 21

The other aspect of PV01 is that it is very helpful as it can help you estimate the changing value of a swap but there are a couple things to know before you go about trying to do those estimates. First we have to introduce now the concept of DV01.
So we talked about PV01 being the present value of a one basis point coupon. The DV01 which is Delta Value and we define it is the changing value of a swap for one basis point parallel shift in the yield curve. So if you think about that it is a little bit different than simply the PV01 of a coupon in some cases. What is the difference?
Well the difference is first if you have a "vanilla swap" where the floating leg is simply a one month LIBOR or a three-month LIBOR but not a percentage of one month or three month, then PV01 and DV01 are in fact essentially the same. This makes sense if you think about if rates shift up on the "on market" rate for a swap would increase by a basis point if the parallel shift was one basis point therefore if you know the PV01 of the swap and you know the average life of a swap, then you can estimate its change in value given the change of rates. So by virtue of picking up the paper or some other source and you find out that rates are up 2 basis points today, you know the PV01, you could recognize that your swap probably increased in value by approximately $18,000. On the other hand, if you have a swap that is on a percentage of LIBOR which is often the case with a governmental entity of let's say 67% of either one month or three-month LIBOR, the math is fairly straightforward. But it's important to realize that essentially a change or shift of one basis point in the yield curve is simply 67% of the PV01 so it is straight math in that regard. So, when we have used our example of a 2 basis point shift in rates, we simply take 67% multiplied by 18,000, it would give us essentially a $12,000 change in the value.

For those of you who may have existing swaps, you may have a question about how does the floating leg margin, or spread effect this calculation. The answer is you can ignore it, the changing value concept is only looking at the percentage of LIBOR which is the only thing that comes into play.

Slide 22

On the next slide, I wanted to point out a couple of things about pricing and some of the limitations of the PV01 and other kind of estimates that you might use during the structuring or looking at a swap on an after-the-fact basis. One thing is that you know, and as Nat mentioned earlier is that the calculations for valuing a swap are fairly noncontroversial. It is just math and the PV01 is a noncontroversial amount that should not be subject to debate and your swap advisor or financial advisor can give you the PV01 value as of a given date and you can find swap values in the Wall Street Journal or even at the Federal Reserve website which is referred to, I believe as the H 15 rates. Among the H 15 rates include the end of the day swap rates as well.
Just a couple of aspects about the PV01, as I know we are running out of time.

The PV01 is helpful if you are using the average life as a way to determine which rate you need to look at in terms of the change in rates today over the average life is reasonable, but it's an imperfect measurement of the swaps amortization. Another thing to keep in mind is that the standard quotes that we mentioned before are all homogenous in terms of the fixed leg has semi-annual payments on a 360 day basis, and the floating legs around a quarterly basis and actual 360 day count basis. That does come into play when fine-tuning the pricing of the swap because for an example actual 360 versus actual/ actual can change the rate by about four basis points if the fixed rate were otherwise 3%. So just changing that floating day basis could add up as , in this case 4x $9000, or $36,000. Compounding is also something that will change the rates the nominal rate will be lower if you have a more frequent payment, and then there's also kind of an entire different set of pricing for one month versus three months although typically it's not that substantial.
In addition, and just going back quickly to the last page because I think this is another good point to make is that if you do know the PV01 of your swap and you can find that out simply by doing the calculation yourself in a spreadsheet, or if you are less technical, just ask the dealer or the swap counterparty for the PV01 it just gives you the information. For instance if your swap is $1 million out of money and you've got a PV01 equal to $20,000 meaning that every basis point change in swap rates will influence the “present value” of the swap by $20,000, you can then say, well if rates move 50 basis points higher I'm going to reach my breakeven so that any time you know the mark to market on your swap (which should be provided to you on a monthly or quarterly basis or as needed by the dealer), ask for the PV01 and simple division will tell you how rates need to go in order for you to breakeven. That’s a good number to know and is usually the types of questions that we get asked that you can probably do on your own.

Slide 23 through 33 [Speaker (Nat Singer) glosses over remaining slides with a general narrative]

Moving forward, and I'm going to go through this quickly so that I can leave a little bit of time for question and answers, an important take away is that when you enter into a swap and say in today's market you entering into a 30 year swap and say the fixed rate is 3% that you are paying and you are receiving it as the floating leg LIBOR, which three-month LIBOR today is about 25 basis points, it is important to remember that the dealer on the other side is not making a bet with you, where they think over time collecting 3% is going to yield them more money than paying you LIBOR, versus today, LIBOR being 25 basis points they don't think they're going to win in that cash flow arrangement over time. Every dealer on the street runs what we call a matched book where you are paying them a fixed

rate and receiving a floating rate they are going to do an offsetting set of hedges where they're going to be paying a fixed rate to someone else and receiving a floating rate so, simplistically the dealer, if you can think of them as the house, are the middle guy that you will pay 4% and they pay you floating rate. Then they will go and try to find someone else that they can pay 398 and receive floating and make2 basis points time the size of the swap. In a real world they can never find somebody that wants to do that or, I should say never, it would be highly unusual to find somebody that wants to do the exact opposite trade that you want to do so, what a dealer does is when you do a swap they look at all the individual cash flows, and break it down into component pieces. Then if they hedge the component pieces properly it doesn't matter if rates go down on any given day, if they are perfectly matched off, the value of their swap, in the book should stay constant. In the real world they can't ever perfectly hedge the swap, so the value of the book goes up and down, but they try and minimize that volatility by matching those trades off as best as they can.

Slide 26

On a typical swap book and this is something I used to manage when I was at Bear Stearns, we had approximately 600 different buckets of risk that we would break our trades down into, and we had LIBOR risk that we needed to hedge, we had treasury bond risk, which is a component of the swaps as the treasury rate, we had volatility issues, but we had all different types of risk that we had to hedge and that is how many different components we would actually hedge to hedge our book. The way we would determine how to hedge is we had models and this is a screenshot of one of the models we would use to model the trade.

Slide 27 to end

So for instance, the trade is a $200 million swap that terminates in 2030, where we are receiving a fixed rate of 5% and we are paying a floating rate, this is an old screen, it says PSA, which is the old term for the SIFMA index. We would load all the details of the swap into the machine, the machine would do the math that Eric just went through that was on the spreadsheet, but there are canned packages that would actually calculate the swap rate. We would put an amortization and call-ability if there's optionality, but the interesting part I want to go through is on the next page and you don't have to look at all the details but the output of the systems would be what would we need to do in order to actually hedge that swap by breaking a swap into its component pieces. Remember what Eric talked about it the first section that a swap is determined by LIBOR fixings at the front end futures within the next three years, then actual LIBOR swap rates observable swap rates for the balance of the term. That's the way a dealer hedges, which for this particular swap it is saying to go out and sell futures contracts in each of those different months that the Euro-dollar futures contract is offered in these amounts. Then, go out and actually execute interest rate swaps at each point in the yield curve to hedge off the cash flows. So the theory and practice come together here. That’s the way we build the swap curve, it is the way we hedge the components of the swap and these are the actual executions that the dealer would actually go and do as soon as you say “done” on the phone, that you accept their deal on the swap. This is what we do to hedge interest-rate risk. The swap may also be a SIFMA swap so we have to hedge SIFMA risk and it tells us what we need to do in the SIFMA basis to hedge and other points along the curve that we would need to hedge. Then, finally if it was an option, we would have to go hedge in the up volatility market or the option market and there are different points that we would have saying in 5 for 10, and 5 for15, it's not important to know the details of the hedging here, but just the fact that the dealer actually has to go out then and hedge all of those individual components. So, when you say done, a dealer has a lot of risk, they have risk to market volatility, they've got risk to actually to BOA or SIFMA ratios, they've got risk to the yield curve and they need to go out and execute the trades and try to bring the

risk down as much as they can. So, if you think about it and you have entered into a trade with a dealer, they've entered into all of these hedges and a year later, or 2 years later, or even five years later you want to ask them to unwind the transaction, the unwind calculation function at that point will be a function of how the individual hedges have performed, and what it costs the dealer to unwind all of those hedges and it's nothing more than the math that Eric went through in his section which is that they're going to go out and calculate a new “on market” swap curve, calculate how much the hedges have moved since they put them on and your termination costs, or the mark to market value of the swap is nothing more than a mathematical calculation of the change in the market from the time you put the trade on, until the time you exit the trade.

QUESTION AND ANSWER SESSION

Question: If the neighborhood effect is as powerful is as suggested an alternative being the variable-rate security and simultaneously selling a swap or executing a swap is typically less expensive than issuing fixed-rate long-term debt, why doesn't everybody do that?

This is the question I ask myself every night, but the answer is that this transaction that we've talked about, this synthetic fixed-rate transaction issuing variable-rate bonds and entering into a swap is not without risk, and we specifically did not get into that within this module because we wanted to get into the pricing. However, when you sell a fixed-rate bond there's a one-way application now that you, as the issuer needs to perform from that point on, every six months you have to make a coupon payment and an annual principal payment if the bond amortizes and those are your totals, but there is no risk t to you, those are just your obligations. When you enter in to option B, which is the swap-based alternative, you've got risk associated with the floating rate debt that you potentially have to roll over with your letter of credit every 3, 4 or 5 years, or whatever the term is of the letter of credit, and you don't necessarily know what the cost of the LOC is going to be in the future. You've also got swap counterparty risk, the risk the swap counterparty is going to perform over time and you potentially have basis risk and maybe the floating rate that you receive on the swap is not the same as the floating rate that you are paying on your bond and certain other risks that you need to understand when you get involved in swaps.

So then the question becomes a risk return trade-off. If you can save 10 basis points by doing option B, versus option A is it worth it? I would argue no. I would argue based on the risks associated with option B you would be better off doing the simpler option A? But what if the differential is 50 basis points or how about in today's market with the spread are over 200 basis points? Then is it worth it?

It then becomes interesting and I would make the argument in today's market that yes it is worth it because at 200 basis points even with a very conservative estimate as to how much your letter of credit cost could increase in the future, or how much basis risk you may incur in the future the risk return is probably heavily skewed in today's market towards the return side.

In addition, and what we are now seeing in the business, is that after the 2008 financial crisis with letters of credit costs skyrocketing, the Lehman Brothers failure, and the failure of counterparties, that we are now seeing some interest again in the spread markets.

One other take away here is the spreads are as wide as we've ever seen them so I think that answers Brian's question and unless Eric, you had anything to add I think that concludes our presentation and leaves us a little bit of time for some more Q&A.

Eric, Nat, I want to thank you for an excellent presentation on Swaps. We've addressed all of the questions at this point so if there are follow-up questions from any participants feel free to e-mail them

to our email address which is cdiac_education@treasurer.ca.gov and we will address those.

Finally, I want to recognize that the webinar programs complement our annual CDI AC seminars which are our core classroom-based training programs. In addition, we have two webinar programs coming up one on December 7, called Agency Securities, and the second, January 11, on Municipal Market Outlook for 2012. We will also be emailing all the participants from today a survey, and we ask that you take a minute to respond to this. The link will be sent through survey monkey and we will facilitate the survey and responses and we always appreciate comments as these help us to structure our future webinar programs.

Also for those participating if you require an attendance certificate again, e-mails the cdiac_education@treasurer.ca.gov and we will get that out to you.
Again, Nat, Eric, thank you very much and for those of you who did participate we appreciate your attendance.

This concludes our webinar.