Artificial Intelligence (AI) for Investments
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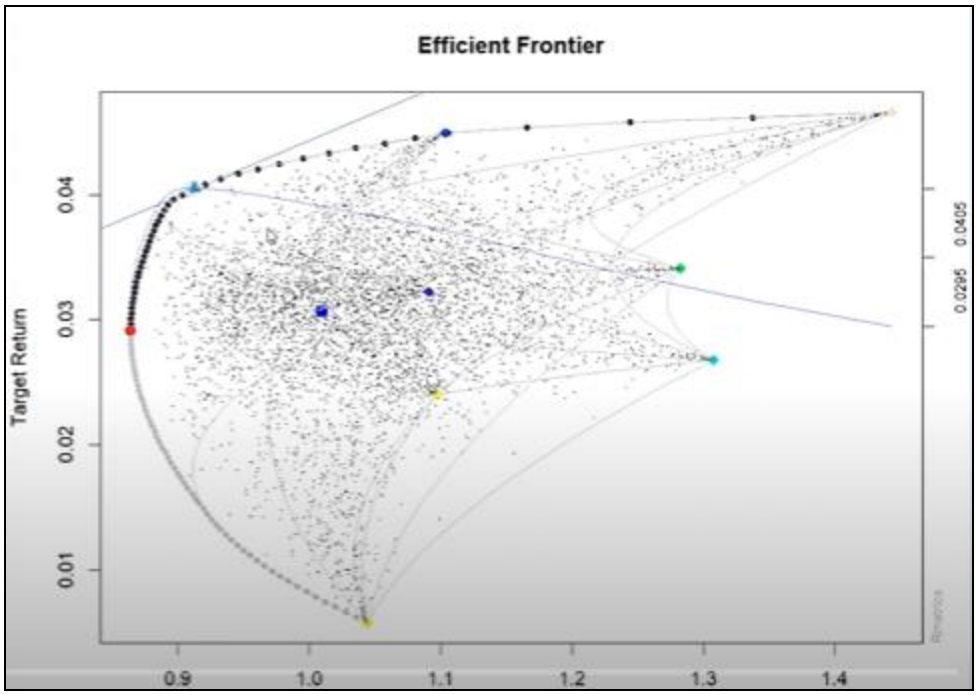
Lecture- 37

In this video, we will learn how to interactively plot mean variance frontiers. So we will interactively plot mean variance portfolio frontiers. As a starting point, let us initiate our mean variance portfolio object. Let us name it MBP spec and as we have been doing, we will use this portfolio spec function to initiate this object. First we need to specify the number of frontier points. These frontier points will be used to specify how many frontier points are required and we will use this MB spec object, MBP spec object and we will assign 100 frontier points.

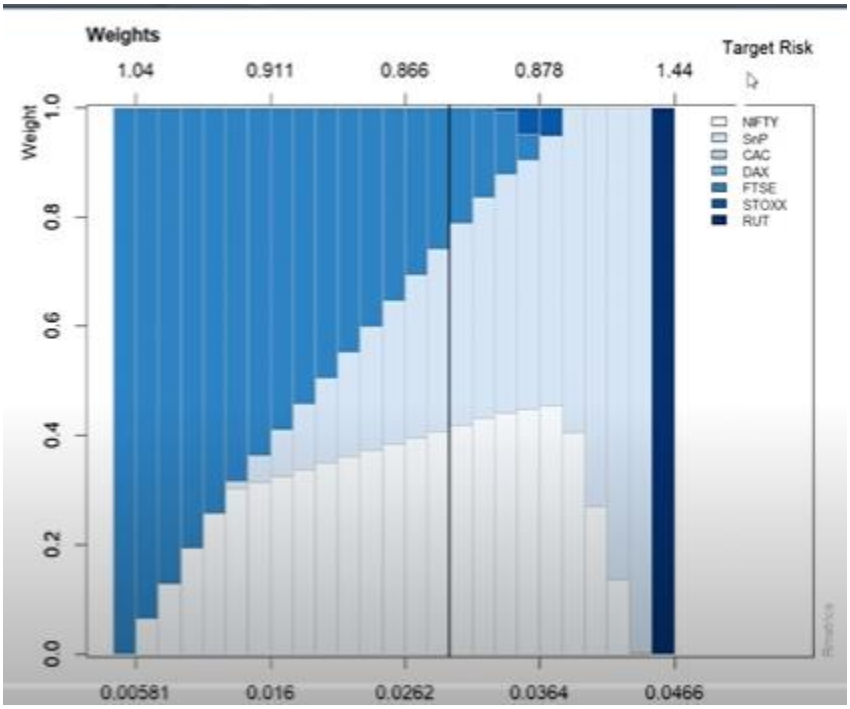
Now finally, we will create our frontier objects because we are using long only constraint, we will name it long frontier. Let us name it long frontier and we will use portfolio frontier function. First we will specify the data object which is final underscore return and we need to provide our minimum variance portfolio spec. Now that we have created this long frontier object, let us print it and see what is inside this object.



So, we can see that it has basic portfolio slot with estimator, solver, optimization, long only constraint and notice out of 100, there are total 100 points, out of those 100 will be

giving us 5 points to as a brief summary. So notice portfolio weights, point number 1, 25, 50. So we have every 25 interval, we have the details of weights, we have covariance risk budgets for each of these 100 points, but here for presentation purposes only 5 points are printed. We also have target, the target returns and various risk, covariance C bar bar risk printed for 5 points out of 100. So let us start.

So let me enlarge the plotting window and we wanted to plot it interactively. So we will plot this long frontier object. Let us plot it and once I click control enter and so I press control enter, 8 options are provided. So in the first option, it will plot the frontier object. Notice the frontier object is created.



Then we will add the minimum risk portfolio with selection 2. That red point is the minimum risk portfolio, it is added here. With number 3, we will add this tangency line. So this is the tangency line and this is tangency portfolio. Also with point number 4, we will specify the risk return of individual assets.

So all the 7 assets are there printed. So here we can see individual assets being printed. With next selection, we will add equal weights portfolio. With selection 5, we will add equal weight portfolio. This is the square solid blue point here, which is the equal weighted portfolio.

With number selection 6, we will add 2 frontiers, 2 asset frontiers, combination or basically combination of 2 assets, large number of 2 asset combinations as they are being created, we can see that line by line, a number of 2 asset combinations are created. Next with point number 7, we will add Monte Carlo simulated portfolios. These dots represent a number of simulated dot Monte Carlo portfolios with different combinations of weights and so on so forth. You can see these small dots representing Monte Carlo simulated portfolios. Lastly, we will add Sharpe ratio of Monte Carlo.

So with point number 8, we will add the Sharpe ratio line. So notice this dotted line here, Sharpe ratio for Markowitz portfolio only. So this is Harry Markowitz portfolio Sharpe ratio. To summarize in this video, we created interactive portfolio of efficient frontier and feasible region plot. In this plot, we started with plotting the efficient frontier, then we added minimum risk portfolio, then tangency portfolio, then we added risk return of single assets, then we added equal weighted portfolio, then we combined all possible 2 asset combinations to create 2 asset frontiers and then we added Monte Carlo portfolios, simulated portfolios.

In this particular video, we are working with long only configuration. So none of the assets are put in short position. In this video, we will again create the long frontier plot, but in a more customized manner. So we will again create the portfolio frontier, but in a more interactive and customized manner. So let us see.

So we will start with our frontier plot object. And here, we use our long frontier object that we created in the previous video. We specify the type, we specify the type as line and we will add line width as 4, which will result in a very solid line in our portfolio. So we will run this command and a very large efficient plot appears, then we will add the you can say CML point or tangency point. Again, we will specify the long frontier object.

We will provide color as red and we will add PCH 19 kind of figure for plotting and line width of 3, LWD of 3. So notice this solid red circle has appeared as the tangency point, CML point or you can call it tangency point or best portfolio. Then I would like to plot equal weight points, points with equal weight portfolio. So equal weight points. Again same objects are supplied only that we change color to probably brown and maybe PCH as 20 this time to change it a little bit.

So this brown circle is supplied here, we can see that this is our equal weighted points, point representing equal weighted portfolio, there are certain combinations. Next I also wanted to plot single assets individually. So I will supply single asset points. So I want

to identify single asset points as well. So I will provide long frontier, PCH as specified at 20, but this time around I want to plot multiple colors.

So I will use color equal to 1 to 7. So 7 different colors will be employed and 6 equal to 3 indicates large circles. So let me start plotting from here. So when I add this notice a number of colors appear. So these are my 7 assets.

I also wanted to draw 2 asset lines as we did earlier with interactive plot. Here we will do it in more customized manner. So I will draw 2 asset lines, but this time I supplied specific colors. So probably I specified color equal to blue.

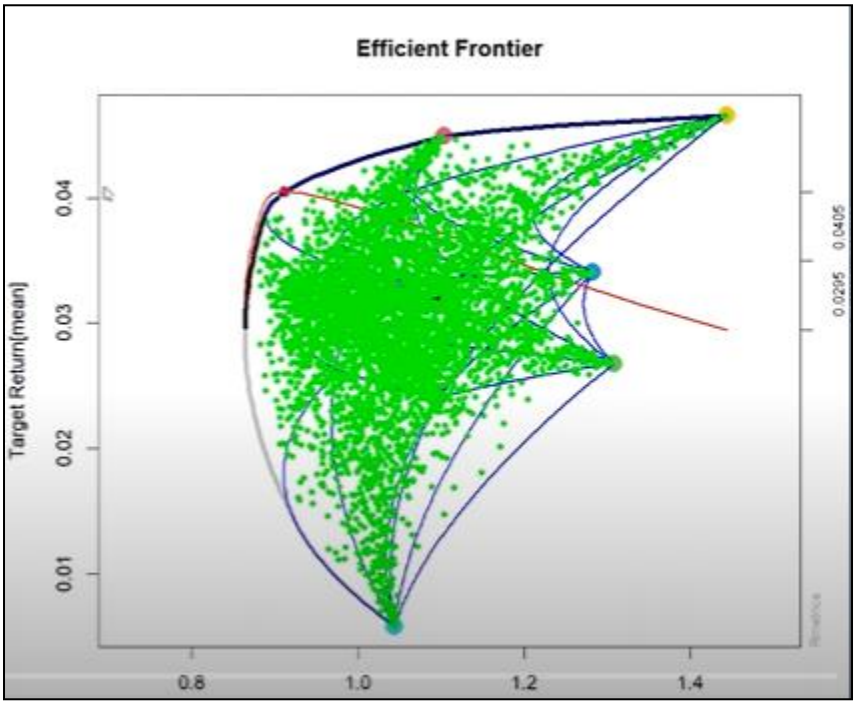
Let me see. So here color equal to blue. So I will run this 2 asset line command, 2 asset lines and I will supply my long frontier object. Let's see if these lines are created. You can see the lines being created. Let's see if we can specify the color also.

So let me give a color of maybe blue. I will empty this chart. So I will again recreate these. Okay so blue color lines are being created and we can see. In fact here if you want you can increase the line width slightly large so that the width of the line can be increased and WD can be specified as 2.

So you can see now again the lines are redrawn with a solid larger width. Also you can add Monte Carlo portfolios or first let's try with Sharpe ratio lines. So if we can plot Sharpe ratio lines with again the long frontier. But this time I will provide color as red for Sharpe ratio line, color as red, line width again will be 2. You can see a very solid line which is sort of going from here is plotted.

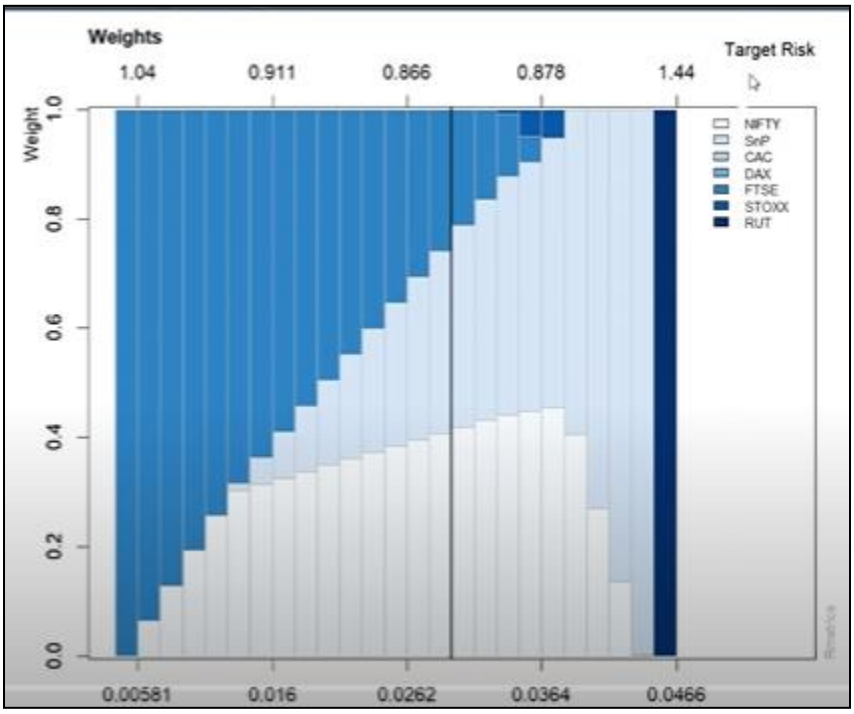
Now let's add Monte Carlo portfolios also. So I will add Monte Carlo portfolios. Monte Carlo points each point represents a combination of securities for a given risk and return. So I will use long frontier. Let's use PCH of 20 and I will use maybe color green.

Let's use green color. It seems less green so we will use green colors to present Monte Carlo points and you can see these filling the feasible region filled with Monte Carlo points. So to summarize this video we created a customized frontier plot where we started with the frontier plot using our long frontier object created in the previous video. Then we added the tangency point with CML points command. Then with equal weighted points command we provided the portfolio with equal weights in all the seven assets. Then we identified the single asset, seven single asset points.



There are seven assets in this portfolio that we are using, seven securities we are using. So with the single asset points command we identified all the points in this region. Then we also created two asset line and a combination of two portfolios. Then we added Sharpe ratio line and then lastly we added Monte Carlo points. In this video we will examine the properties of our frontier point plots.

Most specifically we examine the efficient frontier points and their weights, the weighted return of individual assets and covariance risk budgets. So here we will identify the properties of frontier points. Now initially we started with the object with 100 frontier points. However it would be slightly difficult to visualize 100 points in one graph. So rather what we will do is we will set n frontier points but instead of using very large number of points we will restrict ourselves to maybe 25 points and recall the name of the object in the previous video it was MVP spec.



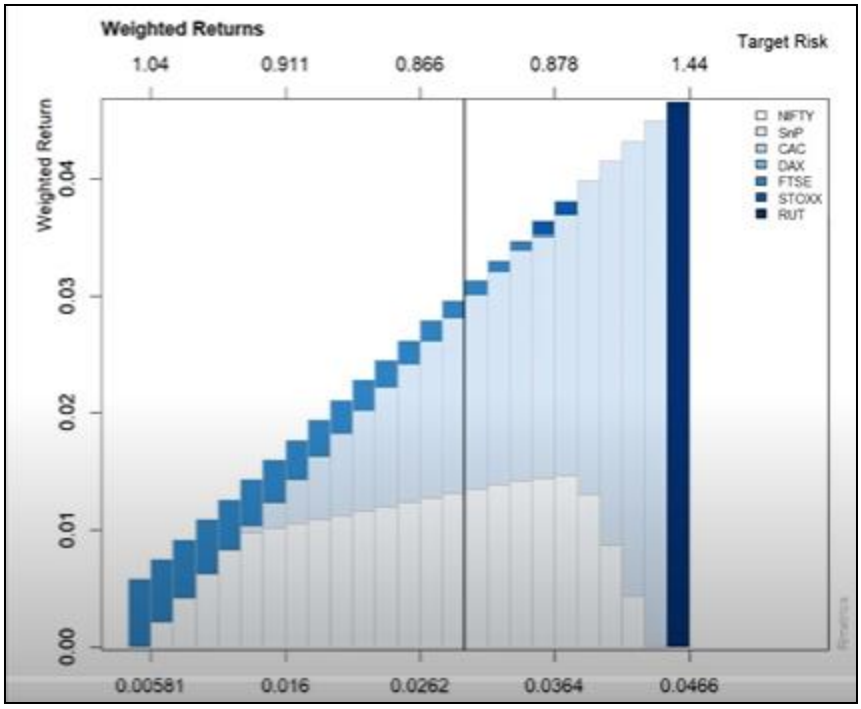
So we will use the same MVP spec object and we will specify that we want to use only 25 points instead of 100. So now the specification is changed. So we will again modify our long frontier object which we have already created but we need to modify it with the new frontier point values. So we will specify our return object, final return which contains the security returns or individual asset returns basically all the seven assets the returns and then we will supply our modified spec object.

So long frontier object is created. Now with this object we will do first we will do the weights plot. So we need to use this weights plot command and we need to supply our long frontier object. Let us run this. So notice in this weights plot command we have weights and on the x axis we have target return on the top of it we have target risk and we have unique combination. So there are 25 points or portfolios for each portfolio we have target risk and target return printed here and their weight out of the total 100 percent or this one represents 100 percent and there is zero.

So their weights. So notice that the first portfolio with the return of 0.00581 here we have completely it is completely it seems DAX and then as we move ahead the proportion of this DAX security goes down and in between we have S&P and NFTY security and last one is seems to be Russell. Last one is Russell. So how the portfolio weight changes can be easily visualized and also we can see the how the movement of

risk takes place. So return here we can see return increases and also the risk increases we can see that for all these 25 frontier points that we have specified.

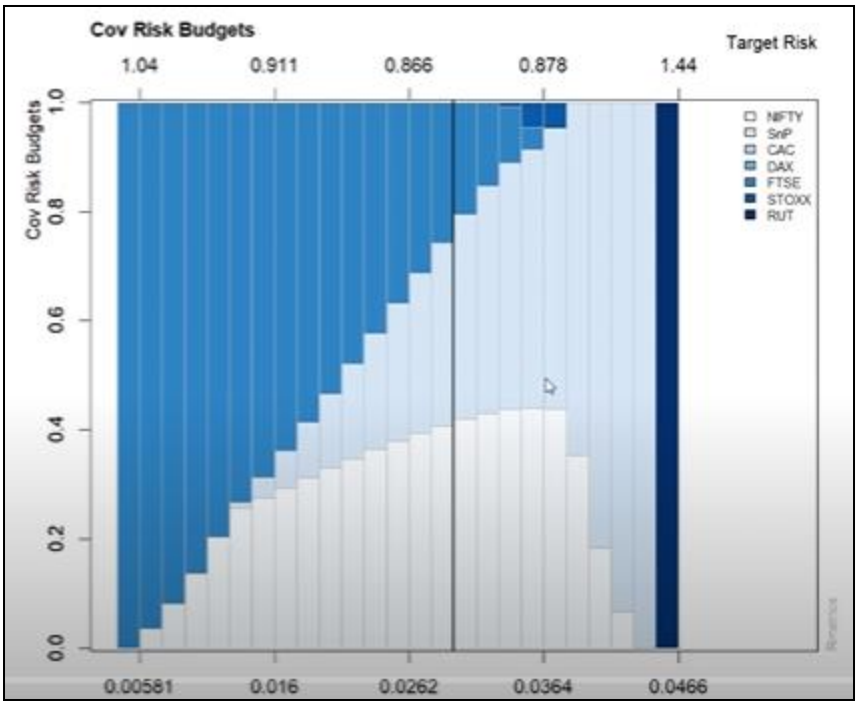
Next we can also plot the weight weighted return plot. So for that we need to add weighted return weighted returns plot and again we use our we will supply this long frontier object to this window and we can see weighted returns that means contribution to overall return by each asset is provided. Again on bottom and top we have target return target risk and we can see initially we have this DAX object and as we move ahead in between we have this NFTY and S&P objects increasing share of in the return as we can see on the weighted return axis and last one is Russell. Finally we also plot our covariance risk budget plot. In the covariance risk budget plot we need to provide again we need to provide our long frontier object and we can see the overall covariance risk budget 100% that is 1.



In the first portfolio as we expected we have the DAX object completely and its return and risk and as we move ahead the risk contribution as we decrease the weight of DAX the risk contribution also decreases in between we have NFTY and S&P significantly contributing to portfolio risk because we are significantly investing in these portfolios or assets. Lastly in the last portfolio we have Russell 2000 dollar. To summarize in this video we visualize our portfolio object with 25 frontier points. We visualize the weights for each of these 25 frontier point portfolios the weights of individual assets for all the 7

assets. We noted that mostly it is DAX, NFTY, S&P and in one portfolio Russell contributing.

We also noted the weighted returns plot we visualize the weighted return plot and lastly we saw the contribution to the risk of overall risk to individual assets through covariance risk budget plot. In fact if you like you can visualize them in one window only for example you can use this powermfro equal to C3,1 and let us see enlarge our plot window let us see. So this entire plot can be visualized in one window itself using powermfro and nicely visualize we can see the movement of weights, weighted returns and covariance risk in a single window with each other. In this video we will initiate a short portfolio object and visualize it. So as a starting point let us initiate a short portfolio object let us call it short.



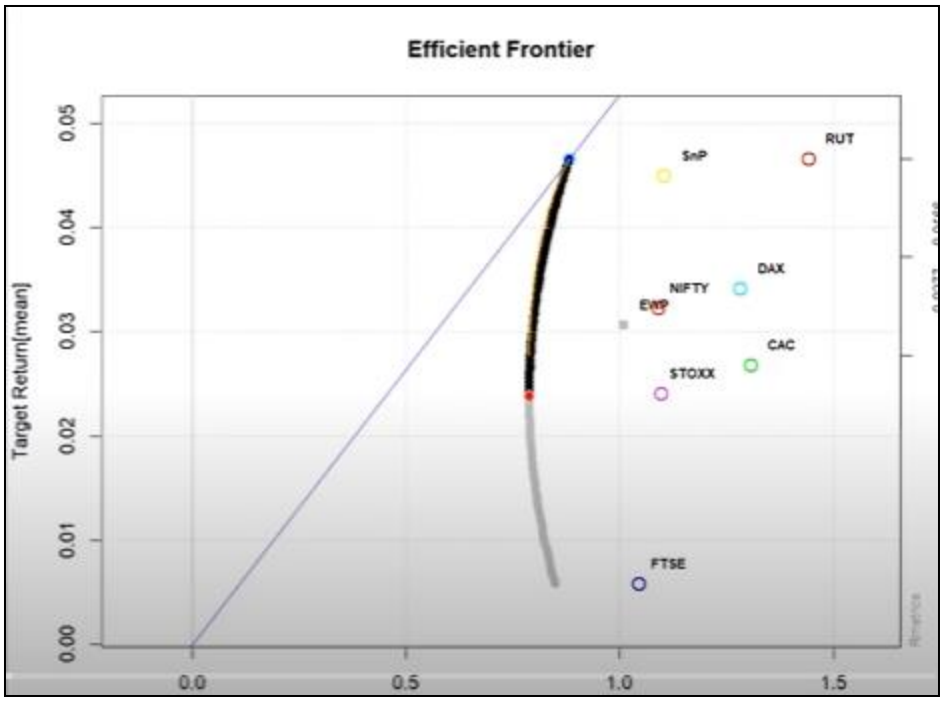
We will initiate and visualize a short portfolio object. So as a first point let us start with this short spec object. Again we will use our portfolio spec command to initiate the object. Once the object is initiated let us assign some frontier points. So first we will assign using this asset and frontier points command as we did earlier.

We will simply put short spec and we will assign we will start with 100 points first and now that we have assigned 100 points also please remember when you are working with short objects where minus infinity to plus infinity all options are on table you need to change the solver also so we will set using this set solver command. If you print the short

spec object notice the current solver configuration is SolveQuad program. Now we need to change it and using this set solver we will use short we will change it to short solver we will supply our short spec object and we will supply solver name which is solver short exact. So this is our solver object solver short exact. Now that we have identified the solver we will start with our portfolio object which is short let's name it short frontier and again we will use our portfolio frontier portfolio frontier function.

We will provide the return object data data which is final return which contains the return of seven securities that we are using. Then spec which is short spec object that we started and lastly we can now provide constraints as short so we will run this. Now short frontier object is created in fact you can print it to see what are inside so we can see now the portfolio weights we can see some of the weights are negative out of hundred five points are printed as we have seen in the previous video notice the solver solver short exact and you can see some of the portfolios have negative in fact in covariance risk budgets also we can see some negative and target we can see the target returns covariance C bar and bar risk calculated. Now using a very interesting command which is called tailored frontier plot we will try to visualize this short object so we will use this what we call tailored frontier plot which nicely prints a graph or plot of short frontier so we will use the short frontier object that we created. Let's give it a heading M text which is MV portfolio with short constraints short constraints.

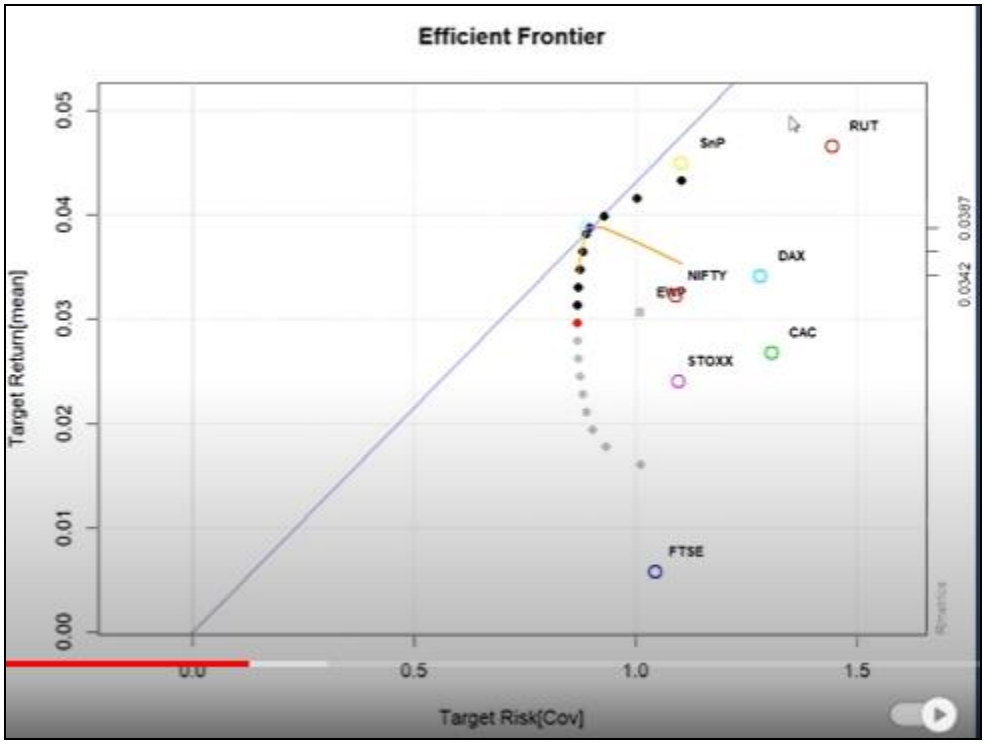
Again we will stick to the covariance risk risk equal to COV. Now let's enlarge the plotting window so that graphs turns out nicely and we can see here let's examine the graph so we have a nicely printed frontier along with the tangency line and we have also individual assets plotted here along with the Sharpe ratio line so this is the complete graph through tailored plot command we can also use plotting commands that we use earlier to visualize this. In addition we would also like to have those weighted returns weights and covariance risk budget plots so for that I will again use the same set of commands copy paste them but I will just change this long frontier to short frontier. So I will just change it to long frontier to short frontier and let us plot them I will use this powermpro31 so that all of them are there in the single plot.



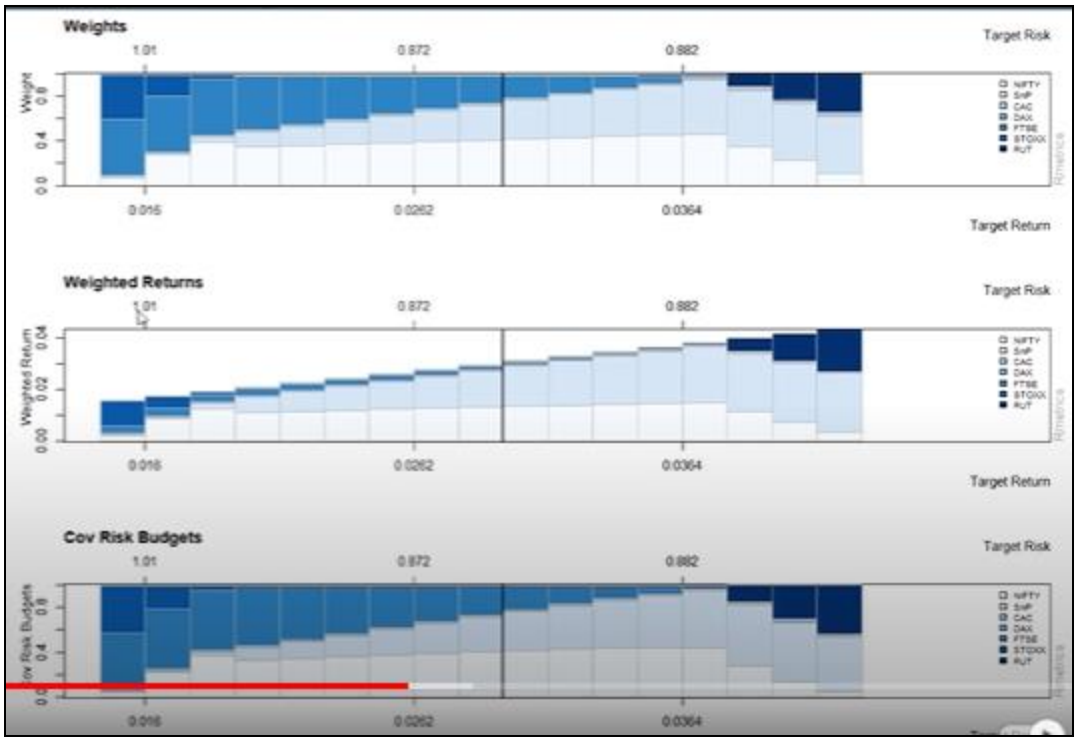
So let me zoom it to visually examine it more carefully. So let us examine this graph more carefully in the first plot we have weights of individual assets and now we can see it varies from 0.005812 to 0.0451 we can also see how the weights are changing now see it is negative minus one we can also see some of the points below minus one and some of them above two which indicates that some of assets have been shorted and the additional well due to shorting is invested in other assets so we can see that. In fact it seems that Russell has been shorted maybe a little bit of FTSE also and on the long side we have probably FTSE and tags on the long side and the pattern moves gradually. On the weighted return plot also we can see the contribution in fact we can see some of the assets contributing negatively particularly the Russell and along with Russell maybe it seems CAC some of them are contributing negatively to the returns along with we can also see along with that target risk and target return.

In the last plot we have covariance risk budgets and again here also some of them are contributing negatively due to their short positions while more specifically the FTSE and DAX are sorry CAC and DAX are contributing FTSE and DAX are contributing positively so they are in the long position niche and the position varies over time. To summarize this video we initiated with the short object with 100 frontier points first we plotted these frontier points along with their frontier then tangency line and individual asset points through tailored frontier plot command here we plotted them and then also we visualize their weights, weighted returns and covariance risk budget plots for this short portfolio object. In the series of next four videos we construct and visualize box,

group and covariance budget constraint portfolios and in the final fourth video we will create a complex portfolio object with all four constraints put together. So first we will start with the box constraint portfolio frontier. Please note when you put constraints in the frontier the frontier is slightly restricted not as free as the frontier printed earlier which means that some of the combinations of risk return portfolios may not be available.



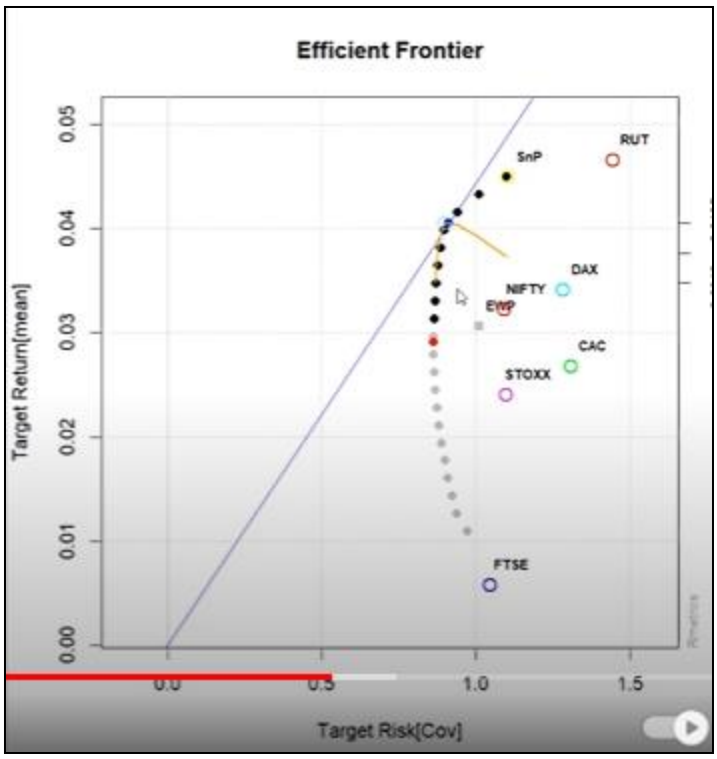
So let's start with this box spec, let's call it box spec and we will again initiate with the portfolio spec object. Let's have it for set n frontier points let's start with 25 points we will start with so we will have this box spec object with 25 points and let's specify the box constraints. Let's have C first constraint may be minimum weight for portfolio 1 to 7 or let's put it on all the 7 portfolios equal to 0.01 as minimum constraint and let's also put the maximum weight constraint for all the 1 to 7 portfolios equal to 0.



So these are our box constraints. Now let's create this box frontier object and this requires this portfolio frontier function where we specify the data as final underscore rate and we also need to provide the specification of this which we have put a box spec and then constraints. So now that we have specified box constraint we can directly put our box constraints object so we have box frontier. Now as a starting point to visualize this or you can directly print this also you can just print it simply and you will find all the constraints we have already discussed in the constraint video topic on constraints 5 points are printed you can see that their target risk returns are also computed covariance as budgets and portfolio weights are computed. You can see the constraints minimum weight and maximum weight these are box constraints on individual assets. So let's use this tailored frontier plot and let's specify the object our object is box frontier heading is mean variance portfolio with box constraints and again our risk is covariance risk.

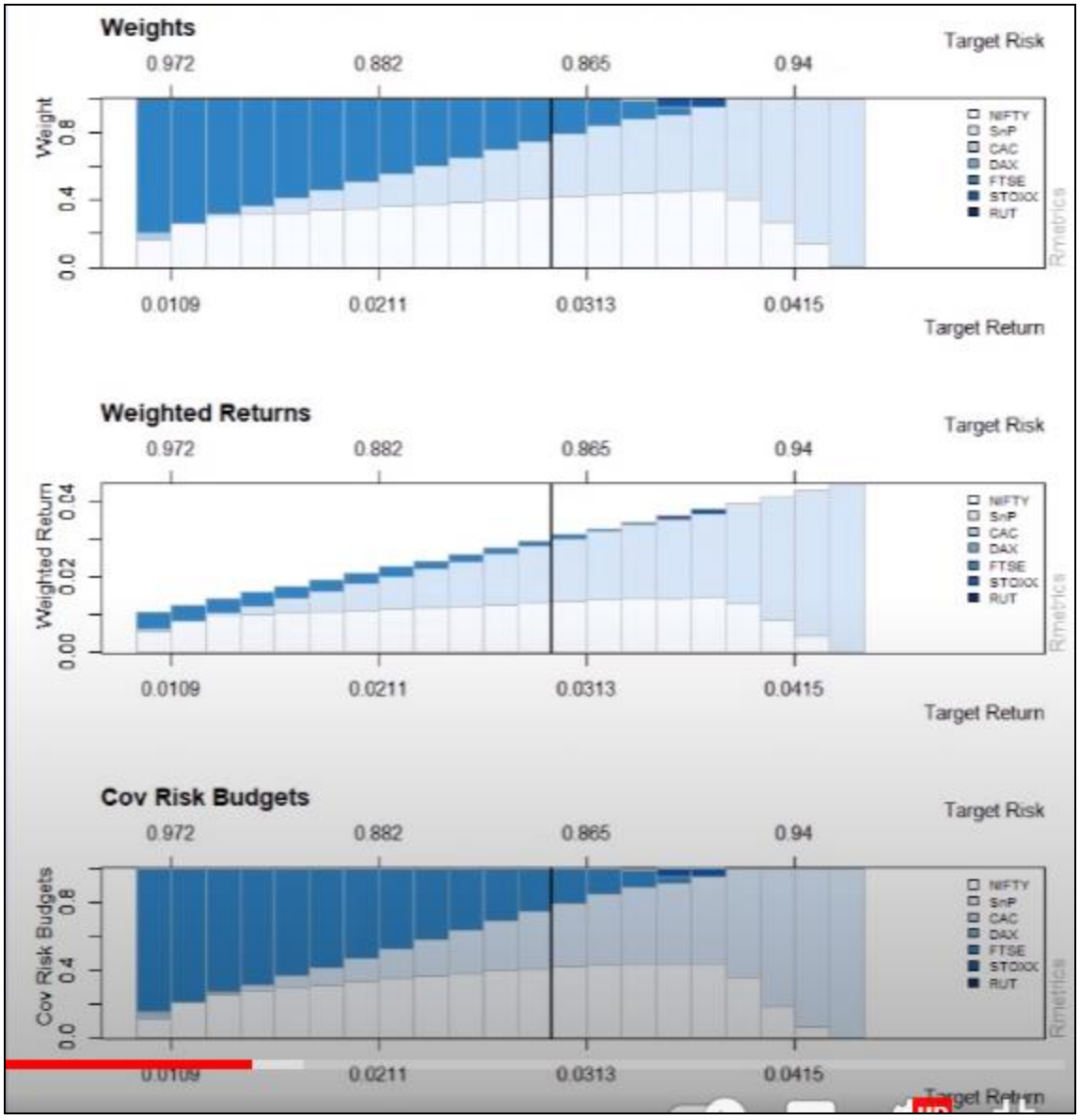
So let's plot this so we need to enlarge the window a little bit and you can see the plots nicely printed plot return on the x y axis risk on the x axis covariance risk you have the frontier points 25 points along with individual assets and tangent line sharp ratio line nicely provided here. So this is your visualization also we can also plot the weights weighted plots and other plots that we discussed earlier that is quite easy you simply need to use the same commands here we will just copy paste in the interest of time I will not rewrite them and I just need to change this short frontier here from box frontier because this is our box constraint object box frontier so I will just put box frontier here

and again they will be plotted and I will just enlarge the plotting window a little bit and then I will run them. So you can see that all the three plots weights weighted returns and covariance risk budgets are plotted the interpretation remains same as in the previous series of videos where we discussed the interpretation with target return target risk weight contribution of individual assets weighted return contribution of individual assets how they are contributing to overall return and how individual assets are contributing to the overall covariance risk of the portfolio or sort of risk of the portfolio which is measured through standard deviation or variance. In the next video we will plot the group frontier or group constraint frontier. To summarize this video we created a box constraint frontier object and visualize it in the next video we will create a group constraint frontier object.



In this video we will construct and visualize group constraint object or portfolio. So first let us initiate with the group spec and again as we do every time portfolio spec function to initiate the group spec object again I will use the same 25 points here we will just change the group spec notice I am changing box spec to group spec here so basically this will assign 25 frontier points to group spec. Now we will create this group constraints and we will assign a group constraints the following constraints are implied first we will use minimum sum weight that means for assets let us say 1 to 4 I am putting a constraint of sum equal to 0 point let us say maybe 0.05 so sum should not be less than 0.05 minimum sum of assets 1 to 4 that means 1, 2, 3, 4 and let me also put a group constraint

of max sum W maximum weight maximum sum I am restricting for a set let us say 4 to 7 to 0.



8 so I am restricting the maximum sum and minimum sum for 1 to 4 and 4 to 7 so these are my constraints. Now let me define the group frontier nicely so group frontier and let me assign it through portfolio frontier function as we have already done portfolio frontier function I need to specify the data which is final underscore return then I need to specify the spec which we have created with group spec group spec object and lastly I need to specify the constraints constraints equal to group constraints. Now I will run this command so my group frontier is created you can print it to see the elements inside for

example you will find basic portfolio slot with covariance estimator solver optimization function you have nicely printed objects the target return risk and so on so let's visualize them. So I will use again the tailored frontier plot as we used earlier so tailored frontier plot for this we need to provide the object which is group frontier object and then we need to provide the heading temp text equal to MB portfolio with group constraints and we will specify the risk as covariance. Let us run this tailored frontier plot and as we can see the tailored frontier plot here nicely printed please notice some of the risk return combinations of portfolios may not be available here because of these group constraints as they were in the original plot.

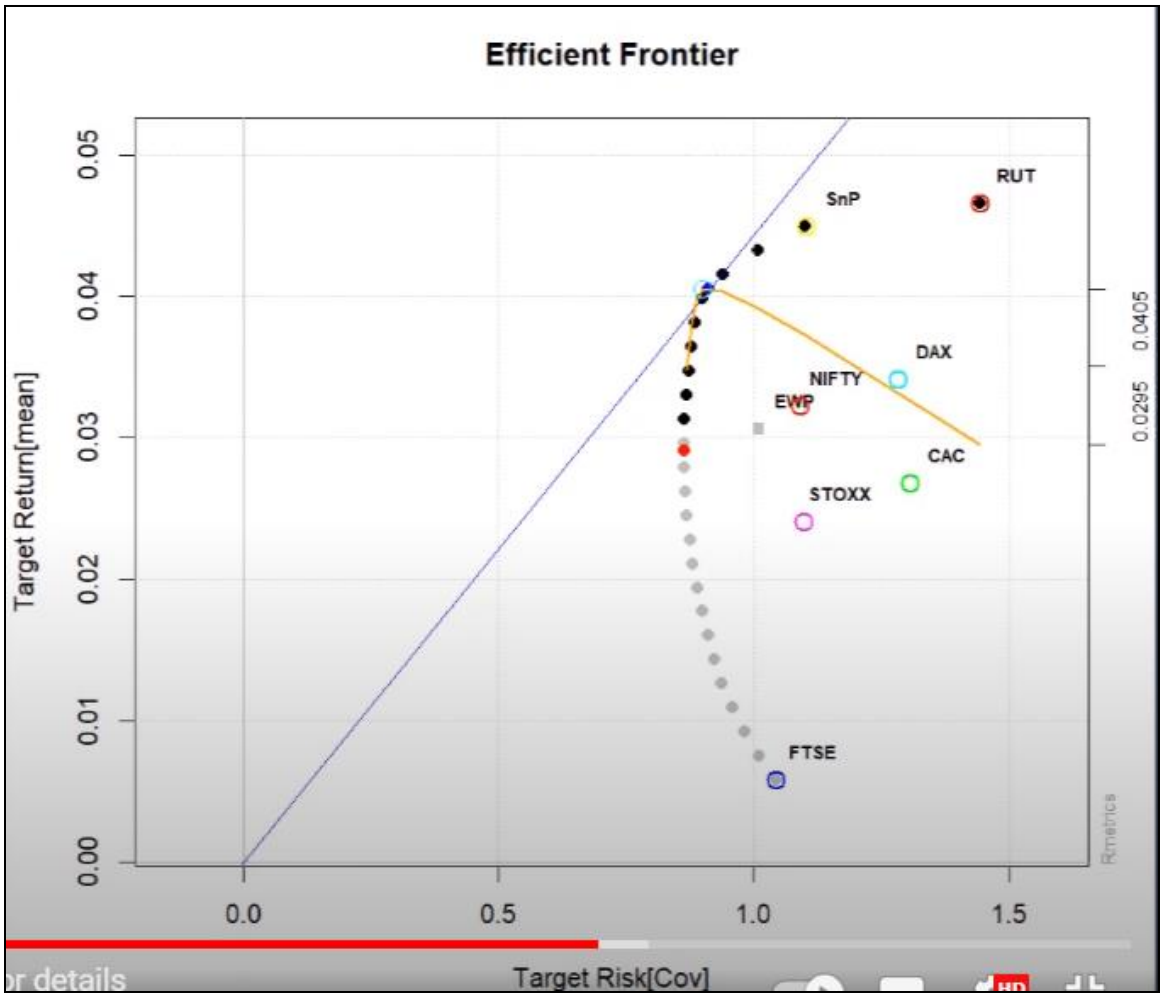
Now we can also add those weighted plots I will simply copy paste these commands I will not rewrite in the interest of time and please notice I will just change the box frontier to group frontier and I will put it here I will just change the box frontier to group frontier as we can see it is being done and then I can print it. Notice all the three weights weighted return and covariance risk budget plots are plotted here the interpretation remains the same we can interpret them in our free time. To summarize this video we started with our group spec object with portfolio spec function we initiated the object and specified 25 frontier points then we provided the group constraints as we can see here with these group constraints we created our portfolio frontier object with group constraints which we visualize with the help of tailored frontier plot and then we visualize three plots weighted plot weighted return plot and covariance risk budget plots. In the next video we will create a covariance risk budget constraint object and visualize it.

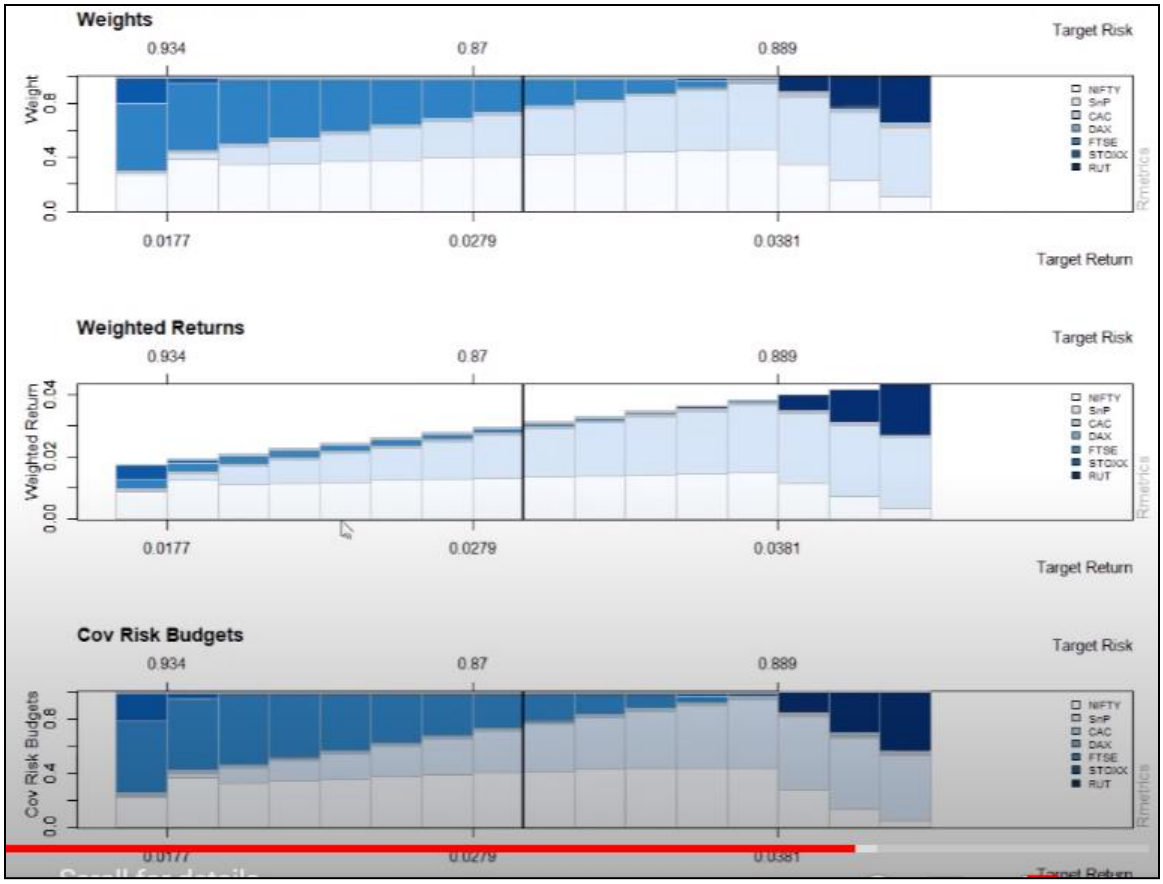
In this video we will construct a budget constraint portfolio frontier. So let us initiate this budget spec and again we will use our portfolio spec object again we will set our frontier points to 25 but let us use this budget spec object here replace this with group spec so we have budget spec and then let us specify these budget constraints. So let us start with identifying these budget constraints. Constraint number one let us call it budget dot one and we specify minimum for one to n assets there are seven assets so this n assets means seven and we will put it to minus infinite so this is minus infinite so we are putting no restriction on the downside and let us put object number two maximum budget maximum budget constraint let us put for one to n assets again seven assets we will have a sequence from 0.4 to one and we will set it by 0.1 so these are two constraints that we are going to use and let us define this object as budget let us specify this is budget constraints and we can assign this with both the conditions c budget dot one and budget dot two we can exclude this in fact we can print these this combined budget constraints we can print them you can see here.

Now let us create our frontier plot so for that let us specify our budget budget frontier object for this we need that portfolio frontier function so let us specify the data as final return final return data then spec as we have already specified our budget budget spec object then we need to specify the constraints equal to budget constraints let us run this so we have budget frontier now we will use our tailored plot frontier command here in fact we can copy paste the same set of commands and we just need to replace this budget frontier let us replace this budget frontier and we will call it minimum variance portfolio with budget risk budget constraints risk budget constraints let us plot this this is our risk budget frontier and again please notice a number of points may be not available here for there in the original plot because now we are putting this budget constraints so some of the risk return combinations may not be available with this budget frontier similarly we can also plot the weights plot that we did earlier we can plot this notice with different combination of weights weighted returns and covariances budgets interpretation remains same only that this time around we are putting certain conditions as we can see here so to summarize this video here we initiated a budget specification object with 25 frontier points and we specified certain budget constraints as we can see in these lines we have specified for all the seven assets certain conditions on their minimum and maximum risk budgets then we visualize this risk budget object here we visualize this through Taylor frontier plot command and then we also plotted the great beta return and covariances budget plots and we noted that there was some risk written combinations may not be available because we have put certain budget constraints that means in terms of maximum and minimum risk where it can possibly attain for individual securities in the next video we will create a complex budget object using all these three box group and covariance risk budget constraints and then construct and visualize the portfolio object in this video we will construct a complex constraint object we will employ the group box and budget constraint objects that we developed in the previous videos we will combine them and create a complex budget object and construct a portfolio around it and visualize it so we will create a complex constraint object let's create that so for that let's call it complex spec let's call it complex spec and again we use our portfolios spec function to create this object will as we did earlier we will specify the 25 frontier points but we need to change the object to complex spec object here so we will do that and now we will create our complex constraints and we will assign our box constraints group constraints and budget constraints so this is our complex constraint object now the remaining commands will remain same we need to create a frontier box constraint frontier so we will let's call it box frontier sorry complex frontier so we will call it complex frontier and here instead of normal constraints and specs we need to specify the complex spec object let's call it we will use our complex we will use our spec as complex spec object and constraint as let me enlarge the plot window a little bit complex constraints object so this will be our complex frontier and now while plotting we use this

complex frontier object to create the plot we will call it mbportfolio with complex constraints let's plot this a little we need to enlarge it a little bit so this is our complex constraint plot as we can see here so let me plot our complex frontier this is our complex frontier similarly using this complete frontier object I can also plot the weight plots the weighted return plots and the covariance risk budget plot so let me do that as we did earlier so this is our complex constraint object we have weights weighted returns covariance risk budgets interpretation remains identical as we did earlier to summarize in this video we initiated a complex specification object wherein again with 25 frontier points and we combine all the three constraints that is box group and budget constraints combining these we created a complex constraint object and we started with the complex frontier and we visualize the complex frontier with our tailored frontier plot as we can see here this was our tailored frontier plot subsequently we plotted the weight weighted returns and covariance budget plot for this complex constraint plot in this video we will discuss how to initiate a C-var conditional var or expected short form specification portfolio in the interest of time we'll only discuss initiation of portfolio the other functions for generating tangency portfolio minimum risk portfolio global minimum risk equal weighted portfolio and also creation of efficient frontier will remain same so we'll in the interest of time will not cover that they can be replicated simply using the functions that we have discussed already in this lesson so we'll just initiate mean C-var portfolio so earlier we were using standard deviation variance or what we called here as covariance risk earlier we'll replace that with C-var conditional work risk so to initiate that object we'll simply use this C-var spec object and initiate it with portfolio spec function so we have initial so this is our portfolio specification object now notice that while I'm setting the type of this C-var spec I'll use the appropriate C-var risk so that this C-var spec is created now notice that while solver RGLPK has been set but we'll use a different variant of this and we'll call this set solver command and we'll pass on the C-var spec object and specify the solver as solverglpk.cvar so this specific solver will you assign we use this specific solver again the number of assets although this we have already done we will assign the number of assets as n call final return so we specify that there are six assets with this our complete specification is come over now you can create number for example if you want to set weights or perform other functions you can exactly do the same commands that you used earlier so for example you want to set weights to this C-var spec object you can simply assign it with the same command rip 1 upon n assets comma times equal to n asset the same command so basically we are able to initiate our C-var spec object now if you want to compute equal weighted portfolio you want to compute tangency portfolio as an example if you want to compute equal weighted portfolio let me show you that equal weighted portfolio equal to feasible portfolio as we did earlier same command we are using and I'm specifying data is equal to final underscore return here spec is C-var spec also you can use those dynamic interactive frontier construction with the feasible region and everything you can do all

that so here I'm specifying long only so if I run this my equal weighted portfolio object feasible portfolio is created if I run this I can print a nicely printed readable summary notice this is C-var object C-var portfolio risk here being C-var and you can see the weights equal weight since it was equal weighted object we can see the equal weights covariance risk budgets target risk covariance C-var and so on so other procedure and implementation remain identical to what we have already seen for example we can construct tangency portfolio we can construct minimum risk or global minimum risk portfolio we can dynamically and in an interactive manner we can construct frontier plot as well so to summarize in this video we initiated a C-var object which was in contrast to our covariance risk object that we created in the previous series of videos in this lesson so just to summarize we created C-var object the other remaining commands to create frontier plots tailored plot and other things remain identical so in the interest of time we will not repeat them we hope with this lesson and with this our implementation we are now comfortable with constructing portfolio of your own choice with your own securities using R to summarize this lesson mean variance framework relies on portfolio variance or standard deviation as a measure of risk more recently tail risk measures such as conditional value at risk which is C-var have been implemented to examine the extreme risk scenarios we augment our mean variance framework with this C-var measure to construct and visualize mean C-var portfolios we start the discussion with introducing these measures next we implement the portfolio concepts using our programming we start by downloading the data from Yahoo Finance subsequently we compute the returns and visualize the data we initiate our portfolio object with simple long only constraints then we construct and visualize portfolios with specific risk return objectives these include equal weighted feasible portfolio minimum risk portfolio global minimum variance portfolio and NC portfolio then we plot efficient frontier in an interactive and customized manner we also initiate a short portfolio object with box group and risk budget constraints and visualize various attributes of this portfolio including weights weighted returns and risk budget composition we also combine these constraints and create a complex constraint object we comprehensively examine this portfolio object with complex constraints lastly we also learn how to initiate a portfolio in mean C-var framework .


Efficient Frontier
Target Return[mean]
Target Risk[Cov]
0.00
0.01
0.02
0.03
0.04
0.05
0.0
0.5
1.0
1.5
0.0295
0.0405
RUT
SnP
DAX
NIFTY
EWP
CAC
STOXX
FTSE
Rmetrics


Weights
Target Risk
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0.87
0.889
Weight
0.0
0.4
0.8
0.0177
0.0279
0.0381
Target Return
NIFTY
SnP
CAC
DAX
FTSE
STOXX
RUT
Rmetrics
Weighted Returns
Weighted Return
0.00
0.02
0.04
Cov Risk Budgets
Cov Risk Budgets