Security Analysis and Portfolio Management

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Module No. # 01

Lecture No. # 04

Risk and Return (Contd.)

Hello, this is a continuation of previous session Risk and Return, where you discussed about the estimation of return for different securities, expected as well as historical rate of return. Then you talked about the risk involved in the investment security assets and different factors that contributory risk and how do we measure the risk in terms of standard deviation, ranges, variance and all those measures.

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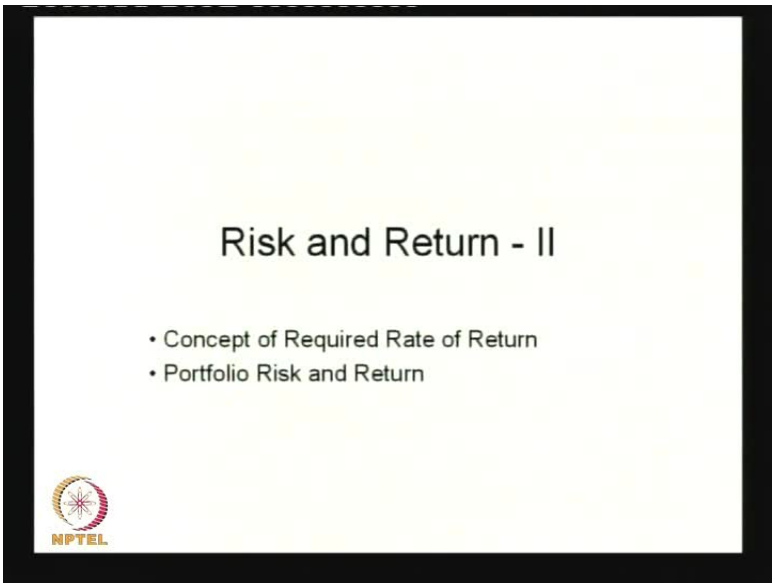

This is a continuation of the previous lecture, in this we are going to talk about the concept of required rate of return, what are the factors that affect as well as you can talk about the portfolio risk and return. When we say portfolio, it is a combination of different financial assets and in this portfolio risk, return depends upon obviously, the individual asset that is comprising of the portfolio comprises of.

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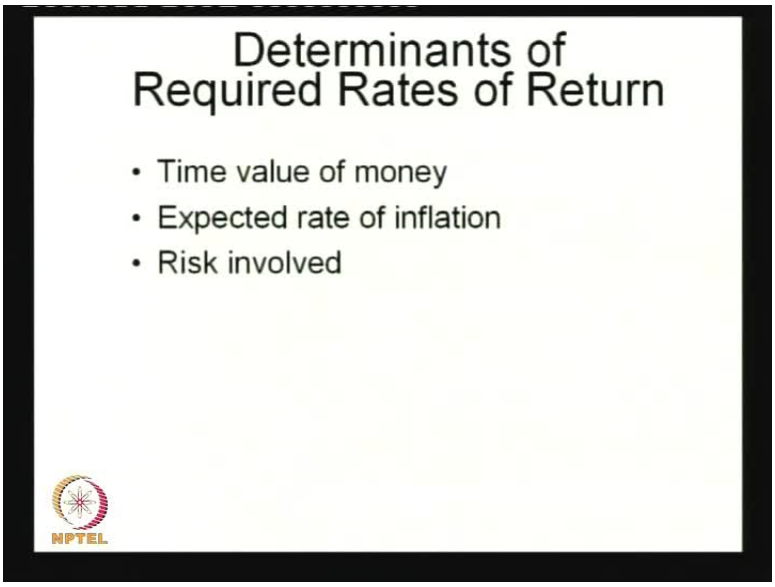

So, coming to the first one, that is concept of required rate of return we it is nothing but the rate of return expected by the investor from an investment. And the factors that affect the required rate of return could be we have the time value of money, time value of money is something a simple principle.

When we say that today's 1 rupee is not same as tomorrow's 1 rupee, if somebody is investing some x rupees today, obviously will be expecting something more tomorrow. It is because, if he is investing in an asset today, he is just differing the conception of his whatever he wants to consume today, he is going to offering to tomorrow.

So, for that he needs a reward and in that case, he should be getting that much money where he can consume little more than what he is scarifying today. So, because of you have a time value of money is one of the basic fundamental principle in an investment scenario, because we invest today to get something back in future. So, there is a time gap and people will like to have a reward for waiting or with holding conception with that resource that they have contributed to by an investment.

Next thing that we have is the expected rate of inflation besides the change in preference, change in conception, differing the conception to future we will also have something like expected rate of inflation; that means, if today I am able to buy 10 units of products with 100 rupees of currency and tomorrow I may not be able to buy the same 10 units of

products, I may be able to buy may be 9 or 8 units of product because there is a there could be change in the price level of the product that I am buying.

So, in that case there is an inflation that is going to take place, say that inflation also will be affecting the required rate of return, if the expected inflation is going to be 5 percent, the required return could be x, if it is going to be more than 5 percent, the inflation is going to more than 5 percent, then required rate of return is going to be more than that.

So, in that case inflation is one thing which has to be captured as a factor of affecting the required rate of return, then we have the risk involved; risk as you discussed previously. So, if there is a high risk involved and then obviously, I will be expect more risk rate of return, if the low risk involved, I will have more rate of I will be expect more rate of return and when it as say there is no risk involved, there is no uncertainty when about what I am going to get back from the investment.

In that case, my required rate return will be equal to the will be only taking care of my time value of money as well as the rate of inflation in the economy or what are the sector for that matter.

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So, risk involved as we discussed previously, risk involved could be of different types and like business risk, financial risk, country risk, exchange rate risk. Before you go

further, we may go to one another concept called a real risk free rate of return that is called RRFR.

In the real risk free rate of return is the thing, where we say there is no inflation; that means, if there is going to be 7 percent inflation and there is a rate of return is let us say expected is 12 percent; that means, real could be 12 minus 7 in a 5 in a very simpler term.

But the formula is not that simpler, as this is little bit complex little and in the real risk free return real risk free rate, what we assume is there is no uncertainty about future cash flow, there is no inflation and we do not say that there is going to be any fluctuation in what we are going to get and one when we say future cash flow, if it in the case of a debenture bond, the future cash flow is determinant in terms of the interest received and then we also get something back in terms of principle.

So, there is no uncertainty as well as in terms of interest to be received as well as in terms of the principle, I am going to get back. So, there is similarly in an equity share, I do not have any uncertainty about getting something dividend, I also do not have any uncertainty about getting some change in the market price. So, if that is not there then, we say there is no uncertainty and then only the inflation is not captured also.

So, in that case the real risk free rate of rate is defined whether, there is no inflation and there is no uncertainty about the future cash flow. Then also it is also only influenced by the time preference for consumption of income and investment opportunities in the economy.

So, I will withhold the consumption till tomorrow. So, only for that I will like to have some reward, I do not bother at inflation because, the inflation is absolutely 0 in this case. I do not bother about these changes in the price level, I do not bother about the future cash flow, it is going to come because that is going to come all of certainty.

So, only thing that I am going to capture in my expected rate of return which is my risk free also, is the only that I am with holding my consumption till tomorrow. So, depending on the economic condition, I am expecting something going to better happen then on that case, I can expect that I will consume tomorrow, so I can invest today.

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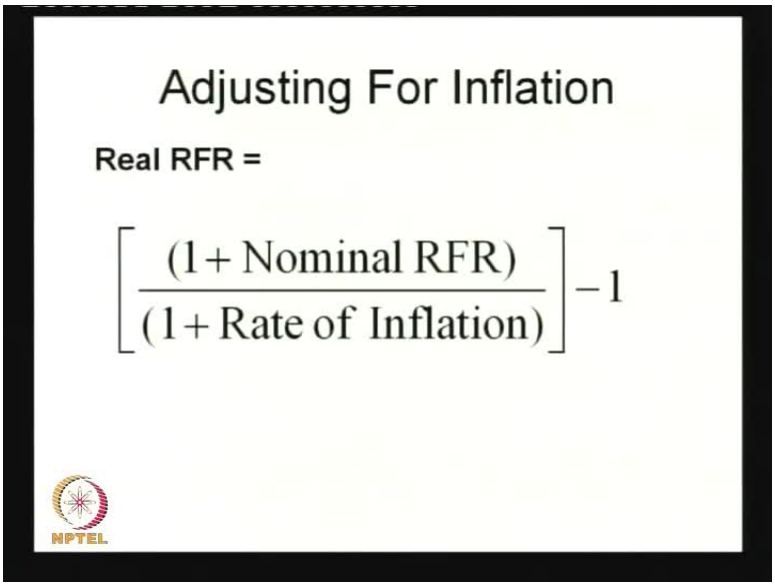

So, to whatever is return I am expected, reward that phenomenon that is called my risk, real risk free rate. And there is simpler formula here, where we say real RFR is nothing but 1 plus in the numerator, we have 1 plus nominal RFR and then you have got 1 plus rate of inflation.

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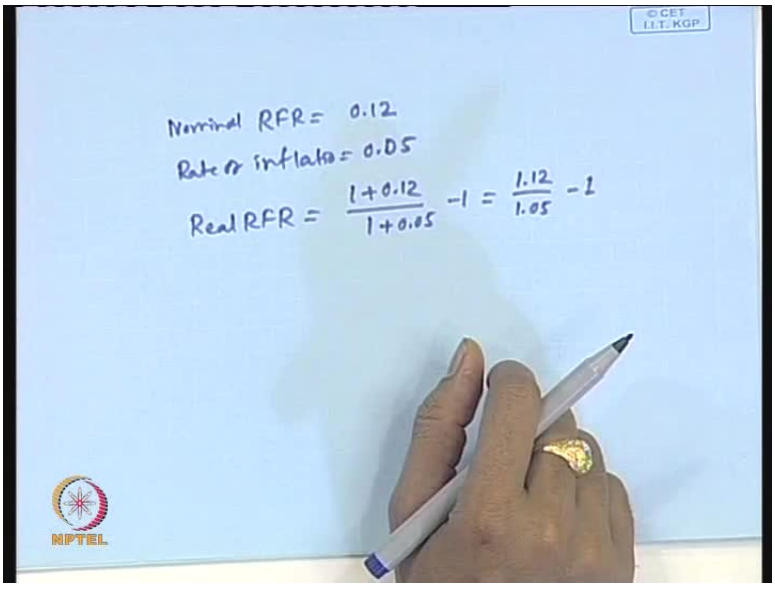

That means, if we have if you have nominal RFR is let us say 0.12 and the rate of inflation is 0.05, where that is called 5 percent then my real RFR will be solve like this, it will be 1 plus 0.12 divided by 1 plus 0.05 minus 1. So, that is nothing but 1.12 divided

by 1.05 minus 1. So, this is the way one can get the real rate of return which will obviously, between something between 5.12 percent if you calculate further.

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Then similarly, we can also find out what is the nominal risk-free rate return, which will depend upon the condition in the capital market. That means, if the condition in capital market is going to be good, then that case I am going to have more, I will expect little more rate of return because the condition is good and as because the economy is going to invest in good assets and the assets are going to give you good return in future.

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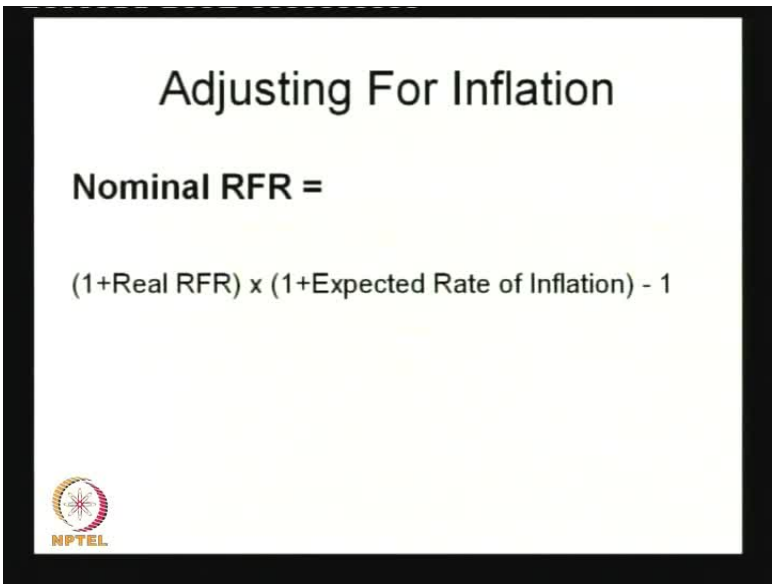

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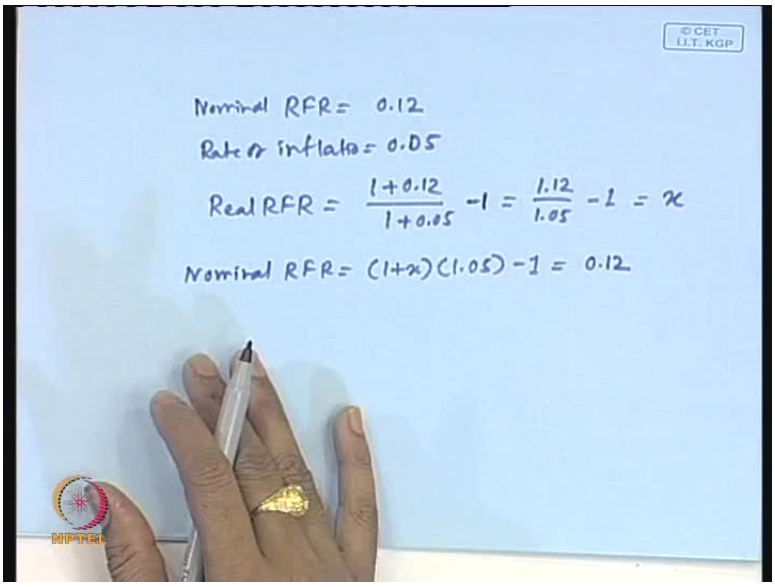

So, for that matter, I will expect a high rate of return as such, then we have one more thing that is expect rate of inflation. So, inflation is going to be higher, then I will expect more rate of return in nominal form and next thing that if you look at if you change the formula, then 1 plus real RFR into 1 plus expected rate of inflation minus 1 gives this one. So, coming back to this particular point, if you get these as x, if you calculate that means, we can go to nominal RFR by applying the formula that is 1 plus x into 1.05 minus 1.

So, the same formula has been derived out of the previous formula here and the nominal is nothing but so that means, you have the real rate of return expected and you has the also the inflation rate multiply that and minus 1, whatever that we get that is called the real say nominal rate of risk free rate of return. Obviously, in this case it is going to be 0.12 because if you have use this same input, which is used in the previous example.

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Then next thing is that what is the risk that is affecting is a continuation of the previous class also, what is the risk that is there which will be affecting the business. So, one is called the business risk, business risk means the company for whatever assets they have put where with that, where the revenue coming from which type of sector they are operating in.

So, and what is the cost structure of the particular company? The cost structure of the company is more in terms of fixed cost and less in terms of variable cost then, they will have to go for a higher production and sales level; so that they can recover and they can break of in point.

They can they can think of having some profit. So, the risk is obviously going to be higher, if the company relatively having a high fix cost. So, this something also known as operating risk and similarly company might have been to gone to different business assets. So, that is also going to affect the business risk of the company.

So, if the investor feels that the business risk is higher in this company, so obviously, in that case, expect rate return which captures the risk in that will be higher, then next in that we have is the financial risk. Financial risk comprises of the fact that, the company has borrowed money and investing. So, if there is any profit, any cash flow before we

take care of other operating expenses, we have to take care of the interest obligation and also you have to take of the principle repayment.

So, there is a claim of the creators over that if it is a bad condition or good condition and if there is a profit making or loss making, whether you have surplus or not interest has to be paid. So, in a very bad condition, interest has to be paid in that case, the return that is available for the cash flow available, for equity investors becomes very less.

Similarly, if there is a good condition in the market, good sales is taking place for this company the target company in that case; obviously, the company is not going to pay more interest because the company is doing well, company will pay the same commutative rate of interest could be 10 percent, 12 percent whatever on the date that the company has taken from the market or from the financial institution.

So, in whatever the interest is something like a fixed obligation, which has to be honored irrespective of the circumstance. So, high date will lead to high interest, high date inflation to equity is going to be more risky than any other company which has got less date to equity. So, the company that way I am investing, if they have got more exposit date inflation to the equity that company is going to be riskier than the rest of the company or the industry as such. So, that is called financial risk next that we have is called liquidity risk.

Liquidity risk is something where we have a doubt that, whether what have we invested today in the market can I get it get out of or not out of the same or not, because a typical concept of market, where the best concept of market could be that, when one of the best condition of the market is that, you should have an easy entrance easy exit option.

It should not be that, I invest in a particular security and then I will like to come out of that for whatever is in and there is no avenue for me to come out; that means, possibly there is no buyer of that particular security or I do not know where to go and sell this security so that, I can get back my money.

So, that is one, similarly if I have I have miss to invest when the company is should this particular security, now I feel that particular investment attractive for me, I should have an option to invest in that particular security.

So, I cannot do that in one case, the company issues additionally those securities in future course of time, but I need not wait for that, if that particular investment is showed by the existing investor - investment holder in that case I can also buy. So, this is something called the provision of liquidity in the market, where you can buy and sale the shears or bonds or debenture or whatever financial assets that you are holding. So, you should not have to wait for some more time to find out who can buy the share.

Say if I feel that who are have invested there is a problem in liquidity in that particular investment to cash are transparent to someone else, there is no readymade market for that then; obviously, I am thinking there is a risk involved as well liquidity is concerned. So, stock exchanges or any exchange financial exchange which is going to facilitate this particular function that is, when you are going to buy and sale this security. So, if you have already bought this security you can as well sale it and get the cash back, if you have not got it you can as well buy that security from the secondary market.

So, that is what the liquidity is, I am presuming the investors presume that liquid is there or not there accordingly the risk case to be incorporated. Then we have got something called exchange rate risk.

Exchange rate risk could one way that the company is investing into certain assets, certain raw material, they are consuming which may depend upon for x rate because they are importing such items. Another exchange rate could be that company's sales itself takes place outside, though they are sourcing and producing everything and the domestic market, but they are selling most of the items in the foreign market.

So in that case, obviously, the realization from the sales would depend upon the change in the for x rate dollar to rupee or pounds turning to rupee or euro to rupee, that rate will going to affect the sales level; if the quantity may remain same, but the value of the sales may go up or decline because of the change in the for x rate.

Another exchange rate is that is risk is that, as an investor I may like to invest in a company which is in Japan or Europe or US or Canada for that matter. So, in that case my investment return and everything will depend upon for an x as rate condition between that country where I am investing and the country which I would belong to. So, that is also going to be there, so the exchange rate risk is also going to be captured as a part of

risk and if the exchange rate risk is preserved by the investor then obviously, return expected by the investor is going to be more.

Coming to the next one, that you have a something call country risk. So, I have beside the fluctuation for x rate, the country that I am going to invest even if the both the countries, where I can exchange my I can buy the asset in a particular currency in both the countries, but still one country may be more riskier to invest than another country because of the political and economy condition in that.

If there is some political unrest in that particular country or the democratic set up is not that well-functioning, in that case and there is no proper legal law and all mechanism where you can resolve your disputes and everything.

So, if such things the governing condition is not good in that country, obviously that country is going to be high risk than the other country, where these conditions are well set and you do have a good mechanism of governance as well as redressing your the disputes and whatever.

So in that case, the country risk is going to be lower. So, I am also going to capture the industries also going to capture the country risk as a part of risk, when the investor is investing in a particular security, particularly when this security is that belongs to a company which is established and operating in another outside country as such.

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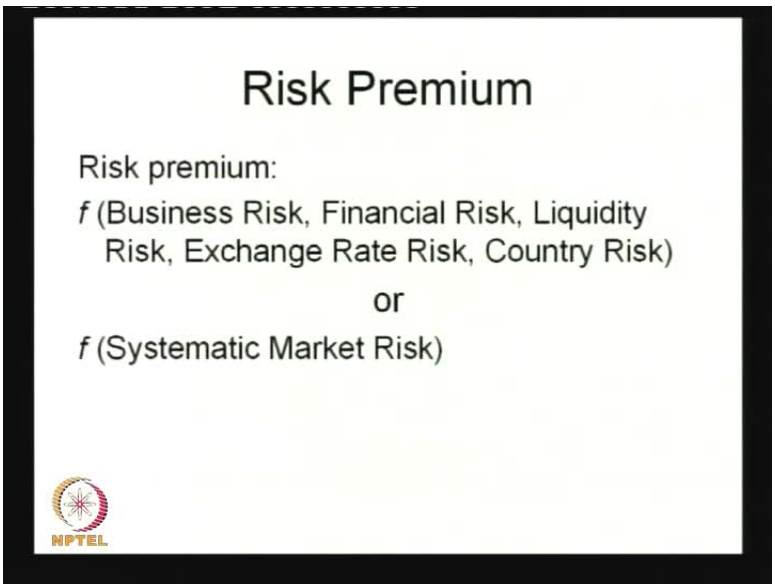

So, these are the different risk that is there in the market. So, the risk premium becomes essentially a function of business risk, financial risk, liquidity risk, exchange rate risk, country risk. And all these risks which are there, the conditions the risk is there, these risk are typically market specific risk.

So, business risk, but for the risk involved in the cost structure the company, these are the risks which somebody cannot mitigate on it is own. So, it is something like a market risk, which is called as systematic market risk. Systematic market risk means, the risk that is involved in investing particular asset which cannot be diversified by investing another security.

So, these risks are going to continue on whether I change the investment from x to y or y to z for that matter. So, this is called systematic markets which you cannot diversify; what you can diversify only on a systematic risk, which is unique to the particular company where I am investing.

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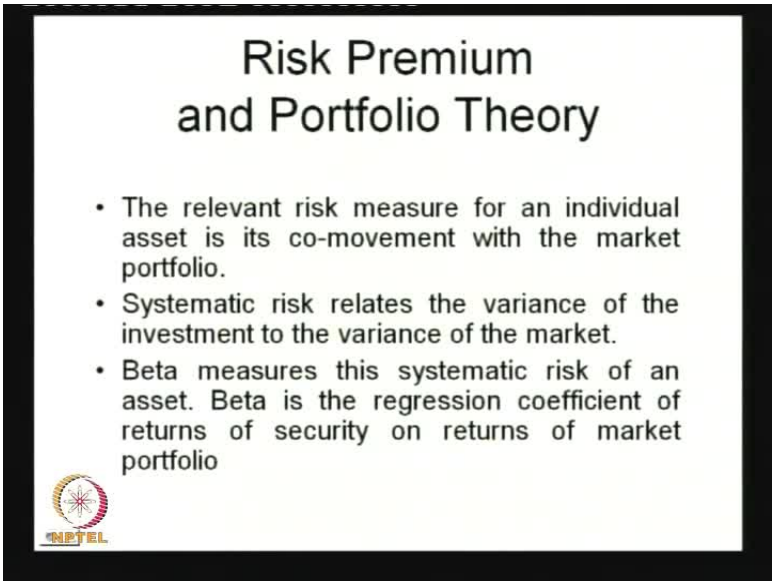

So, the risk premium depends upon the systematic risk of the… or the market risk for that matter. Now having discussed the risk premium assets, there is a relation between risk premium and the portfolio theory. Portfolio theory in detailed we will be discussing in subsequent classes and even you talking about portfolio theory.

But typically when you say portfolio nothing but the combination of financial asset the particular investor is owning or investing in. So, in that coming to that, relevant risk measure for an individual asset is the co-movement with the market portfolio.

So, when you talk about portfolio theory context, what he say here is that whatever when you talking about individual asset, how this particular asset is moving with another in the market asset. So, moving with the market means, if the market is going up then this particular securities also going up; the market gives a positive return this could also gives a positive return, market gives a negative return this could market also gives a negative return.

So, it may be so that, that is the particular security is moving and tandem with the market asset, but there may be some security which may move against the market, against means the market is actually upward and this particular stock is actually moving downward.

So, there is an expected fall in the market represent by the index like sensex or nifty or nasdaq index s n p nadac index. So, I like to buy the share of that company which is going to actually move upward direction, when the market is down. So, that is called that is moving in opposite direction in the market. So, any share can move in either opposite direction or in the same direction in the market or may not follow a particular path like this direct or indirect path, it may follow it own path.

So, this measure that we talk about the how the particular stock is moving along with the market portfolio. Market portfolio is typically comprising of the ideally market portfolio should comprise of all the assets all the financial assets traded in the market whereas, but it is not possible to find out the portfolio of the assets of all the investments in the market assets.

Because some of the investments may not be traded may not be total liquid highly liquid for that matter. So, you do not get the proper price return statistics on those. So, we rather go for a representative market portfolio, that is could be an index. So, best of index could be the one of this bse sensex or nasdaq index or standard and poor's index or we have about cns nifty in indian context.

So, these are the index which comprises of something 50 stocks as in case of nifty, 30 stocks in the case of sensex. So, say 30 or 50 shares that comprises that, that is the index compriser of comprise of they are suppose to repress the broad market.

So, this sensex or nifty for that matter represent the market portfolio, they are not necessary market portfolio asset. So, what we see how this particular stock is moving, how this along with the market portfolio. And then, as we discussed it is the risk involved with the market is called systematic risk, it is this risk relates to the variance of the investment to the variance of the market.

So, how much it is varying with the respect to the market. So, that is called the systematic risk which will be there, which we cannot avoid because this is going be that as long as you are investing in the market assets. So, all the investments, all the shares, all the financial assets are likely to move with the market and markets movement is the variance is known as variance there. So, what is the relation, the variance of the investment to the variance of the market is the systematic risk.

So, some of the investments may not move in the same proportion of the market, it may move in same positive direction, but not necessarily equally proportionately with the market assets. Then the return that we the systematic risk that we actually call, we measure in term something called a beta.

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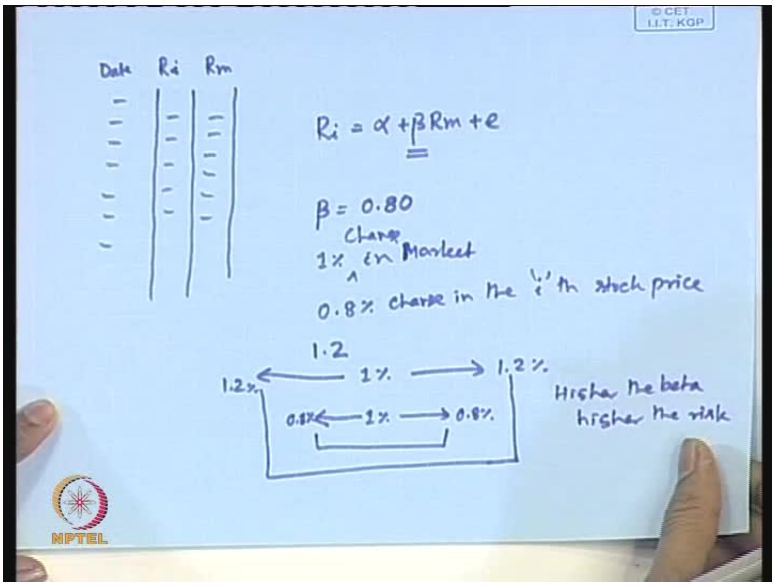

Actually when you say beta, it is nothing but the regression coefficient of the returns on security and returns on market. That means, if you have a series of returns on a security called i, then you have series of return on security called m on the market portfolio then we have got something called a date here.

So, there are different dates and different dates the holding period return could be something like this and there will be some returns what about 10 percent 12 percent 5 percent whatever that may be. Now, when you are on a regression of this R i, it is called dependent variable on the return of market that is called R m. So, that whatever slope you get that is called the beta assets a simple regression coefficient.

So, if you can keep in a simple format. So, we have got alpha plus beta R m plus in a popular term, we have got error term. So, this beta what we are going to get is nothing but drowning the regression of this return on the security called i th security, which is also known as a dependent variable. And this return on this security i depends on the market return that is called the independent variables, so we are saying the security return depends on the market return. And whatever slope you get here this beta that is called beta. So, the beta is high obviously, it is suppose to be more risky, beta is less this suppose to be less risky.

So, interpreting beta assets, the beta is found to be 0.80, it implicates that if there is 1 percent change could be upward or could be downward in market; that means, the market goes up by 1 percent or market comes down by 1 percent, then there will be 1 percent change in market then it is going to lead to 0.8 percent change in the i th stock price.

Similarly, the beta is 1.2, see one percent change in market will lead to 1.2 percent change; that means, when he say 1.2 percent change, if there is a fall of 1 percent, it will be coming down by 1.2 percent; in a 0.8 percent case, if there is a 1 percent change in market, the rise could be up to this and the fall could be up to this.

So, this difference between these two points 0.8 percent here, 0.8 percent here obviously, is lower than the difference between these two points. So, the when we say change, change can be upward change can be downward and there is a variance we can see, we can it go down by 1.2 percent it can go up by 1.2 percent.

So obviously, looking at that higher the beta we say higher the risk. So, the particular stock which has got higher beta, so we say higher the risk involved in this particular asset a financial asset for that matter.

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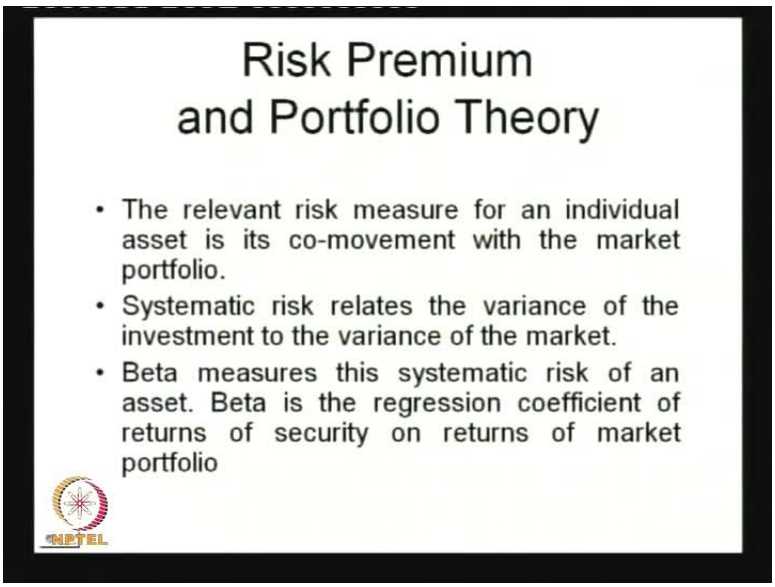

So, this is the simpler interpretation of beta which is representing the systematic risk of the company, the investment which is actually affected by the market risk of the market risk involved in this investing that particular stock.

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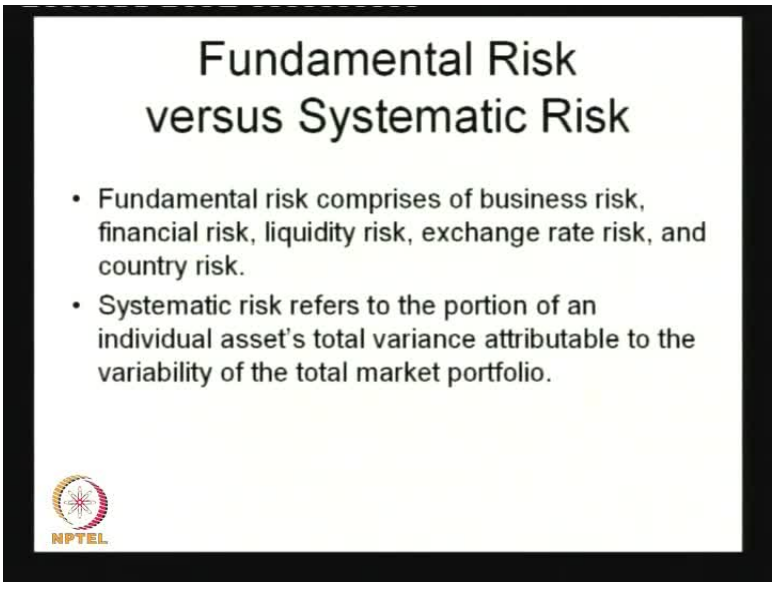

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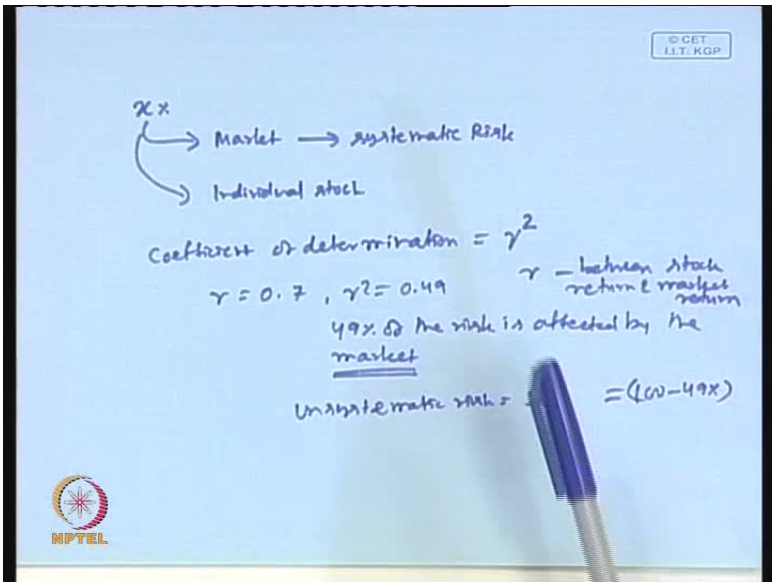

Then as we already we have told about that, there is something called fundamental risk versus systematic risk. Fundament risk comprise of business risk, financial risk, liquidity risk, exchange rate risk and country risk all those things are there, whereas systematic risk is something which is the portion of an individual assets total variance attributable to that variability of the total market. If the risk is x percent, but how much is affected by the market and how much is affected by the individual stock itself.

So, this is called the systematic risk, there is a very simpler measure also where we have a concept called coefficient of determination, which is known as the square of correlation coefficient, you have to known as R, then R square gives you coefficient of determination.

Now, if correlation coefficient is 0.7. So, r square becomes 0.49. So, that says 49 percent of the risk is affected by the market, when you say correlation we say the correlation is between the - so, the R is between the - correlation coefficient it is between the stock return and market return. And we know, the market return is dependent and stock return is independent. So, the market return is going to affect the stock return. So, 49 percentage of the risk involved in the stock is affected by the market, which is actually independent variable.

This is another way one can find out the systematic risk. So, systematic risk portion is 49 percent and on systematic risk is obviously, 51 percent that is nothing but 100 minus 49 percent.

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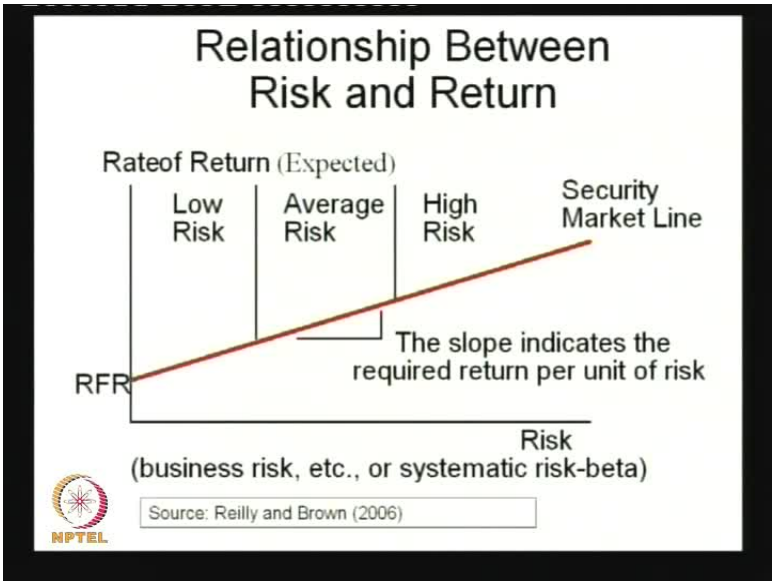

So, this is the unsystematic risk. So, this 49 percent is market risk, which cannot be diversified. So, we can diversify due to the extent of 51 percent then, there is this particular graph shows the risk free rate of return, the nominal risk free of return on the x axis and the business risk that is your systematic risk, which is measured by beta is on the y axis (Refer Slide Time: 27:40).

So, sorry the RFR is on the y axis whereas, the business risk and systematic risk or beta is on the x axis. So, if the business risk of the particular asset is going up, so that means, if it is moving from 0 to 1 2 3 like on the x axis. So, depends on that more is the risk, so it will be high, low or average.

So, low risk means the beta is high, as low risk means beta is low that is lesser, average mean it will more, high risk is little further more and this particular when you plot this different stocks, different investments on this line, this particular line is called security market line. It is nothing but the on the x axis we have risk, measured by the beta of the particular stock and beta is measured as we discussed earlier and on the on the y axis, we have the rate of return that is expected.

So, we start is something like risk free rate of return that is the graph starts from the RFR when the business risk is 0, then in that case, you are going to have this much minimum rate of return and as the risk of the particular asset goes up, if this is so, the return expected on the investment in different assets go up. So, highest risk is obviously, going to have highest possible rate of return.

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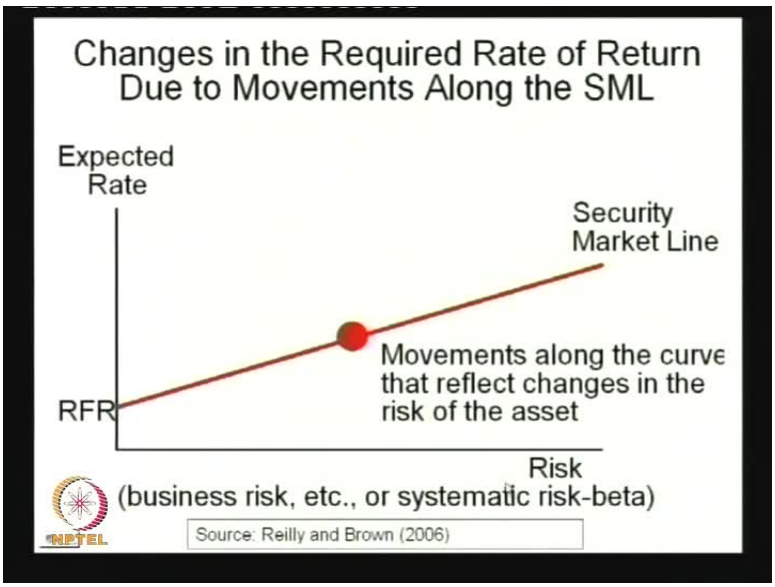

Then what happens in the market, so changes in required rate of return due to movements along the security market line. So, if there is I feel, the investor feels that the investment is going to have less risk assets.

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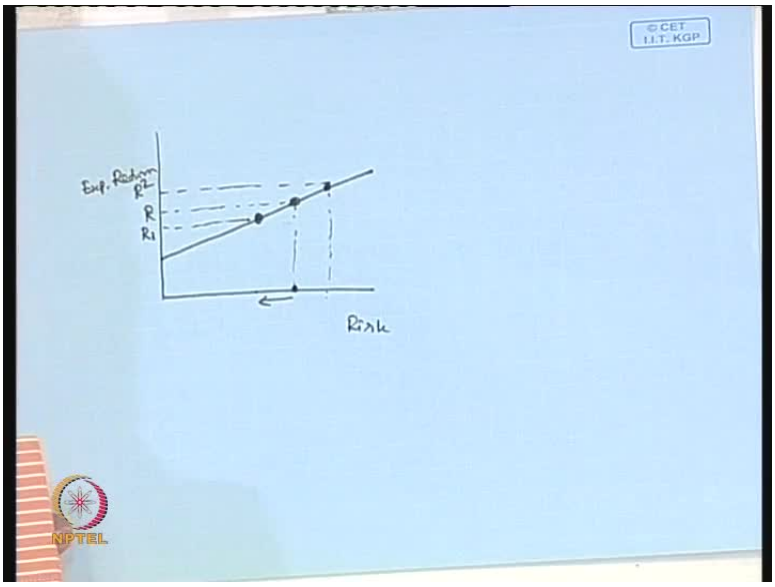

So, in that case what will happen? If we had an SML as in the graph that is shown in the SML like this, then at this point of time (Refer Slide Time: 29:36), I feel this is the risk involved as for the investor this is a risk and this is the required that is the return expected by the investor.

So, if this is the risk I am filling, obviously this is the amount of return I expect, that is nothing but this particular return, but if I feel that the risk of the particular investment in this particular asset as moved down, let us say from this point to this point, so in that case, that means, risk is actually moving down from this point to this point then, my return that I am expecting will be now this much (Refer Slide Time: 30:00).

So, in the SML as I move upwards, my return is going to be higher as I move downwards my return is going to less; moving upwards means I am going a high risk. So, it is not necessary that for every time to come the risk involved in a particular asset is going to be constant, rather it can go down or it can also go up, if goes up to this particular point, then my return will be little that I have expect little bit in R2 is little more, because the risk involved in a particular asset actually has to less gone up.

So, that is the change in the position of a particular stocks return in a particular SML, so this is a movement from high risk to little lower and further little lower to further lower risk involved in that.

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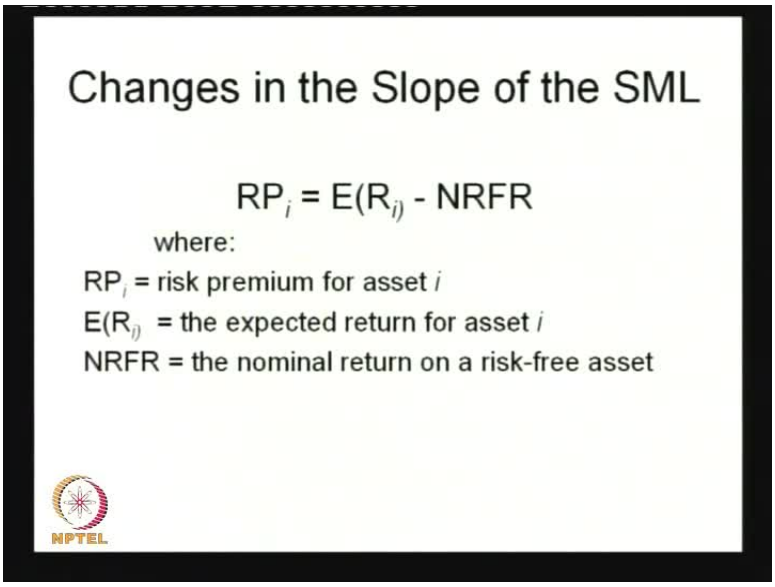

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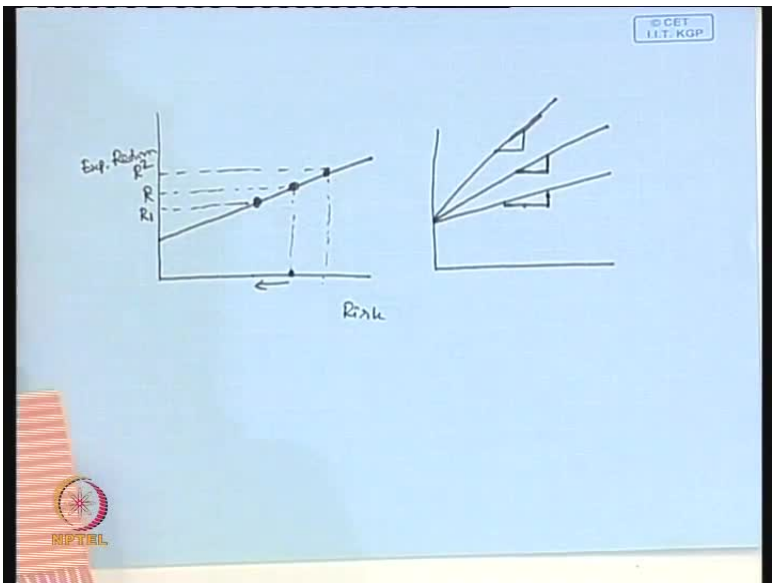

Next, in fact, we estimate like this, where you say risk premium is nothing but expected rate of return minus the nominal rate risk free rate of return. So, this is the difference assets risk premium and so change in this slope can also be… So, slope means I have a presently the SML is like this (Refer Slide Time: 31:30).

So, this is my slope, this is relation between this and this means gives the slope, but that means, for every additional unit of risk, I expect a particular amount of return, but the slope itself may go up. So, in that case the line will change. So, the slope is going to be

higher that means, at this point of time, the investor is expecting a reward for any unit of risk invest little more reward than what he was expecting earlier.

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So, the slope of the line is changing, now possibly in depending on the market condition I may expect little much more risk, this will more return than this particular graph where my slope is actually higher. So in that case, I am expecting more return on the investment depending on the risk involved.

Earlier, if I was expecting let say 1 percent extra per unit of risk involved now, I may expect the 1.2, so the beta might have gone up from one stage to another stage. So, in that case it will be going to be more as such. So, the market risk premium for the portfolio can also be found out. So, where we say that, the market portfolio risk return as such is nothing but expected return and minus the nominal risk free rate of return.

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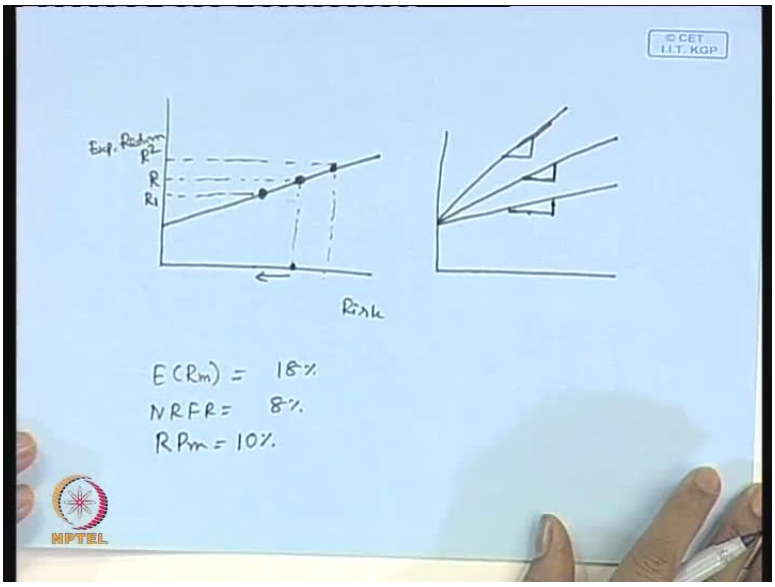

That means if my expected rate of return is 18 percent that is on the portfolio, then if the nominal risk free rate of return is let say 8 percent; that means, the risk premium on the market, I am taking is how much is called 10 percent.

So, this is nothing different than any individual asset also, instead of talking on individual asset, you are talking about a combination of the financial assets called the portfolio. So, the risk premium measurement is the almost same as what do you do in an individual asset as well as in the portfolio assets.

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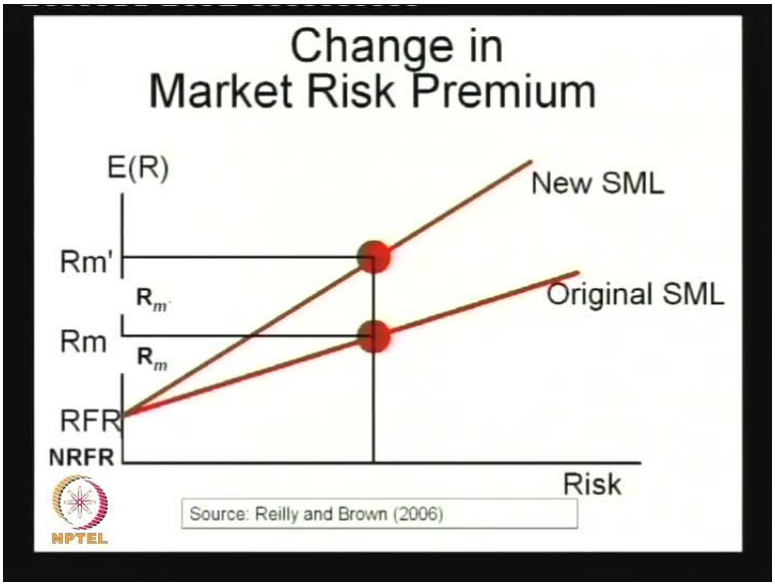

So, this is one place where we have got this SML changing from one place to another that has you discuss in the graph. So, there is what is happening here? Whatever risk return they were expecting for risk involved as actually that per unit per unit risk, the return is expected is actually going up. That is why the SML has moved from one stage to another stage, in some other case also the SML can come down.

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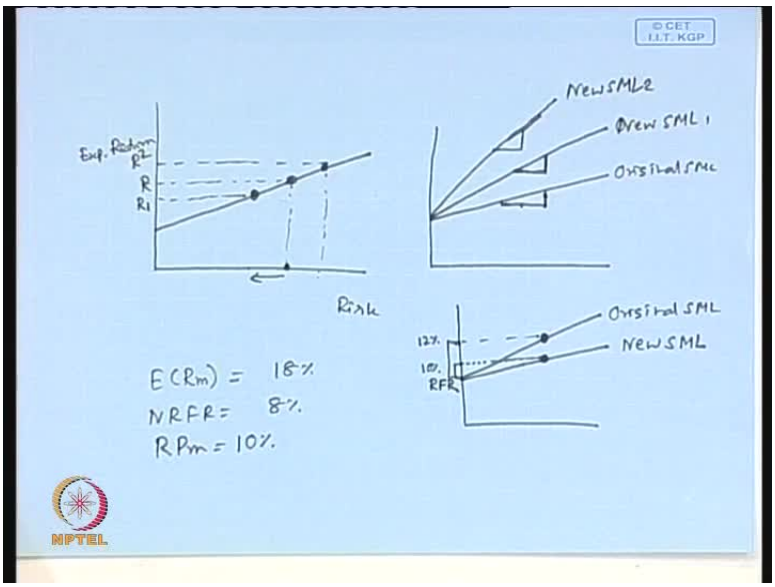

So, where you have a SML like this, since I am expecting that my expectation is something that my return I expect from the risk involve has come down (Refer Slide Time: 34:00), so the SML in this case what will happen if I am my I my asset return comes at this particular point of time and if I am expecting that reward per risk is going to come down, my expectation is like that then the slope of the particular graph will be lower.

Now, I will be expecting this much return, but the same type of asset, but I am going to expect rates return and this is called the risk free rate of return (Refer Slide Time: 34:37). So, I will be expecting this much extra, earlier I was expecting this much extra. Though the asset class has not changed it has remain this same, but since the return I expects the for the risk involved is lower, that is why my return expected from this asset has now come down from here, may be it was 12 percent could have become now 10 percent.

So, this is the way this is an original security market line and this is my new security market line. Here we talked about original SML, and then we had new SML 1 and new SML 2, where the return expected per unit of risk involved as actually gone up from to one stage to another stage to another stage.

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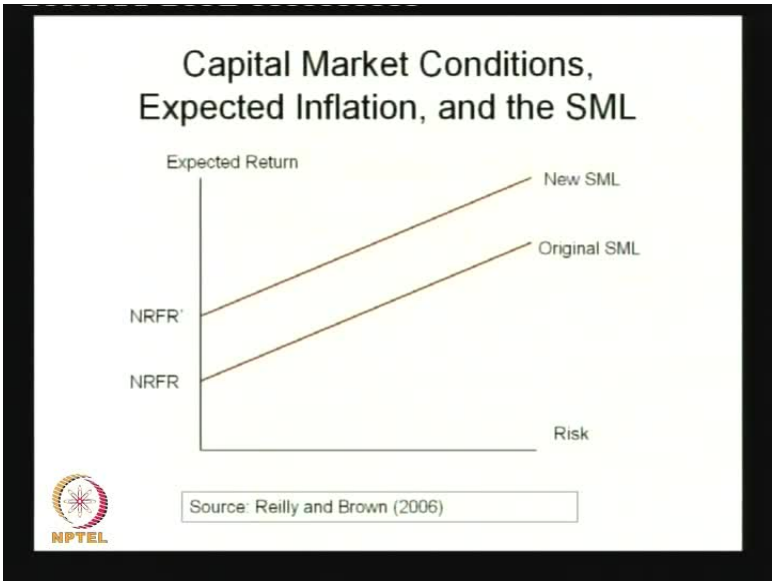

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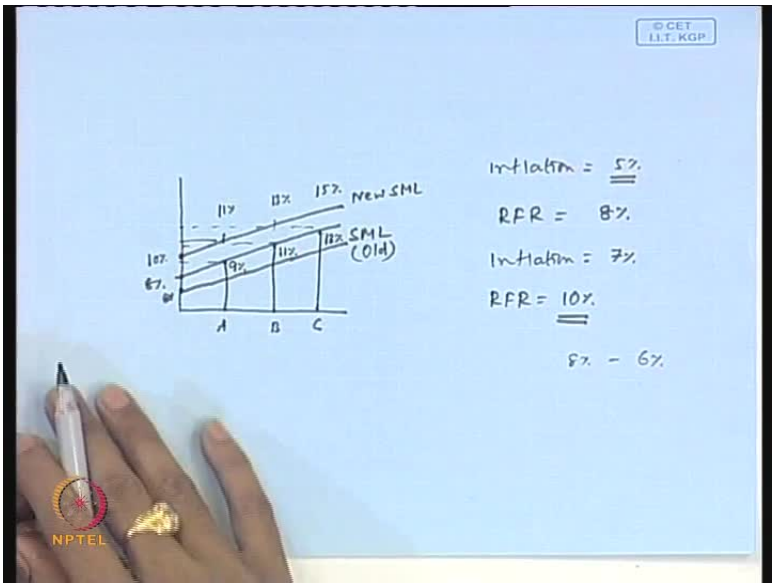

Then overall in the market itself the expect return from the in the market may go up because, there is a change in the risk free rate of return. So, earlier I was expecting an inflation of 5 percent.

So, in that I keep factoring that, my risk free rate of return was let say 8 percent for whatever is in, the inflation has either gone up or come down let say inflation has become now 7 percent. So, quite naturally my RFR will now move up from 8 percent to at least 10 percent, if you have to have a simple addition of 2 percent difference between this inflation earlier and inflation now, then 2 percent plus 8 percent becomes now 10 percent.

In that case the graph which you had started, the SML which are started, the old SML which are started at this point since RFR it is changing it becoming this one then graph will just move upward without any change in the slope of the graph. So, this becomes a new SML.

Now, if I had a class of asset like A, I had A class of asset like B and I had class of asset called C, if I was expecting here I was expecting let say 9 percent, here I was expecting let say 11 percent, here I was expecting actually 13 percent these are the percentage here, then since this RFR itself has gone up from 8 percent to 10 percent so obviously, this 9 will now become 11 percent and this 11 will become now 13 percent and 13 will become now 15.

So, there is an upward parallel shift in the SML from old to the new. Similarly, if the I expect the risk involved in the overall market is going to be now lower, then in that case my RFR itself may come down from 8 percent to let say 6 percent because of change in inflation, lower inflation whatever that may be, in that case, I will have a new SML which will start from the RFR of 6 percent and which will be parallel to the olden.

So, what you are saying? Here we are assuming that, the per unit risk whatever return I am going to get is not going to change, rather the base of risk free return as change. So, the overall SML itself has either gone up, moved up or it has gone down depending on the RFR condition.

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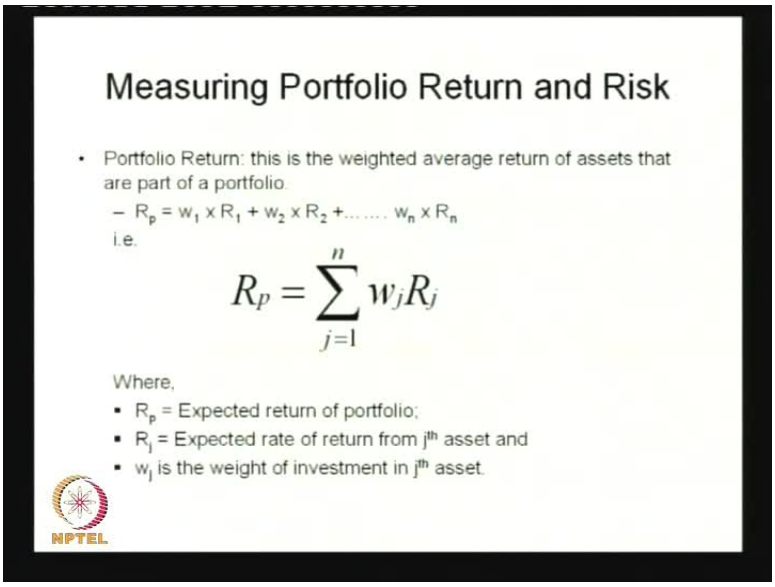

Now, we go to the next part of this particular class, where you talk about how we measure the portfolio return and portfolio risk. Earlier class we have already discussed the portfolio return, but we can also repeat that now. So, the return on a portfolio depends upon the weights involved in the assets, that we have and the individual return. So, if you have about 2 assets called asset called A and asset called B and if we are going have 14 percent return from asset A and 16 percent return on asset B.

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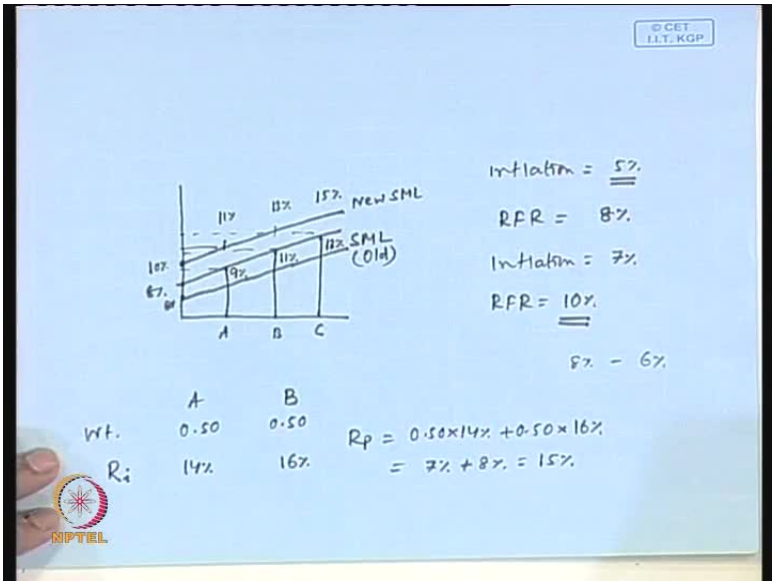

And if your weight is involved is let say 0.50, 0.50 on both the assets, asset called A asset called B, that is the weight of investment and if we are expecting return on asset called A as 14 percent and asset called B as let say 16 percent. So, the return on the portfolio is the return on the asset called i th asset called A or B. So, returns on portfolio have been now 0.50 into 14 percent plus 0.50 into 16 percent. So, that gives us 7 percent plus 8 percent that is gives you 15 percent return on the portfolio say between 14 and 16 percent now.

So, if the weights change from 50 50 to 40 60, so accordingly portfolio return is also going to change. So, this is only a two asset scenario, you can have n number of assets and obviously, for n number of assets we need to have the weights of the different assets, as well as the return expected from the different assets access.

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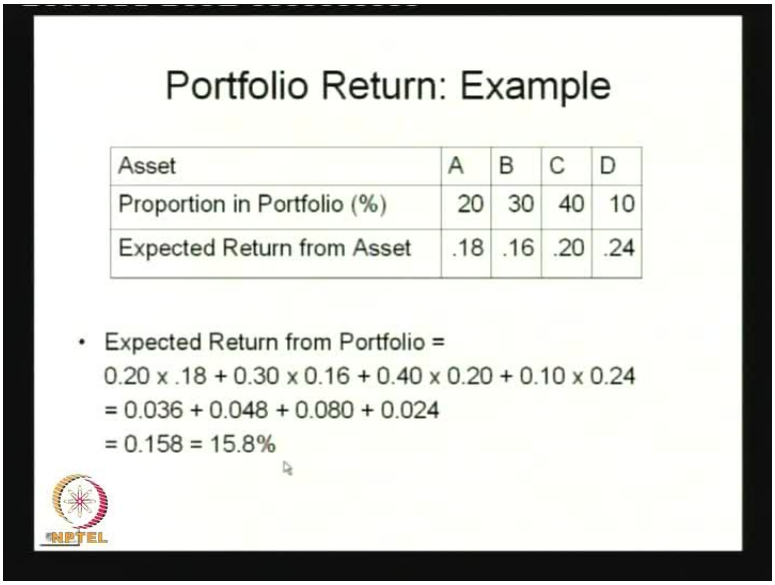

So, we can look at another example where we have got 3 or 4 assets, where we got 20 percent asset 20 percent on investment in A, 30 percent of investment in the asset B and 40 in C and 10 percent in the asset called D. And the expected return from the each asset is like this that means, 18 percent, 16 percent, 20 and 24 applying the same formula you multiply 0.2 there are 20 percent into 0.18.

Accordingly like that for assertive, we multiply 0.10 and 0.24. So, overall that you will get is 15.8 percent; that means, in an extreme case, if I had put money 100 percent the

asset called C and then in that case, I would have got 20 percent had I put 100 percent asset called B, I would have got 16 percent that is the lowest return and the C is giving highest return.

But instead of that, because I may feel that asset called C may actually go up or come down it may more risk involved. So, to diversify to have a many more return assets sum is assured rate of return, they instead of putting money all money into one asset called C, I now put money into four different assets and that expect return is combination of that is called 15.8 percent is the return expected from the portfolio.

It is the very simple principle that we say, do not put all x in one basket rather you keep different x in different basket. So, the one basket is lost, at least some of the x are still left which you can be consumed by the consumer, you otherwise all the if you are putting in one particular asset all your money 100 percent money is I may go up like anything if the market is moving up or it may also, can also come down if the market is down.

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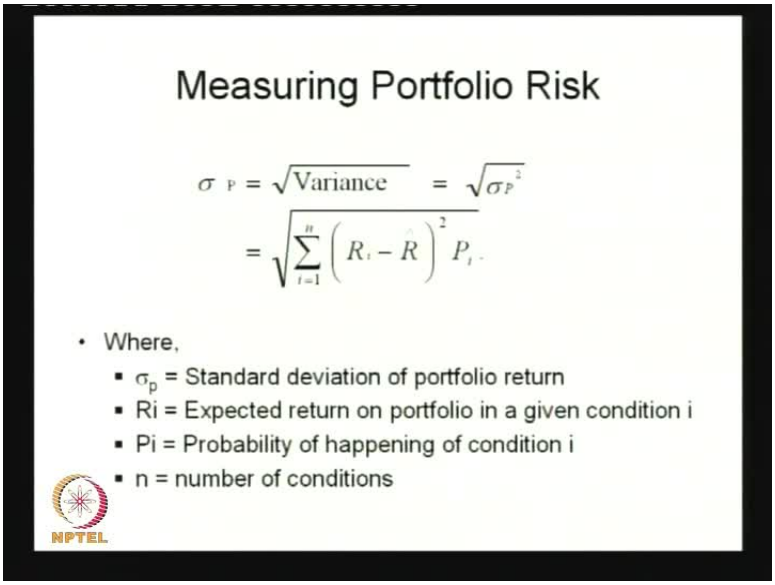

So, in that case, we rather diversified portfolio by investing in different assets. Next thing that we have is called the portfolio risk. Portfolio risks nothing but the variance involved in the portfolio. So, if one is able to find out the variance in the individual asset then one can also find out the variance in the portfolio.

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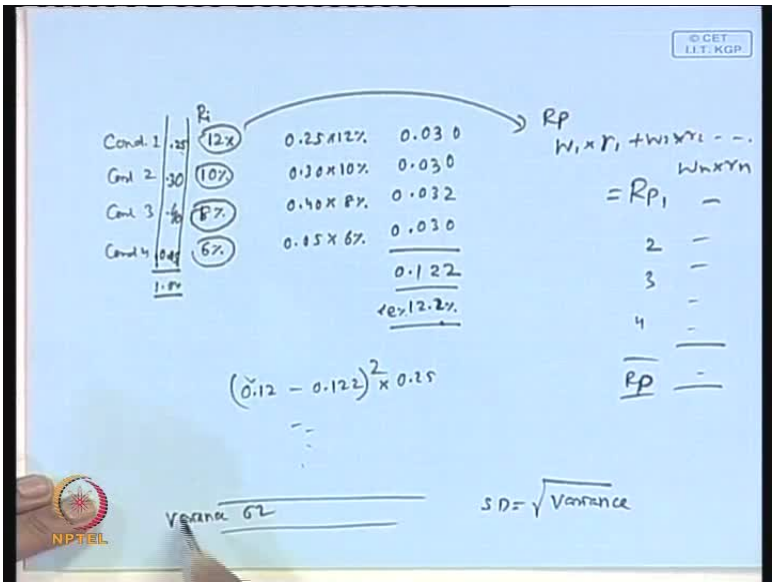

Now, if I have got in the earlier case, when you have got return on different condition 1, condition 2, condition 3 and condition 4, it could be the best economy condition this could be very good condition, this could be an average conditions, this could be poor condition (Refer Slide Time: 42:20).

So, for a particular stock, if you are expecting let say 12 percent in the best condition, then 10 percent in the little worst condition, then 8 percent and then 6 percent, these are the condition, for that we also should have the probability associated with this particular event condition 1 to condition 4. So, you have let say 20.25, 0.30, 0.40 and the rest is 0.05. So, what we do, we multiply like this, so 0.25 into 12, 0.30 into - so, this total is actually 1.00 - 0.30 into 10 percent 0.40 into 8 percent and 0.05 into 6 percent.

So, what we get here is that 12.12 into 0. 25 that give 0.03, this also gives 0.03, then we got 0.032 and then we have got 0.030. So, say total of this gives you us to and so, 0.122 to that is 12.2 percent is the returns from the asset expect return depending on four different conditions. So, like that we do here, we can also do the same thing for a portfolio.

So, what you do here is that this 12 percent or 10 percent whatever that you have expected from the return in the stock, we have to now measure that from the portfolio it is and this particular 12 percent in the return on a portfolio, it will depend upon

obviously as you discuss earlier, it will be w1 into r1 plus w2 into r2 like that we have got w n into r n. So, whatever you get, we now get r p under condition 1, similarly condition 2, condition 3, condition 4 whatever return you get and then multiply with respect probability then you get return on the portfolio.

So, in the risk calculation what you will do? We take the difference between the return that is 12 percent and the average return and square it and then we multiply with the respective. So, what we do here? We say 0.12 minus 0.122 in the first case and we square it and multiply the respective rolled in the case 0.25, like that you do and when you add that summation that gives actually variance or sigma square and you take the square of the variance that gives us the standard deviance, that is called the variance square root.

So, same principle is applied as far as the return as per the risk of the portfolio is concerned. So, what you do here assuming that this is the portfolio return, average return and these are the different returns and different circumference in the portfolio. So, in that case, 12.2 percent is the average return and I we can found out the variance in the same measure, that same way that we did in the previous session as far as a risk in this individual asset is concern.

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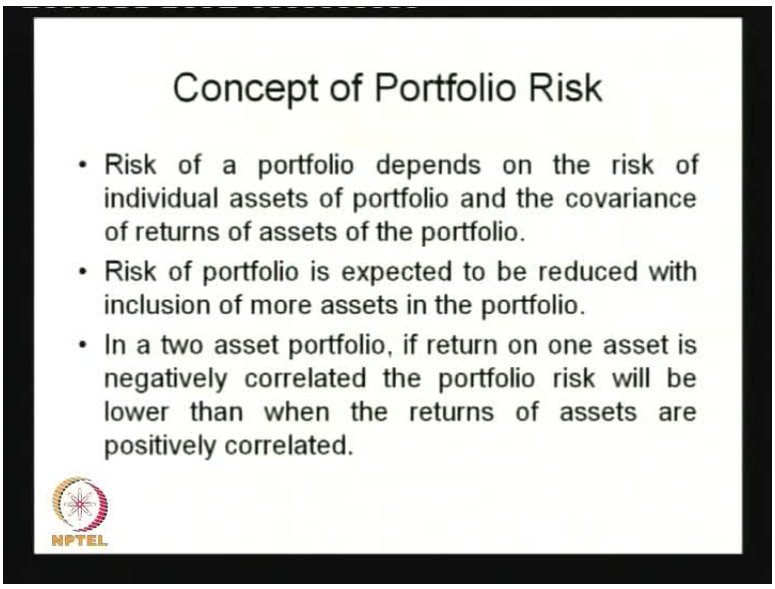

This is one way and another way that we have is that, we find out the movement in the assets, how they move with each other and how they move along with the market and based on that also one can find out the portfolio instead of doing a weighted return of the portfolio and finding on this way, we can also find out in another which we will be discuss in subsequent slide.

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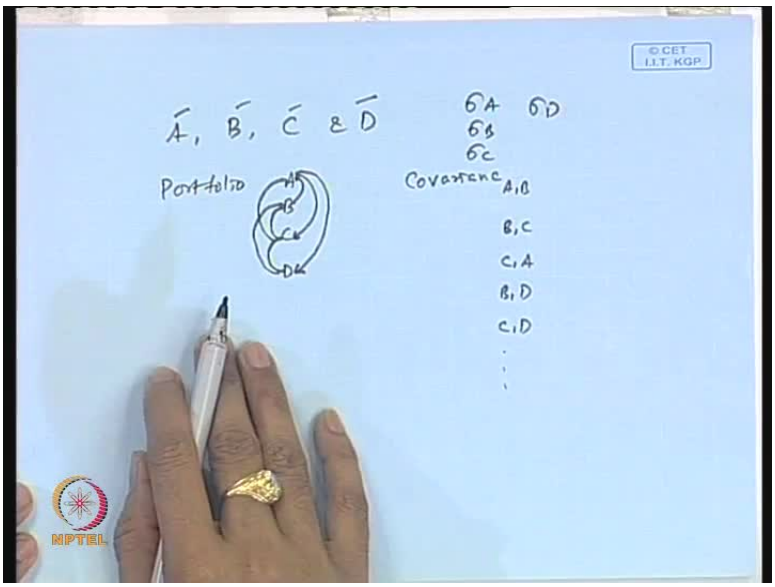

So, risk of the portfolio actually depends on the risk of the individual asset of the portfolio and the covariance of returns of assets in the portfolio; that means, if the there are assets in a portfolio like A, B, C and D.

So, risk of the portfolio which comprises of this four assets, will depend upon the risk of individual asset like A, B, C and D and how they move with each of them, how A moves along with B, how B along with move A, how A moves along with C and how C moves along with A and how A moves along with the D and D moves along with the A.

Similarly, what the how is the D and C are related, then how C and B are related and how D and B are related and how C and A related; that means, as many pairs that can be possible about the relationship. So, this movement is also going to affect the risk of the portfolio. So, it is not only the risk involved in A, B, C or D rather, how they move with each other that is also going to affect the reason.

And they moving with each other are called the covariance. So, covariance could be there, there could be covariance between A and B, covariance between B and C, C and A, B and D, C and D like that as many pairs as possible there is covariance. So, this all these covariance as well as variance of individual stock like standard, it was a standard set B standard deviation C and standard deviation D all these things are going to affect the variance of particular portfolio.

So, one should not take that variance of a portfolio is simple, the average of the variance of individual assets in that portfolio. If individual asset the portfolio affect the portfolio of a variance as well as the how the individual security are varying with each other, that is also going to affect.

That means if one asset is going upward another asset is going to downward, so that means, risk involved in one asset is compensate by the risk in another asset as such. So, any gain in asset A is now neutralized by a loss in asset B or another way you can say a loss in asset B is now neutralized by A gain in asset A.

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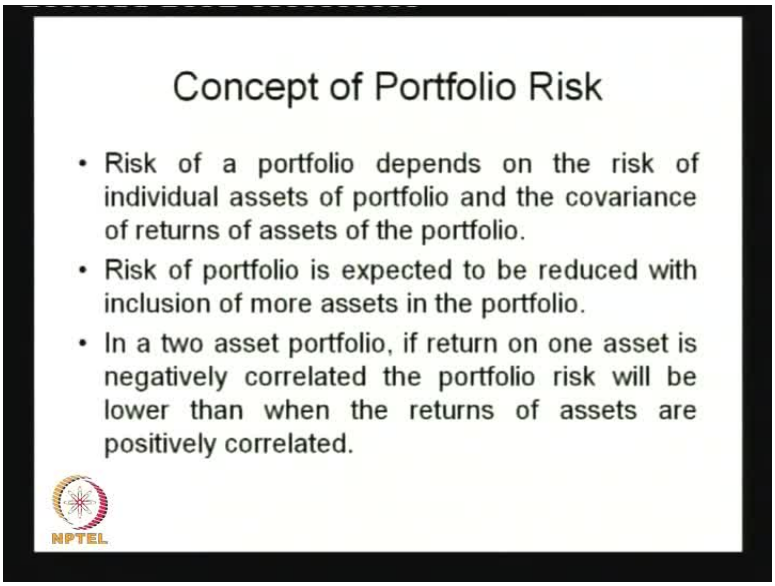

So, that case the risk is going to be reduced. So, risk of the portfolio is expect to be reduce with inclusion of more assets in the portfolio, but there is a cell, it is not necessary that you have to can increase the portfolio size in terms of number of assets to as many

numbers of assets. There could be a limit optimal limit up to there is 30 40 stocks if you can have, then the portfolio can be taken as well diversified portfolio.

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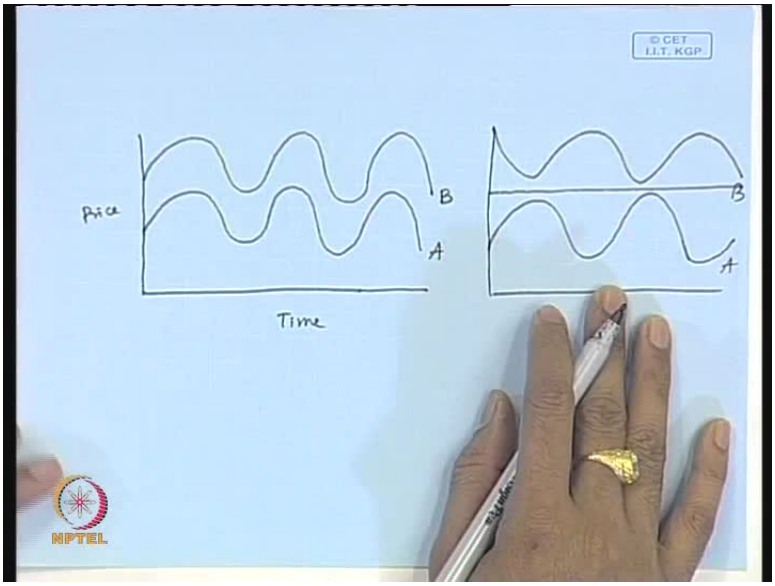

In a two asset portfolio, return and one asset is negatively correlated of the portfolio risk is going to be lower, when the returns of assets are positively correlated; that means, if we have to club make a graph this is the price of an asset (Refer Slide Time: 48:48).

Let me go back to this graph once again, this is the time line of an asset and this is the price of the asset, the time line of the investment. So, if even asset called A which is moving like this and you also have an asset B, which is also moving like this, almost parallel to asset B, then there will not be any direction, the diversion diversification if we are having 100 percent A and now you are having 50 percent and 50 percent B in asset composition, in that case the risk is not going to this because the B is moving in tandem with my a asset (Refer Slide Time: 49:19).

But, that means, there is a rise here, there is also rise, there is a fall there is also fall here. So, they are not neutralizing each other; that means, obviously one can find out this is a positive correlation and very high possibly correlation could be one here. But, if you have a scenario asset A is moving like this whereas, asset B is moving like this, in that case if there is an upward movement in asset A, there is a downward movement asset B. So, they neutralizes each other some over return may fall in line between these two and

obviously in this case, the fluctuation is not be seen and there is no fluctuation invest in the portfolio of A and B; that means, the report free risk is actually reduce.

So, if you can have two assets which are perfectly negatively correlated, then the risk can be reduced to the maximum extent. So, positive correlation between stocks will lead to less risk, less diverse in the risk assets than high positive correlation between stock returns.

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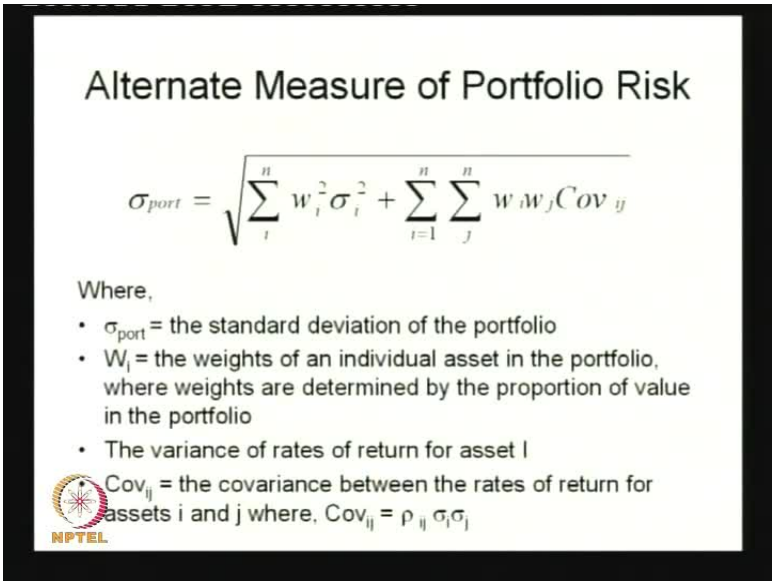

So, as you suggested earlier, there is an alternate measure of risk here, what will happens here? As you discuss again, the portfolio risk depends upon the individual risk that is the standard deviation i th asset, weight involved in the particular asset as well as the covariance between the i th asset and j th asset, i can go from 1 to n, j can also go from one to n.

And so, portfolio is standard deviation of the portfolio, where the weights are assigned as far the combination of asset and the variance of returns is given on the asset i then, we have the covariance; that means, we need to have the covariance between two asset return, we also should have the variance of the one asset return in the individual asset in the portfolio.

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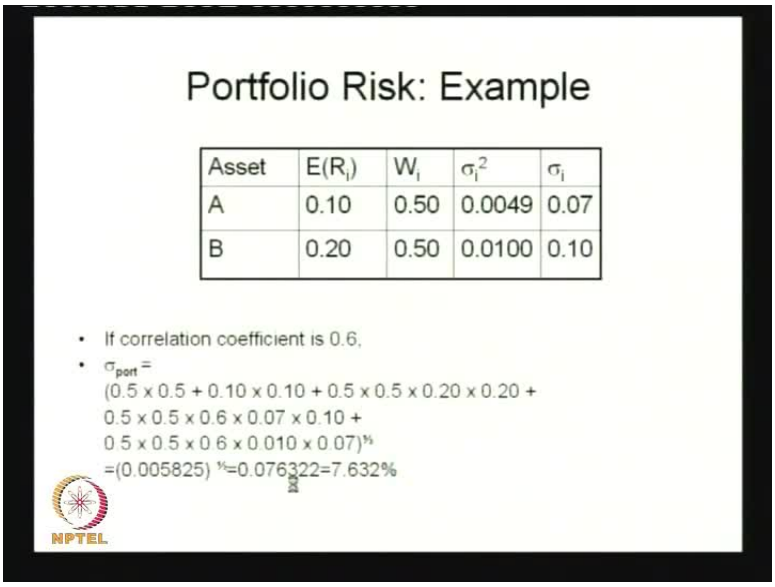

Then if you look at this particular example, we have the asset R, asset called A and B where you have got 10 percent return expect return and 20 percent expect return is there in asset B. And weights attached to these two stocks are 0.50 and 0.50, the 50 percent weight is there and the variance is 0.0049 and 0.0100 then, we go to find out the standard 0.07 0.10.

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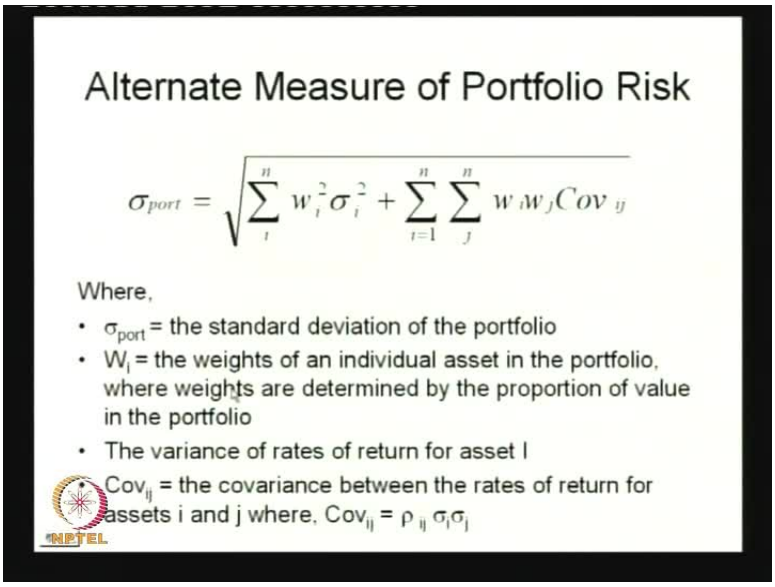

The standard deviation portfolio is nothing but what you do here. The weight square the 0.5 and 0.5 then, if you go back to the graph. So, the equation we have got W 1 square

and standard deviation 1 square, then we will have W 2 square and standard deviation 2 square, so like that it has been done.

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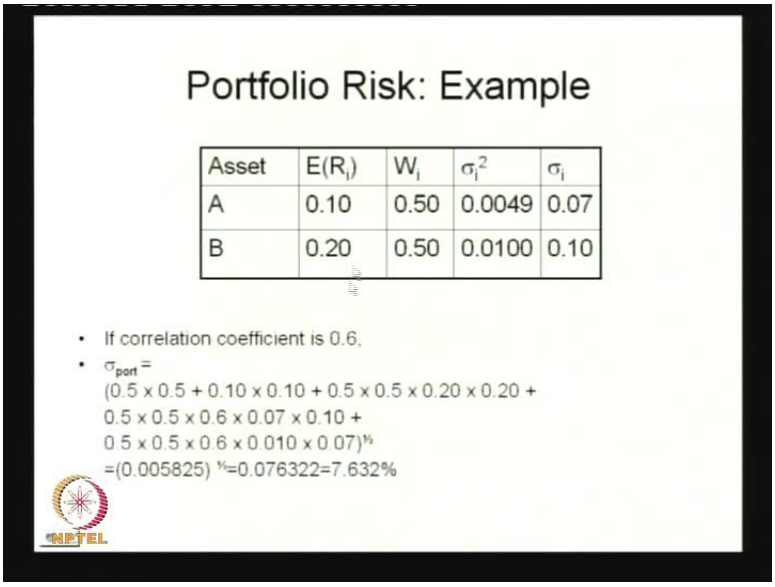

So, this one gives us the W 1 square, this one gives us the standard deviation one square, this one gives the W 2 square, in this case both the assets have got 0.5 and 0.5 weight age. So, this got 0.20 this is a 0.20. Then this is the relations between asset A and asset B, this relation between asset B and asset A. So, in a 2 portfolio context, actually these one the third component of this equation and the fourth component that was is nothing but one and same.

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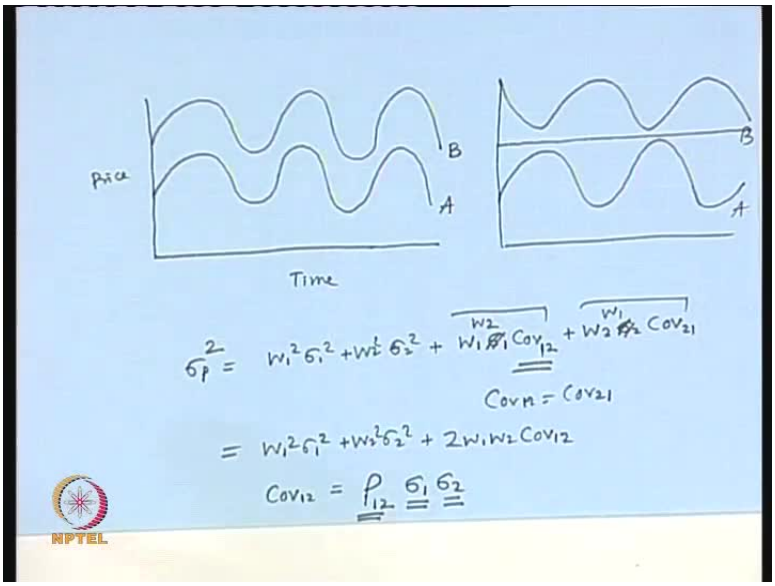

So, what happens in equation format, the portfolio return in a 2 port towards asset portfolio, this is a variance; then we have got W 1 square standard deviation 1 square plus W 2 square into standard deviation 2 square. Then we have got W 1 standard deviation 1 and then covariance 1 2, then you have got W 2 standard deviation 2 then, we have got covariance 2 1. So, essentially this becomes one and same.

W 1 and W 2 and W 2 into W 1 and instead of standard deviation or a standard deviation two assets. So, covariance 2 and 1 and covariance 1 and 2 is same as covariance 2 and 1. So, if you have to simplify this equation, it becomes W 1 square standard deviation 1 square plus W 2 square standard deviation 2 square and see these two component becomes one and same, it becomes now 2, W 1 W 2 and covariance 1 and 2.

And this covariance between two stocks two stocks return depends upon the correlation between stock 1 and stock 2 return and the standard deviation of 1 and standard deviation of 2. So, if somebody has the correlation between this stock return and the individual standard deviation of the returns of stock 1 and stock 2, then no need to go for a calculation, one can replace these with the covariance of the stock assets.

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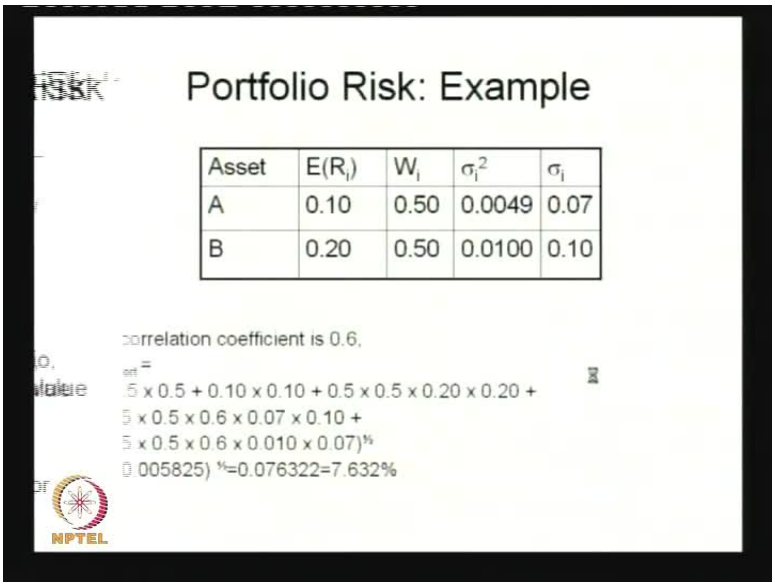

So, if you go to the equation what we have done is, we have taken the 0.6 the correlation coefficient and 0.6 into 0.07 0.10 gives the covariance of the between 1 and 2 or as well as 2 and 1.

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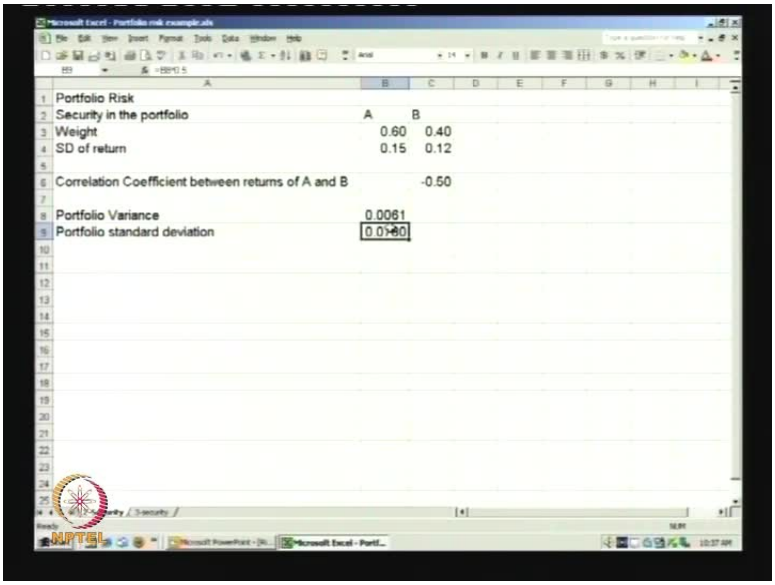

So, if you go further, you will get a simpler excel sheet, in this case we have to take the portfolio risk you are calculating in a 2 security portfolio. So, there is A and B and weights are 0.5 and 0.5, and standard deviation return is 0.15 and 0.12 and correlation is 0.80.

So, portfolio of variance by applying the formula is now 0.0164 and standard deviation 0.1282, if somebody if one there is a 0.80 means high positive correlation. As you discussed earlier, low positive correlation will leads the risk and if because negative becomes much less risky assets, so if I one change it from 0.80 let say 0.50 on the portfolio standard deviation which changes from 0.1282 now become 0.1172.

If somebody makes it minus 0.5, now 0 .117 has become 0.0687. So, this is the thing when what happens is that, with less positive correlation or risk of the portfolio comes down, when becomes negative, the risk of the portfolio becomes much lesser.

In a three security portfolio what you will need? We need the weights involved in three securities, we need the weights the standard deviation also of three securities, but we need the correlation between A and B, B and C, and C and A all the compression of assets have to there. Then accordingly the variance can also be found out with this input and we get in the three portfolio three asset portfolio, where 35 percent A and 40 percent B and 25 percent C is there total is 100 percent.

The portfolio standard deviation is not 0.1369, if somebody changes this makes from any another makes to it another makes, then also the standard deviation is going to change. So, if in this case, we make this point in the two asset portfolio make 0.6, now you make it 0.40, then the standard deviation has change from something we can add it become 0.0780.

Now, similarly that means, weights of the assets of portfolio and the individual assets risk and the relation between two different assets return that changes, that makes the portfolio risk asset. So, this is way we covered how to calculate the risk of the portfolio involved.

Thank you.