Investment Management
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Lecture - 39
Portfolio Evaluation (Contd.)

Hello there. We are discussing about Portfolio Performance Evaluation as part of the MOOC course Investment Management. In this session, we will continue to discuss different measures of portfolio evaluation, particularly with respect to the performance of the portfolio in the context of a benchmark portfolio and the portfolio that an investor has invested in.

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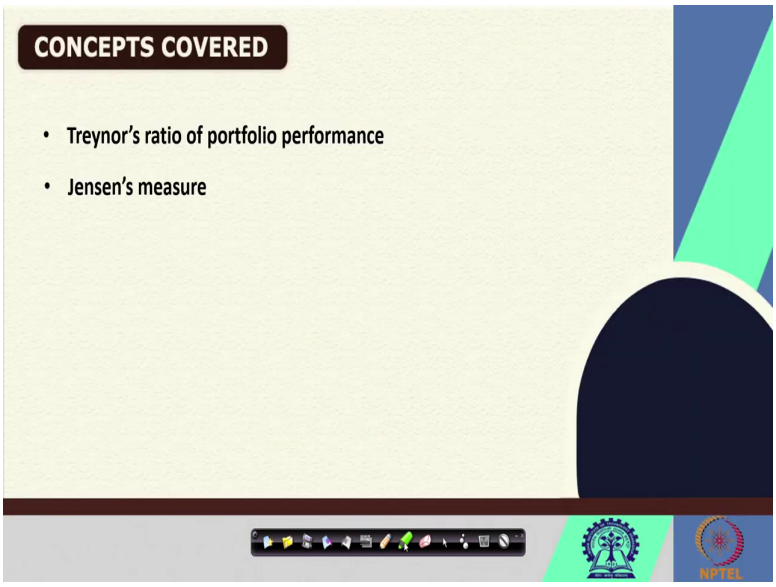

Specifically, we are going to talk about two measures: Treynor's ratio of portfolio performance and Jensen's measure of portfolio performance also known as Jensen's alpha.

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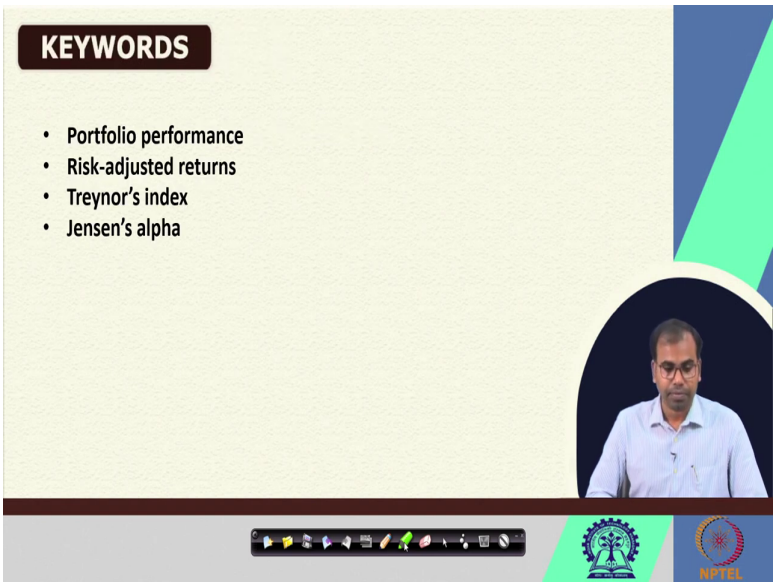

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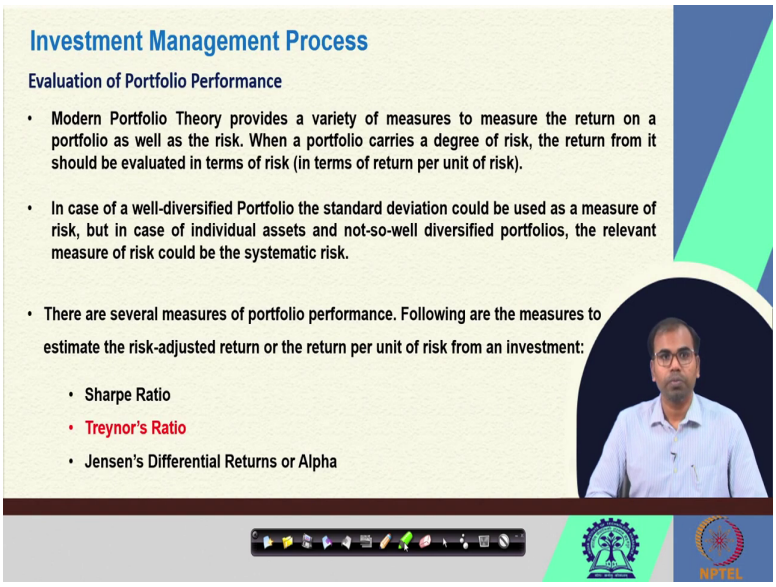

When it comes to evaluating the portfolio performance, we know that modern portfolio theory provides several measures and these measures can be used to understand whether a portfolio has done well, in the given holding period or it has done better or worse compared to any other portfolio or the benchmark portfolio. When we compare a portfolio with another portfolio or benchmark portfolio with return, particularly absolute return, we do not make justice.

We have to compare the return for every unit of risk that investor is holding, which means a true measure of portfolio performance evaluation should be risk adjusted return. Previously, we discussed about Sharpe ratio, where we learned that we can calculate Sharpe ratio of different portfolios using the differential return or excess return on the portfolio that is return

of portfolio over and above the risk free rate of return divided by standard deviation of the portfolio that is total risk of the portfolio.

And we realize that for every unit of standard deviation, if a portfolio has generated better risk premium, that is better return over and above the risk free rate of return, we consider that portfolio with superior performance compared to any other portfolio with lower risk adjusted return. Today, we are going to talk about Treynor's ratio first and then we will talk about differential measure of returns given by Jensen's or also known as Jensen's alpha.

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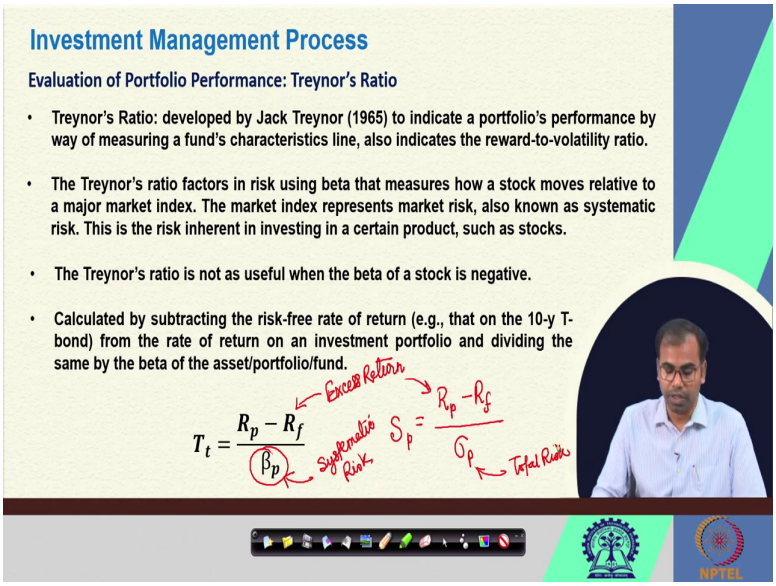

When it comes to Treynor's ratio, typically a Treynor's ratio is very much similar to what Sharpe ratio indicates. Treynor's ratio was developed by Jack Treynor's in 1965. He proposed this index to indicate a portfolio's performance by way of measuring a fund characteristic line also indicated as the reward to volatility ratio.

The Treynor's ratio factors in risk using beta that measures how a stock moves relative to a major market index. Earlier, we have discussed about the beta coefficient as a measure of risk, particularly with respect to the systematic risk. So, market index represent market risk also known as systematic risk and this is the risk that is inherent in investing in certain products such as stocks in stock market.

So, when we talk about systematic risk here, we are talking about beta that act as the measure of risk for which we are calculating risk adjusted return. The Treynor's ratio is not very much useful particularly when the beta of a stock is negative. In rare yet obvious circumstances, we find some stocks or some assets with negative beta and that at that point of time Treynor's ratio might not serve the purpose.

We calculate Treynor's ratio or Treynor's index by subtracting the risk free rate of return that is rate of return on the portfolio minus treasury bill or treasury bond or government bond rate of return and dividing the same by the beta of the portfolio or the asset of the of the fund.

If you recall previously, we learnt about Sharpe ratio where we calculate Sharpe ratio of a portfolio as risk free rate return on the portfolio minus risk free rate of return divided by sigma of the portfolio which is a measure of total risk. Here, we consider beta as an indicator of risk and the numerator remains same where we have excess return, which is basically return on the portfolio over and above the risk free rate of return just like in Sharpe ratio.

Here we use the measure of systematic risk that is beta. Earlier we use the measure of total risk that is sigma of the portfolio. The point here Treynor's ratio wishes to make is the Treynor's ratio indicates risk adjusted return for every unit of systematic risk or risk that cannot be diversified by portfolio diversification or any other strategy that we can as an investor we have the control over.

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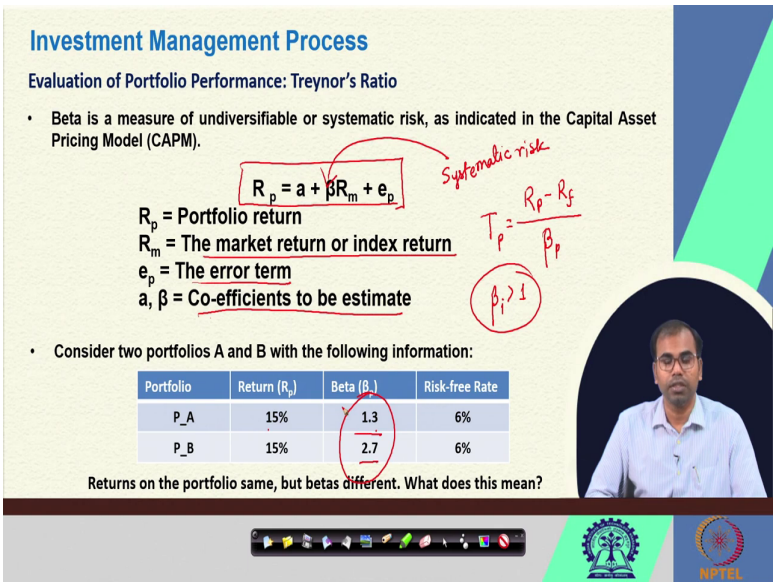

When we try to look at the details of this Treynor's ratio, we see that it is dependent on beta of the portfolio or beta of the asset and we know that beta is a measure of undiversifiable or systematic risk as we have learnt it in capital asset pricing model where, we learnt that return on the portfolio or return on any asset is going to be a function of alpha and then beta coefficient return on the market and then error term.

So, here R p stands for return on the portfolio, R m is the market return or the index return, e p is error term or epsilon and alpha and beta are the co-efficients that that are to be estimated. Now, here this particular beta is the systematic risk that we are talking about here. With this systematic risk as a measure of risk we use the systematic risk while calculating Treynor's ratio for the portfolio where we have the return on the portfolio minus risk free rate of return divided by beta of the portfolio.

Now, let us look at this example. Here we have two portfolios, portfolio A and portfolio B and portfolio A has 15 percent of return as well as portfolio B has 15 percent of return, which means both portfolios have generated 15 percent of return during the sample period. However, the beta coefficient that is the measure of systematic risk are different for these portfolios.

Portfolio A has a beta coefficient of 1.3, whereas, portfolio B has a beta coefficient of 2.7. Now, if we recall we know that we interpret beta coefficient such that if an asset has a beta coefficient of 1 when an asset has beta coefficient of 1, we consider this asset as risky as the market asset or the market portfolio. When an asset has beta coefficient greater than 1 then we consider that this asset is more risky than the market portfolio or the benchmark portfolio.

So, for example, if an asset has a beta of 1.5, we can safely call this asset to be 1.5 times riskier than the market asset or the benchmark portfolio. So, if an asset has a beta coefficient of 2 then we can safely assume that this risk this asset is twice as risky as the benchmark portfolio.

With this interpretation if you look at the beta coefficient of these two portfolios given as 1.3 for portfolio A and 2.7 for portfolio B, we can say that portfolio A is 1.3 times riskier than the market portfolio or the benchmark portfolio whereas, portfolio B is more than twice riskier or close to thrice riskier as the market portfolio or the benchmark portfolio.

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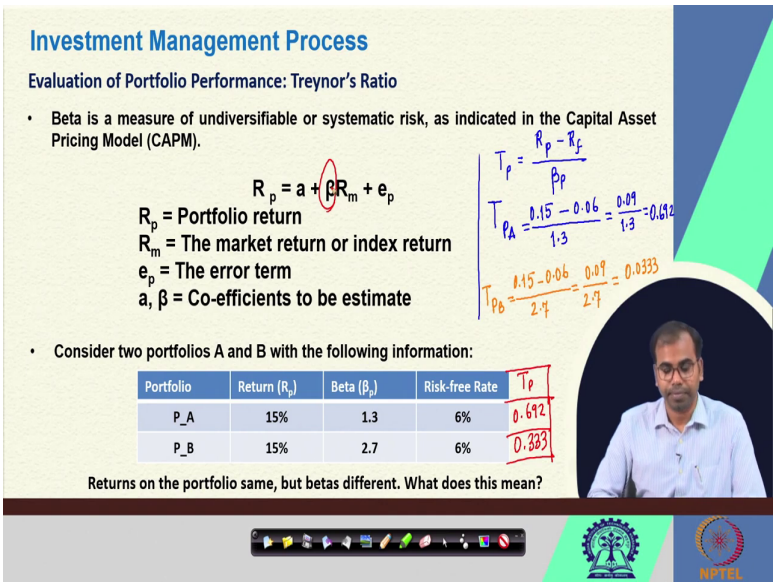

So, if you want to calculate Treynor's ratio here to indicate whether with portfolio A or portfolio B is doing better in terms of risk adjusted return. We can calculate Treynor's ratio and we know that Treynor's ratio can be calculated by return on portfolio minus risk free rate of return divided by beta of the portfolio. So, if we calculate Treynor's for portfolio A then we have to use 15 percent of return as the portfolio return minus risk free rate of return divided by beta that is 1.3.

So, we can have 0.09 divided by 1.3 and if we solve this, we get 0.692 as the Treynor's ratio for portfolio A. If we calculate Treynor's ratio for portfolio B, then we use 15 percent of return minus risk free rate of return that is 0.06 divided by 2.7 and this gives us 0.09 divided by 2.7 and we find a value of 0.0333 as Treynor's ratio for portfolio A and B. So, if we calculate this Treynor's ratio for portfolio A this is 0.692 and for portfolio B it is 0.333.

Now, if we look at these two in the these two numbers that is Treynor's ratio Treynor's index for portfolio A and portfolio B we see that the risk adjusted return for portfolio A is much

better almost twice as better as the portfolio B Treynor's ratio, which means for every unit of systematic risk portfolio A is generating better return than the portfolio B.

So, Treynor's ratio gives us an idea of how the portfolio is doing in terms of risk adjusted return where the risk is systematic risk or market risk or undiversifiable risk as indicated by the beta coefficient.

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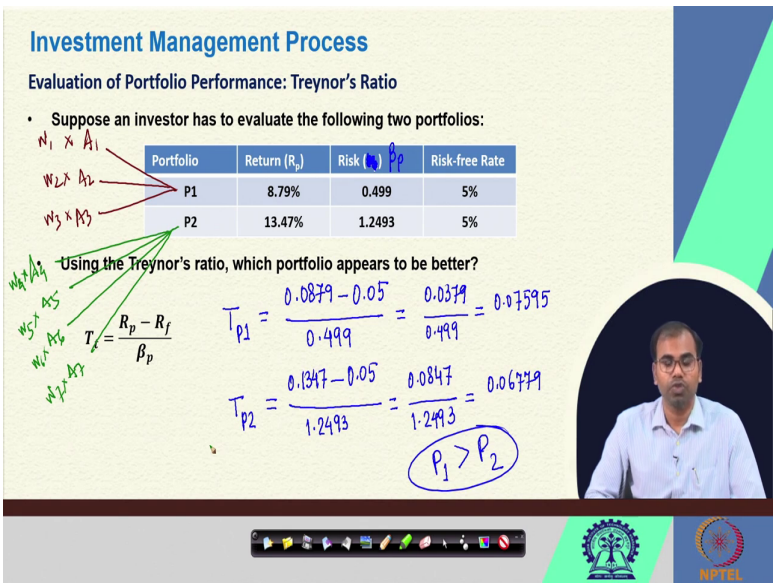

If you look at some more example here, suppose an investor has to evaluate the following two portfolios; portfolio 1 and portfolio 2. Here portfolio 1 has a return of 8.79 percent, but portfolio 2 has a return of 13.47 percent. If we look at the absolute return we can say that portfolio 2 has better return, but if we look at the risk associated with portfolios we see that the systematic risk, which is indicated by beta which should be indicated as the beta of the

portfolio then we see that for portfolio 1 has a beta of 0.499 and portfolio 2 has a beta of 1.2493.

Risk free rate remains same for both the portfolios. So, if you want to calculate the Treynor's ratio for portfolio 1, we can use this portfolio return which is 0.0879 minus risk free rate of return divided by beta, which is 0.499. And similarly for portfolio 2 if you want to calculate Treynor's ratio its 0.1347 minus 0.05 which is risk free rate of return and then we have a beta value of 1.2493.

So, if we calculate this number 0.0379 divided by 0.499, so, we get a value of 0.07595. For portfolio 2 we have a value of 0.0847 divided by 1.2493 this gives us a value of 0.06779. Now, if you look at these two numbers it is very much evident that in terms of returns, that is absolute returns portfolio 2 looks better with 13.47 percent of return.

But at the same time it also carries higher systematic risk that is beta and that is almost thrice as much as the beta of portfolio 1. So, portfolio 2 has a beta of 1.2493 and when we calculate Treynor's ratio that is risk adjusted return or return for every unit of systematic risk we calculate this to be 0.0759 for portfolio A 1 and 0.0679 for portfolio 2. So, in this case portfolio 1 seems to be doing better than portfolio 2 in terms of risk adjusted return.

This way we can calculate the portfolio performance using Treynor's ratio. Now, it goes without saying that these portfolio might have individual assets, asset 1, asset 2, asset 3 in a different proportion where weight 1, weight 2, weight 3. And similarly for portfolio 2 there might be different assets, asset 4, asset 5, asset 6, asset 7 with weight 3 4, weight 5, weight 6, weight 7 and so on.

It is another matter to find the stocks or assets to be included in the portfolio and to optimize their optimal weight that we have discussed earlier. Here we are only concerned about the comparison of portfolio performances using risk adjusted return such as earlier we discussed about Sharpe ratio and now, we are talking about Treynor's ratio.

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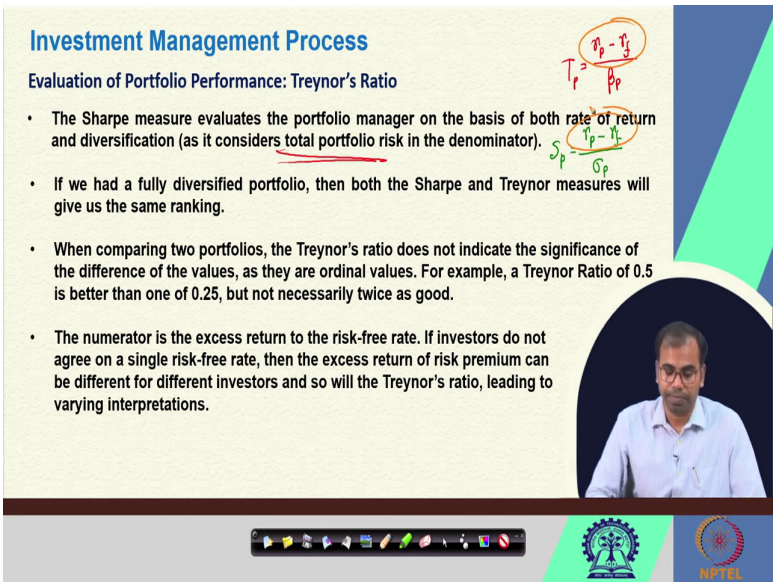

Let us take a look at another aspect of risk adjusted return. We know that Sharpe ratio evaluates the portfolio manager on the basis of both rate of return and diversification because it considers total portfolio risk in the denominator. So, Sharpe ratio has a formula of Sharpe ratio of a portfolio is risk of return on the portfolio minus risk free rate of return by sigma p whereas, if we look at Treynor's ratio. Treynor's ratio has a return on the portfolio minus risk free rate of return divided by beta of the portfolio.

So, here Sharpe ratio considers total risk whereas, Treynor's ratio considers only systematic risk. In case we have fully diversified portfolio then both Sharpe ratio and Treynor's measure will give us the same ranking. And when we compare two portfolios or even more than two portfolios the Treynor's ratio does not indicate the significance of the difference of the value because they are ordinal values.

For example, if we find a Treynor ratio of a portfolio to be 0.5 and another portfolio with Treynor ratio of 0.25, we can say that portfolio with Treynor ratio of 0.5 is better than the portfolio with Treynor ratio of 0.25, but we cannot say with confidence that it is necessarily twice as good as portfolio with 0.25 as Treynor ratio because of the ordinal scale of the numbers.

Similarly, the numerator is the excess return of the over and above the risk-free rate. We see here that we consider risk-free rate as the base return then and if investor do not agree on a single risk free rate for example, if different investors have different risk free rate to be considered then obviously, there is values of Sharpe and Treynor's ratio will change and it will also lead to different interpretation of Sharpe ratio and or Treynor's ratio.

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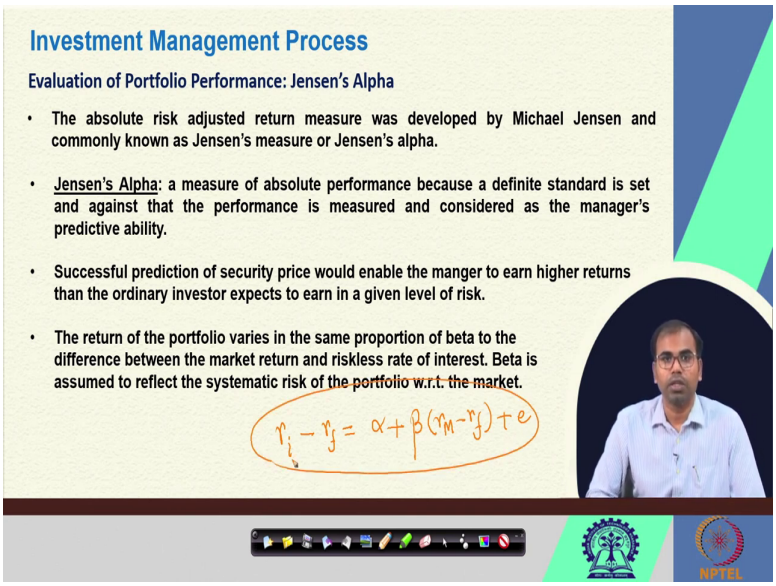

With these understanding if you look at the third measure which is Jensen's alpha or Jensen's comparative performance basically the absolute risk adjusted return measure was developed by Jensen alpha; Michael Jensen and also commonly known as Jensen's measure or Jensen's alpha, which basically is a measure of absolute performance because a definite standard is set and against that the performance is measured and considered as the manager's predictive ability.

So, here we are trying to find how much managers has contributed to generate excess return or generate better return than the average portfolio in the market. So, manager's successful prediction of security prices would enable the manager to earn better returns higher return than the ordinary investor expects to earn at a given level of risk and that is indicated in terms of alpha value.

The return of the portfolios vary in the same portfolio of beta to be different between the market return and riskless rate of return or risk free rate of return. We know that beta is believed to be the systematic risk of the portfolio with respect to the market.

So, we have seen earlier that in case of cap M holds in the market then r i or r p minus r f is alpha plus beta r m minus r f and plus epsilon. So, with this assumption we go ahead and try to understand what Jensen's alpha implies for comparing or measuring the portfolio performance.

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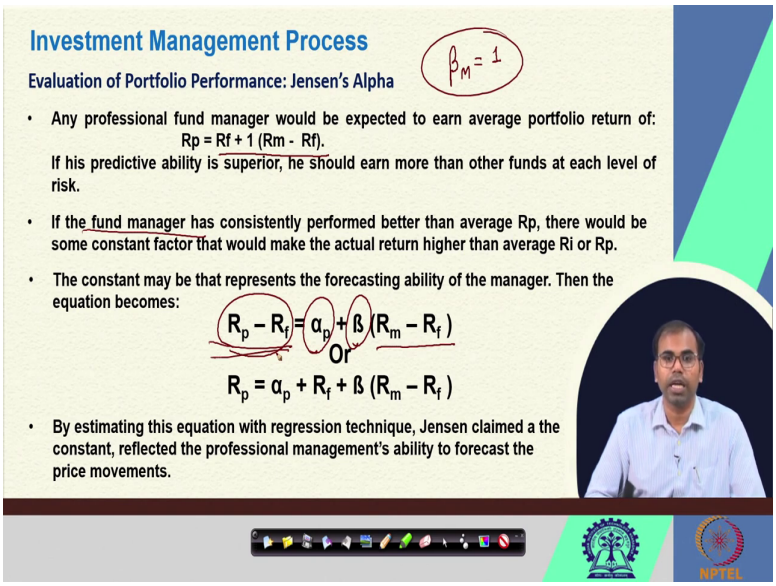

We know that any professional money manager or fund manager would be expected to earn average portfolio return which can be calculated in terms of portfolio return as a function of risk free rate of return plus 1 into Rm minus Rf. Here 1 indicate beta of the market asset which is supposed to be 1.

If his predictive ability is superior then the portfolio manager should earn more than other funds at each level of risk, which means with every unit of increased risk level the portfolio manager for his abilities should earn better returns. If the fund manager has consistently performed better than average portfolio in the market there would be some constant factor that would make the actual return higher than the average return on asset or average return on portfolio.

And that constant may be represented by the forecasting ability of the manager. If that happens then we see that cap M can be expressed as R p minus R f which is excess return on portfolio over and above the return of risk free rate risk free asset is equal to alpha of the portfolio plus beta into R m minus R f. Here this particular coefficient is the systematic risk coefficient which interacts with the market risk premium and this indicates the ability of the fund manager or the manager superior ability because of which the excess return is higher or lower.

So, by estimating this equation with typical regression techniques Jensen's claim that a constant reflected the professional management's ability to forecast the price movement and ability to generate superior returns for the fund or for the investment that this manager is managing.

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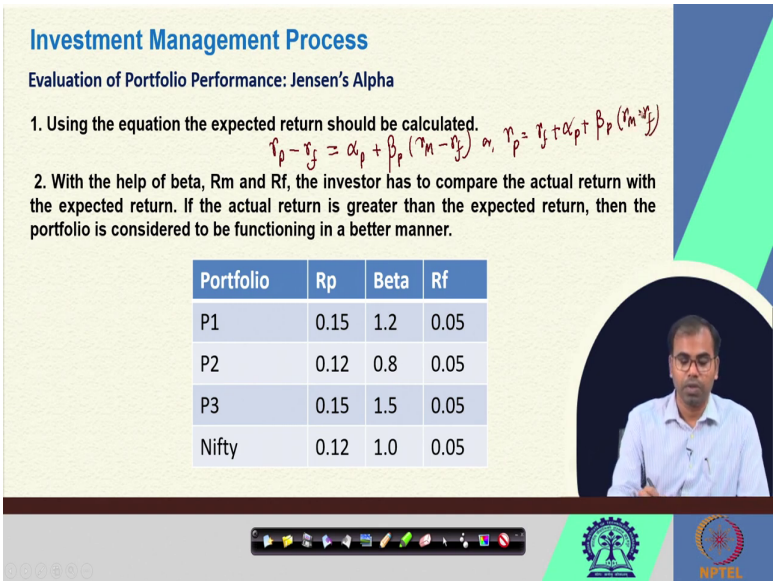

If you look at the way we calculate Jensen's alpha then typically we follow two-step process where in first step we use the equation that expected returns should be calculated. For example, here the return on the portfolio minus risk free rate of return is alpha of the portfolio plus beta of the portfolio into r m minus r f or we can also write it as r p is equal to r f plus alpha of the portfolio beta of the portfolio r m minus r f.

With this help of beta, we use r m and r f and then we can compare the actual return with the expected return or the observed return with the expected return. If the actual return is greater than the expected return then the portfolio is considered to be functioning in a better manner. And we can see that portfolio is superior over other portfolio or the benchmark portfolio.

For example, if we look at this set of portfolios P 1, P 2 and P 3 we have return on the portfolio given to be 15 percent, 12 percent and 15 percent whereas, the Nifty benchmark or the market index has given generated a return of 12 percent, beta for all these assets are given.

Beta for portfolio 1 is 1.2, beta for portfolio 2 is 0.8, beta for portfolio 3 is 1.5 and risk free rate of return is 5 percent. Nifty or beta will remain 1 because it is the market index. Here we can see that P 2 is less riskier than the market index whereas, P 3 and P 1 are more risky than the market index.

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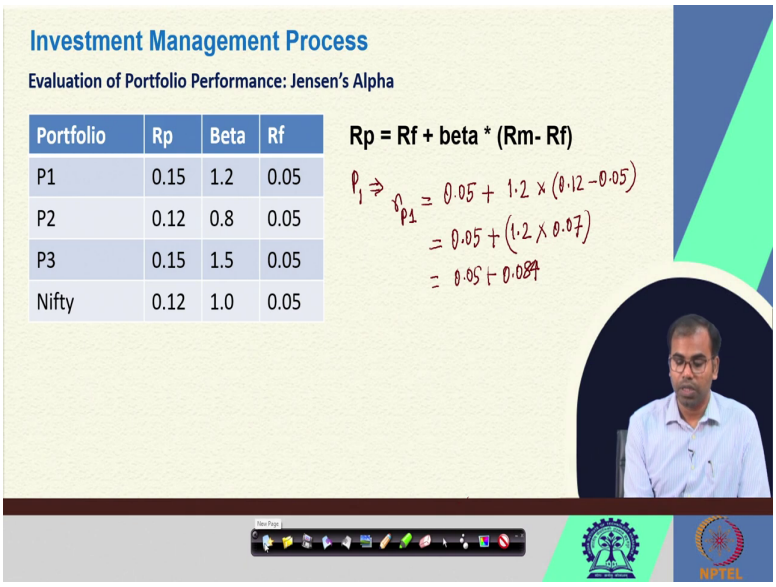

If we assume these numbers to calculate Jensen's alpha or basically the process to calculate the superior performance or identify the portfolio with superior performance, what we are going to do is we are going to first estimate the return on the portfolio as per Capital Asset Pricing Model or CAPM, where we use Rp that is return on the portfolio of any portfolio here P 1, P 2, P3 Rf plus beta into Rm minus Rf.

So, ideally when we are calculating return for portfolio 1, we use a portfolio 1, r P1 is equal to 0.05 plus 1.2 that is the beta into 0.12 minus 0.05. So, what we will have is 0.05 plus 1.2 into 0.07. So, we will have 0.05 0.084.

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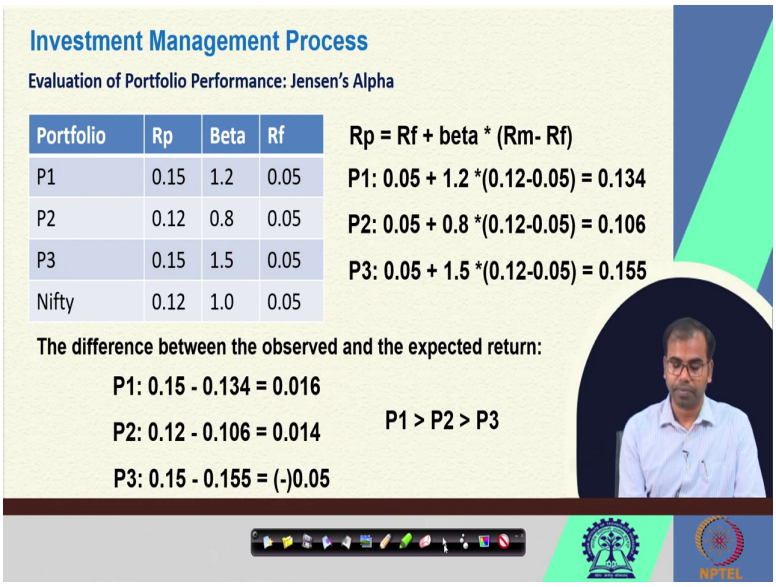

So, with this we can calculate the portfolio return of all the assets and these are calculated returns. So, if we use this formula, we will have return of 1 0.134 or 13.4 percent for portfolio 1. For portfolio 2 we will calculate a return of 10.6 percent. Portfolio 3 will have a return of 15.5 percent and these are all calculated return or expected return according to the Jensen's model or a capital asset pricing model.

When we compare this calculated or expected return with the actual or observed return what we find here is for portfolio 1 we have 0.15 that is expect return observed and we have calculated the return of 13.4. So, we have excess return that is 0.016. Similarly, for portfolio 2 we have 12 percent of return that is observed, we have 10.6 percent calculated, we have an excess return of 0.014.

Similarly, for portfolio 3 we will have 15 percent of return observed 15.5 percent of expected; so, minus 0.05. And if we compare these portfolio, we know that portfolio 1 is better than portfolio 2 and portfolio 2 is better than portfolio 3 and portfolio 1 is better than portfolio 3. So, for an investor to choose from portfolio 1, 2 and 3 the order should be portfolio 1 then portfolio 2 and portfolio 3 should be avoided in general. This way we can compare performance of the portfolio.

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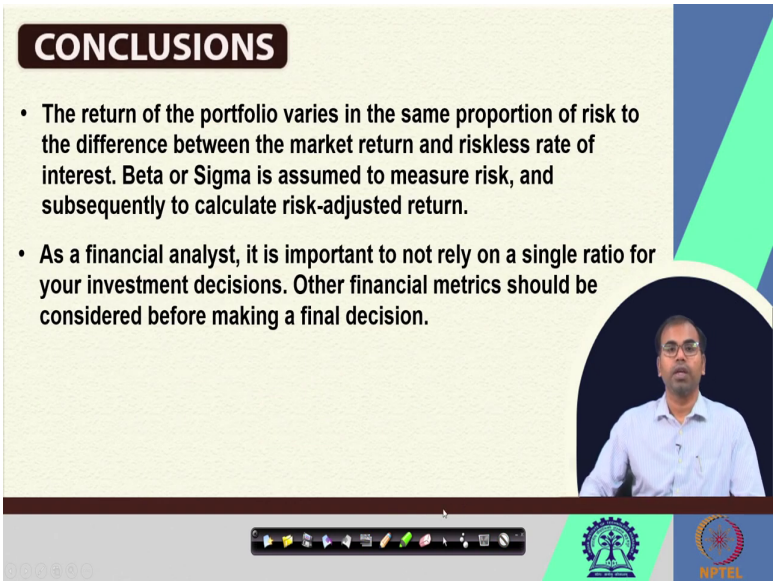

In order to conclude we discussed that the return of the portfolio varies in the same proportion of risk to the difference between the market return and riskless rate of return or risk-free rate of return where, beta or sigma can be used to indicate the market measure risk where beta indicates the systematic risk and sigma indicates the total risk and then we calculate the risk adjusted return for investment that we have made in any portfolio.

As a financial analyst it is important to not rely on a single ratio for example, just Sharpe ratio or just Treynor’s ratio or just Jensen's alpha or any other measure for that matter for our decision investment decision making. Other financial matrices should also be considered before making a final decision. With this I end this session. That is all.

Thank you.