**Financial Institutions and Markets**
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**Lecture – 06**
**Systematic Risks in Financial System**

So, after discussing about the basic role of financial system and how it is related to the economy growth; we can start the discussion on certain concepts, which are linked to this particular financial system. And this particular concepts will be used across the different type of Financial Institutions and Market what we are going to discuss in the coming sessions.

So, as you know that the most important thing in the financial system is the management of the risk. Because every participants come to the market knowing that they are going to exports certain amount of risk, and accordingly they want to maximize the return in such a way that whatever risk, they will face, the risk can be adjusted and as well as they can get certain return for their benefits and as well as the maximization of the wealth.

So, keeping those things in the mind, we can starts some discussion related to different type of risk what always we observe in the financial system as a whole. Then those type of risk will be discussed more elaborately, whenever we go and discover whenever we are going to discuss these particular market and institution specifically in the following sessions.

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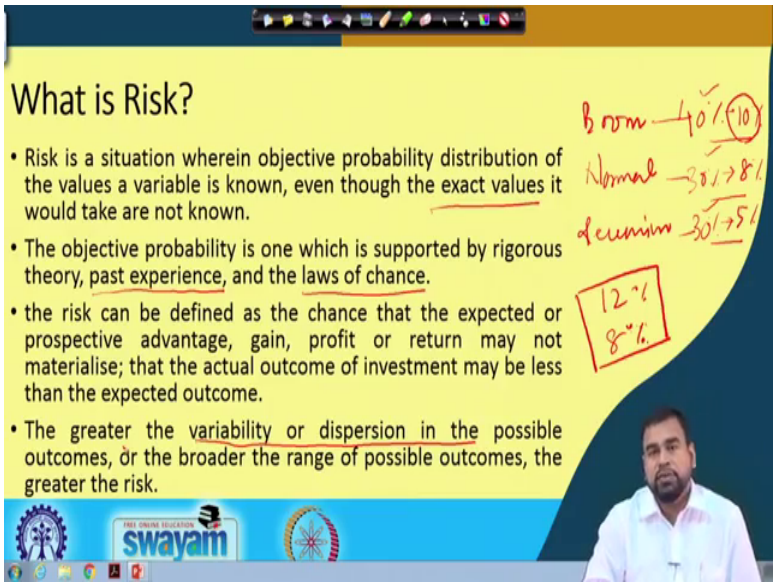


So, let us first see that what do you mean by the risk, how the risk is defined. So, you might have known that the risk and uncertainty, these are the two words, which are popularly used in the financial literature. And there are some kinds of theoretical differences between them. So, I will give you these basic differences between them little bit later.

But, let us first analyze or try to understand, what exactly the risk is. The risk is basically a situation, where the objective probability distribution of the values a variable is known, even though the exact value it would take are not known. What exactly it means? It means that whenever we are going to predict something in the market or we are going to say that, how this particular stock or particular bond is going to perform, and what is the probability that we are going to 5 percent, 10 percent, 15 percent return, we can have different scenarios.

For example, you say that let the particular market has three scenarios. One is a normal condition, there is a normal condition, there is a recession, and there is boom, the market is growing up. So, in these two condition, let we can assign different probability that ok. There is a probability that if there is a boom and there is a 40 percent chance, there will be a boom. So, if there is a boom, the return will be let 10 percent.

And there is a 30 percent chance maybe the market will be in the normal condition, the return will be 80 percent. And if there is a recession, there is a also probability that a 30

percent probability that is recession, and you can get let 5 percent return. So, here what you are trying to say that whenever we are talking about the return what you are going to observe from the market, we are defining a certain probability distribution.

And we are assigning that if something is going to happen, then what is the probability that we are going to get this amount of return or this amount of return or this amount of return. But exactly we do not know, whether really this returns can be realized or not, but still we are thinking there is a probability that this kind of return can be achieved from the market. So that is why, we are we are saying that the exact values basically is not known here. But, we can go for a probability distribution of that particular variable, which is our outcome variable or the forecast variable.

And how the probability distribution is made? The probability distribution is made on the basis of the theory, and the past experience, and as well as the laws of chance. What basically this, we have the data about that particular variable, which is available for may be last 10 years or 15 years. And we have observed that how this data behaved in the last periods. And accordingly, we can decide that if the data is behaving in this way historically, then how this particular data is going to behave in the future also. So, the probability distribution can be derived from the past observations, whatever we have. And accordingly, we can assign certain probability with respect to this. And finally, this expected return, what we are going to get from this that can be calculated.

So, therefore here what we say, what is the risk here? The risk here is for example, you are expecting if there is a boom, you are going to get 10 percent return, but it is not necessary that you are going to get this 10 percent return. The reason is maybe you may get 12 percent or you may get also 8 percent. So, what is trying to say? If there is a deviation, if there is a deviation from the actual expectations whatever you have, it is not actual, basically you are expecting something.

So, if you are expecting something, but you are getting something that means, there is a probability that whatever thing you are expecting that may not be realized. So, if it is not going to be realized or it is not going to be metalized, then we are facing certain amount of risk in the market that means, we are saying that investment or positioning in the market is risky, because whatever way we are expecting that particular thing may not be received by us.

So, then what basically, we are trying to say? If the variation is more, then the risk will be more. You are expecting 10 percent, you are getting 1 percent, somebody else is expecting it possible 10 percent, getting 8 percent. So, there is a differences. If somebody is getting 2 percent or 3 percent, we are expecting 10 percent and somebody is getting 8 percent, but he was expecting 10 percent. So, there is a deviation. The deviation there is a variation in the deviations, so that variation or the variability basically measures the risk. How the actual value is deviated from the expected value?

So, in the statistical sense, the expected value is nothing but the mean value of that particular series that is what in the simplistic way we can say. Although there are different ways the expectations of that particular distribution can be calculated. But, in general, we can say that the mean value of that particular series can be used as the expectations or expected value of that particular data, so that is why more the variation, the risk will be more.

And obviously, if the broader the range of the possible outcomes, the greater is the risk. So, more the variation more is the risk that is what basically, what we can conclude. So, the risk what we are going to face that is not basically related to the actual return, what you are getting that is related to the we always calculate the risk with respect to the variation of the return of that particular data with respect to the expected return, what we are expecting or we are calculating before, so that is why the variability or the dispersion in the possible outcomes, basically measures the risk of that particular series or risk of that particular distribution. So, this is the basic concept of the risk, what always we observe in the market or we always use it in our analysis.

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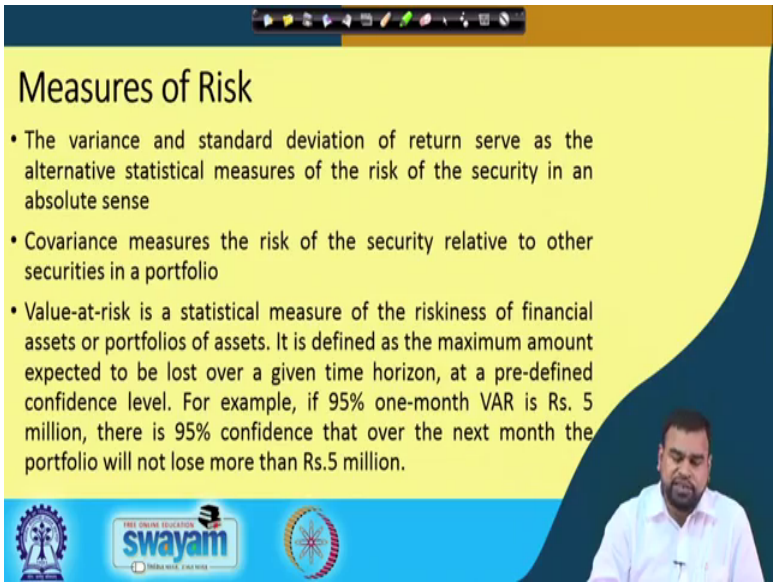


Then let us see that how this what are the popular measures of risk, how the risk is basically measured? Whenever we measure the risk all of you might have known, that the basic way of measuring the risk is the variance, the basic way of the measuring the risk is basically the basic way of the basic way of measuring the risk is basically what, we can say that is the standard deviation.

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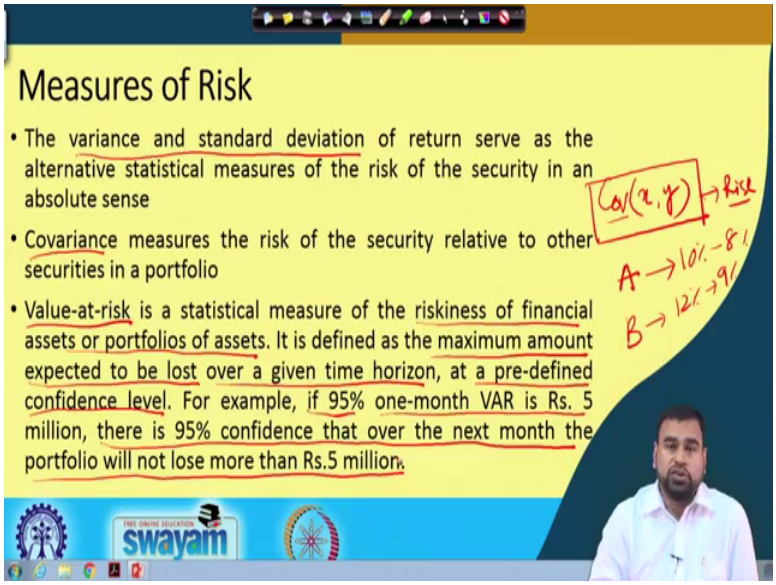


So, variance or standard deviation, these are the basic measures of the risk. So, here what we are trying to say that all of you know that how the variance can be calculated that it is

the deviation from the mid deviation from the mean of that actual series. If you take those square of that divided by the degrees of freedom that is n minus 2, so that basically measures the standard deviation of that variance of that series and if you take the square root of the variance, then we can measure the standard deviation. So, this variance and standard deviation, these are the two things basically what we always used for measuring the risk in the market.

So, then another thing is basically you see, you can also use the co-variance. The co-variance basically measures the risk of the security, they related to the other security in the portfolio. And whenever we are comparing the different type of alternatives whatever we have, if you are comparing the alternatives of the choosing the assets in the market, then what basically we are trying to do? We are using the concept of the covariance or how the co variance between x and y. And that covariance between x and y is basically measures the risk factor of that particular or relatively how that particular a variable is a risky, and whether this particular very or particular alternative can be taken for earth investment or not.

And another thing also we have that is called the coefficient of variation. The coefficient of variation basically whenever we use it, we use it basically whenever we are comparing the two alternatives. For example, in one alternative you have A, in another alternative you have the B. If e A is giving 10 percent return and giving a risk of 8 percent and B is giving a return of 12 percent, and you are facing a risk of 9 percent.

Then here if there is a dilemma that which alternative should be chosen, so in that particular point of time, basically we use the coefficient of variation. And the coefficient of variance is nothing but that for one unit of the risk, how much extra return you are getting? It is basically the ratio between the mean return what you are getting, and the standard deviation, so that particular measure is used whenever we have the different alternatives. And we are going to use that alternatives in the market for the investment or choosing the investment from the varieties of alternatives, which are available.

Then another type of measure, we have popularly used that is called the value-at-risk. So, what this value-at-risk means? The value at risk is basically a statistical measure. The value-at-risk is statistical measure of the riskiness of the financial asset; it is a statistical

measure or the riskiness of the financial asset or portfolio of the assets. What it is basically, what it defines? How we can define this value-at-risk?

The value-at-risk is nothing but the maximum amount you are expecting, maximum amount expected to be lost over a given time horizon, at a pre-defined confidence level. In the statistics, you might have known about the confidence level and the significance level. And whenever we measure the value-at-risk, we basically consider at what significance level or at what confidence level, we are basically measuring this value- at-risk.

So, if you have the 95 percent confidence level, then that means significance level is 100 percent minus 95 percent that is 5 percent. If it is a 90 percent confidence level, then it is significance level is 10 percent like that. So, here what we are trying to say? If you see this example, if 95 percent one-month VAR is rupees 5 million that means, if you want to interpret it what basically the interpretation is the interpretation is that is 95 confidence that over the next month the portfolio will not last more than 5 million.

What basically it means, it means that what is the maximum loss or the host loss somebody can make in a particular time period at a particular confidence level that is basically is defined as the value-at-risk. The value-at-risk is basically a measure, which tried to tell you that, what is the maximum loss this particular investor or particular company is going to make if he or she wants to invest in the market, that is basically the measure of the value-at-risk; or this is the way the value- at-risk can be defined.

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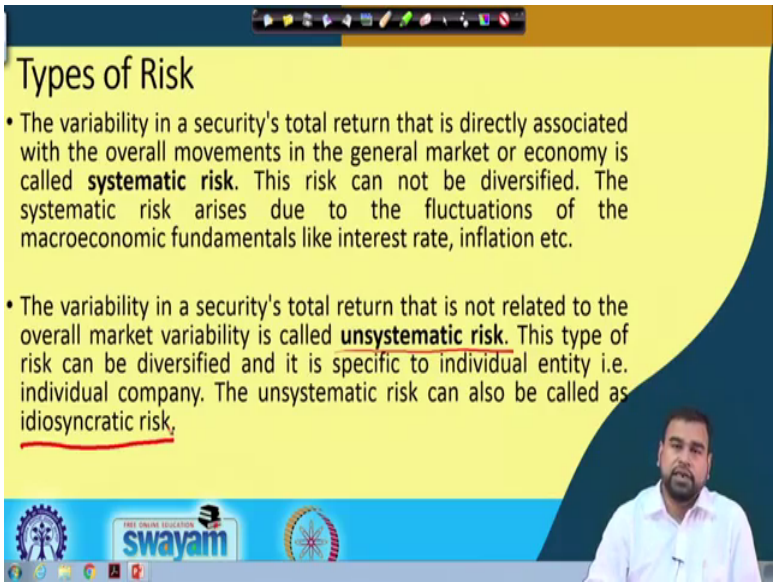


Then if you see that there are different types of risk, broadly the risk can be defined in two ways. One is your systematic risk, and another one is the unsystematic risk. What do you mean by the systematic risk? The systematic risk is a risk, which is basically everybody is basically suffering from that. All the entities are exposed to the systematic risk, because that is basically related to the macroeconomic fundamentals.

And if the general market or macroeconomic fundamentals like interest rate, inflation all these things became volatile, so in that sense we can say that we are exposed to the systematic risk of particular market that means, whether any company operates or any individual operates in the market. So, if there is a change in the inflation, there is a change in the interest rate everything, so then what will happen that everybody will be going to face that particular risk in the system. So, therefore it is called systematic.

So, any kind of investment strategy if you want to make so that particular risk cannot be diversified. So, this sun systematic risk cannot be diversified that is why, the other name of the systematic risk is also on diversifiable risk. This particular risk cannot be diversified in the system. So, whatever way you want to make your portfolio strategy or investment strategy that is not going to help the participants to the investor to reduce or it would diversify that risk in the market.

Then another type of risk is the unsystematic risk. So, this unsystematic risk is basically nothing but this risk is specific to the particular entity, either it is maybe with respect to

individual or with respect to a company. So, any fluctuations within the company like if the sales is fluctuating or if there is some kind of uneven situations, which have occurred in the company, but that is not applicable to another company.

So, those kind of events, those kind of incidents can also to create certain kind of risk for the particular investment alternatives or for that particular entity. So, those risk can be diversified those risk can be by diversified, but in the sense what we are trying to say? If any kind of investor wants to invest in the stock market, if they are holding 50 stocks, 20 stocks or 30 stocks, so in that context what happens that if all those 30 stocks if you are chosen, and if one stock is do not doing well, another stock can do well. At one sector particularly may not perform well, but another sector may perform well.

So, in that context what they trying to do, they are trying to minimize the risk, so that is why, what we can say? The unsystematic risk is also known as it is called the idiosyncratic risk. The idiosyncratic risk is nothing but it is specific to the individuals it is specific to the individuals. And those kind of risk can be diversified, if you are holding more number of assets or more number of alternatives investment alternatives in the system or your investment portfolio that is why, we can say that this is a diversifiable risk. So, if you are holding more assets in your portfolio, then this particular risk can be diversified. So, this is basically another thing, what we can say.

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Now, let us discuss that, what are those different types of systematic risk, major type of systematic risk, what we face in the market. So, the 1st one is the beta. The market risk, which is defined as beta and another one is interest rate risk, inflation risk, exchange rate or the currency. These are the major risk, which are driven by the changes in the macroeconomic fundamentals, and because of changes in the macroeconomic fundamentals this every market participants are exposed to this type of risk in the market. So, let us see that how this particular type of risk can be find, and what basic how we can measure this.

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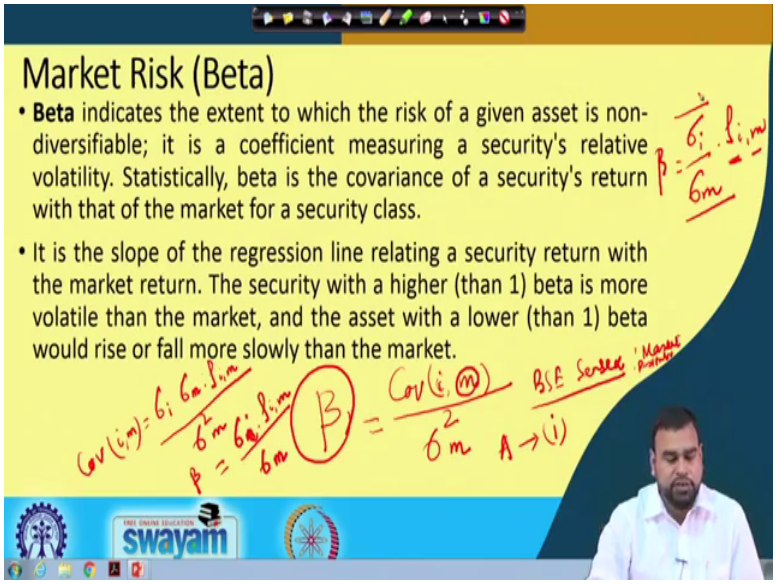


So, then we can come to first to the market risk, which is popularly known as beta. So, what this beta indicates, the beta indicates the extent to which the risk of a given asset is non-diversifiable, and it is basically measured as a coefficient, which measures the security's relative volatility with respect to the market volatility.

So, how this beta is calculated, so if you in the sense let me explain you that how the beta is calculated. The beta is calculated in this way that beta is equal to the covariance between the individual assets return of the individual assets with the market return divided by the variance of the market. So, this is the covariance between i represents the individual return from the asset, it may be stock, it may be bond, it can be anything. And this m represents the market return.

So, here how this m for example, if you take the stock market, in the stock market the m is basically what. Let you can take the proxy BSE Sensex, this is an index. And people consider this is a market portfolio this is a market portfolio. So, the return from the BSE can be consider as the market return. Let you are using a stock A, the stock A is returned is basically represented as i. So, we are talking about the covariance between the return of the individual asset or the individual stock, and the return from the market divided by the variance of the market that will give you the value of the beta.

So, here what we are telling that if you little bit expand it, then your covariance i and m is nothing but the standard deviation of i into the standard deviation of m into the correlation between i and m divided by the variance of m. So, one standard deviation and one standard deviation can be cancelled out. So, you will end up with the standard deviation of the market multiplied by the correlation between i return of the individual security in the market divided by the sorry this is standard deviation of i standard deviation i will be cancelled out, then you have the standard deviation of the market.

So, in general we can represent it that your covariance i, m is equal to or the beta is equal to basically this one. Then beta is equal to covariance is equal to this, standard deviation of i and the standard deviation f into the correlation between i and m divided by the variance of m. So, then what has happened. Finally, one standard deviation of m can be cancelled out, because the standard deviation variance of m is nothing but standard deviation of m into standard deviation of m.

Then finally, we have your final your beta is equal to standard deviation of i divided by the standard deviation of m into the correlation between i and m. This i represents already I told you, this is the return from the individual stock or individual security, and this is the return from the market, and this is the variance sorry standard deviation of the market, and this is the standard deviation of the return of the particular security, so that is why, this is basically what, this is basically the calculation of the beta. So, this is the actual calculation of the beta, but the beta also can be calculated in other way.

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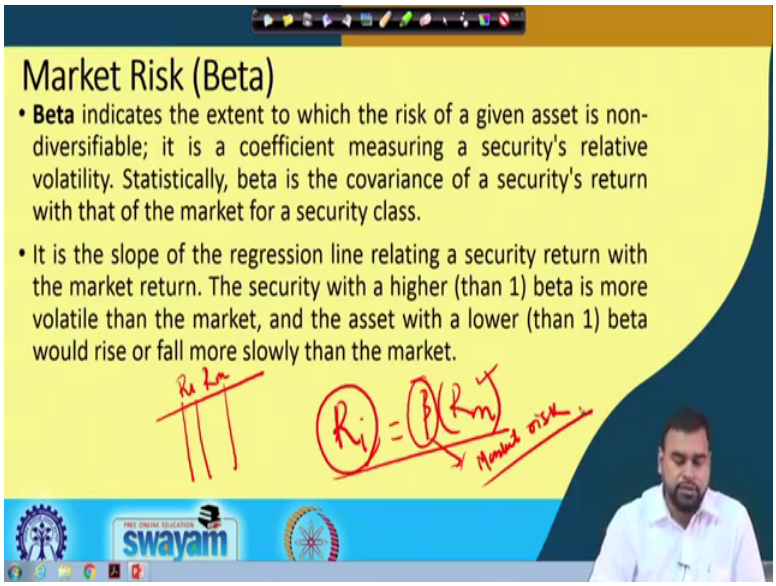


If you regress if you can run the regression line, let R i is equal to beta R m, this is the simplistic way of calculation. The beta is the coefficient, R m is the market return, then what you can do, you can take two columns. One column you can take the return from this individual asset, and another column you can take the return from the market run the regression, where R i is the dependent variable R m is the independent variable.

And whatever coefficient, you will find that coefficient also this beta, this is basically the also the market risk, this is this is the way also the market risk can be calculated. So, therefore the security the this is a slow, and the security with the higher beta is more volatile than the market, and the asset with a lower beta would rise a would rise or fall more slowly than the how the market is volatile that is the way the beta can be defined.

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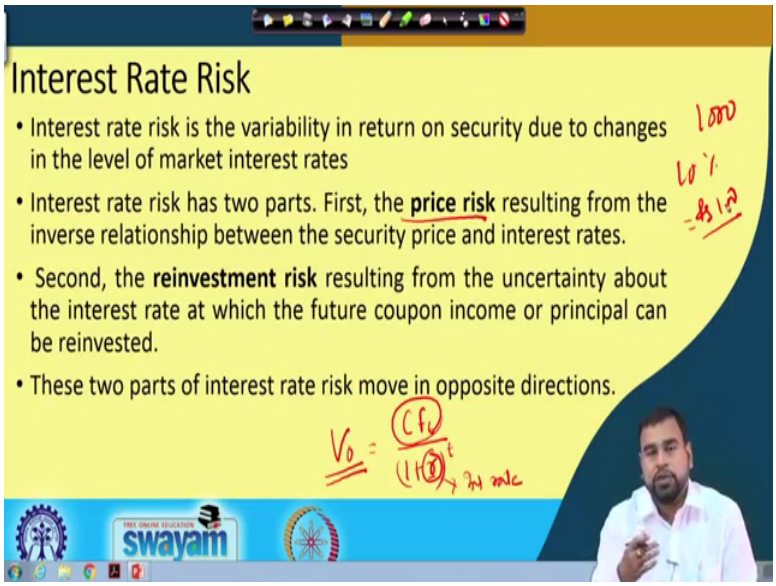


Then we can come to the other type of risk that is basically you have interest rate risk. So, what this interest rate risk is basically talk about the interest rate risk is basically nothing but the variability of the return on security due to changes in the level of market interest rate. If you go back the generally this if there is a change in the interest rate, then the value of this particular asset gets changed. However it basically happens?

For example, if you talk about the bond the price of the bond is what, if you if you write this price of the bond, the price of the bond works in this way write V 0 is equal to your cash flow divided by 1 plus r to the power t. And this r is nothing but the interest rate or the discount rate. So, here if you see, if your r changes, then V 0 changes if r increases, the value of the bond goes down. If r declines, then value of the bond goes off, because it is in it is a discount factor, which is taken in the denominator.

And here the price is increasing, for example somebody has invested in the bond. And in the bond if they get the coupon, so the coupon is nothing but the regular cash flow right and as well as in the principal amount, whenever in the end we get it. So, in that context what we say, if the interest rate increases the value of the bond goes down, but whatever coupon they get, if the coupon amount can be reinvested in the market, they get more return that is why, whenever the value of the bond goes down, we say that increase the interest rates declines the value of the bond that is why the price risk increases, which is called the price risk.

And whatever money we get it from the coupon, like if we have bond value of the VAR value of the bond is 1000 rupees, you your coupon is 10 percent, then every year you will be getting 100 rupees. If that 100 rupees again you are reinvesting in the market, then if your interest rate goes off, maybe you can get some more return. So, therefore the price risk and reinvestment risk work in the opposite direction.

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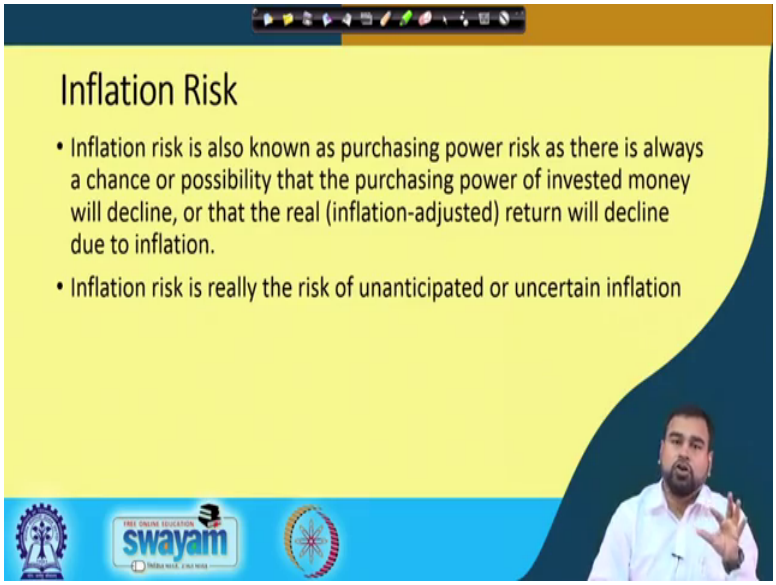


Then we can come to the other type of risk like inflation that everybody knows. Inflation is basically nothing but the purchasing power. If the inflation goes off, the purchasing power of the consumer goes down. And that is always if the inflation increases, the real value of that particular asset goes down, because it affects or it negatively affects the purchasing power.

So, therefore always we should expect that inflation should be low, because the real addition or the real return from that particular asset can be increasing. At always you remember whenever we compare or we try to analyze the inflation risk, we are not talking about the actual inflation, which is happening now, we also consider the uncertain inflation or the expected inflation. The expected inflation is very much so important, whenever we talk about the inflation risk in the market, so that is basically we have to keep in the mind.

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Then we have another one that is called the exchange rate or the currency risk. So, the currency risk all of you much very much aware about if there is a change in the exchange rate, then the value of that particular currency changes. And that affects every type of international transactions or anybody who are doing this international business across this basically, it effects mostly the multinational companies and who are doing the foreign exchange business.

So, therefore the exchange rate risk is defined as the cash-flow variability experienced by the economic units engaged in the international business or international exchange. And there is no exchange rate if you see that do you have different type of exchange rate system like India adopt a managed exchange rate system, China adopts a fixed exchange rate system, because the government decide how should what should be the exchange rate of that particular currency with respect to another currency.

So, if that is the fixed exchange rate system, we are not exposed to exchange rate risk. If there is a floating exchange rate system, market determines how much should be the exchange rate of that particular currency with respect to another currency, then what will happen that we are much more exposed to the exchange rate risk and accordingly the value of the set can go down. So, therefore these are the different one of the major risk, which is affecting the value.

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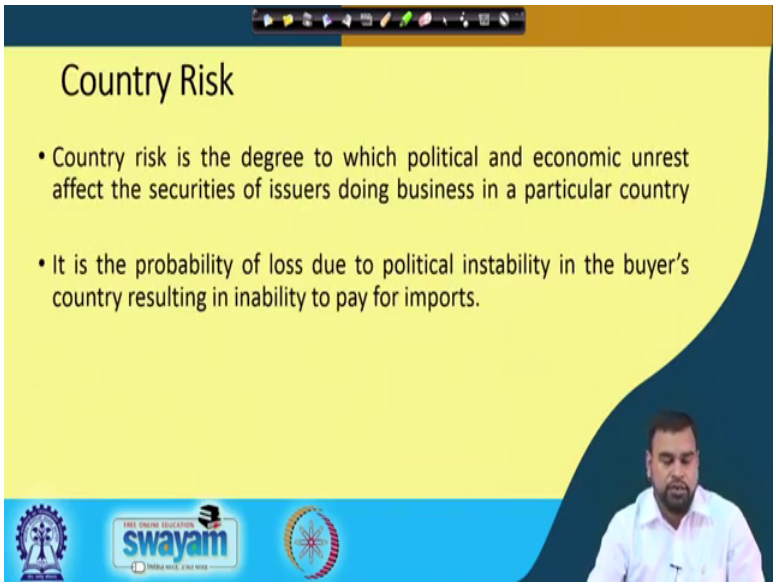


Then finally, the country risk. The country risk is basically what, the particular risk which to which the political and the economic unrest affect value of the securities. If there is the probability that there is a unstable instability in the political scenario or there is no political instability exist in the system. Then what will happen that basically affects the balance of payment.

Mostly it affects the buyer's country, who are basically doing this foreign exchange business or any kind of business, whatever anybody any company is doing or any individual is doing. And that is why it is the probability of loss due to political instability in the buyer's country resulting in inability to pay for imports, because there is a political instability.

We sometimes that affects the whole economic system and generally if it is adversely affect in the balance of payment, and finally the value of the total assets can be affected, so that is the way the currents the country risk can be defined. So, these are the major type of systematic risk. And we will be discussing the unsystematic risk in the next session.

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Please go through these particular references for this particular session.

Thank you.