Economics of Banking and Finance Markets
Prof. Sukumar Vellakkal
Department of Economic Sciences
Indian Institute of Technology, Kanpur

Lecture - 09
Risk structure of Interest rate-II

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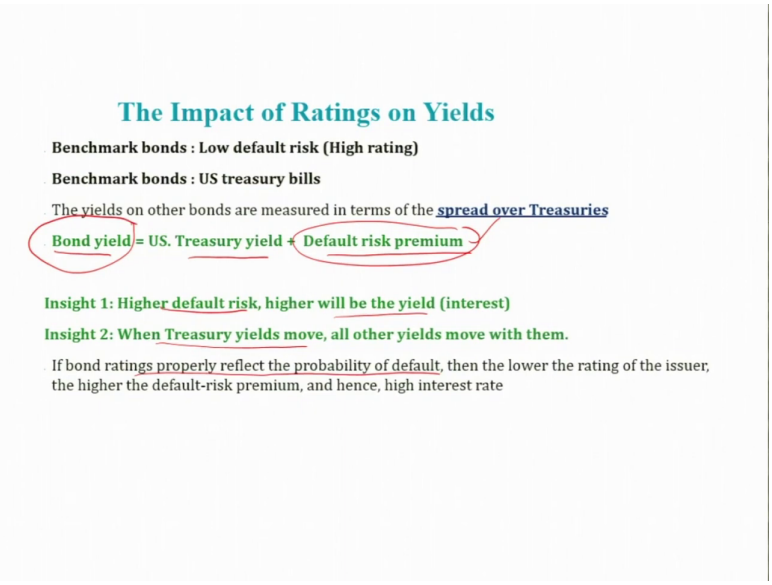

Welcome to this session. In this session, we will continue our discussion on Risk Structure of Interest Rate. And subsequently, if time permits, we will start discussing the term structure of interest rate. Coming to the risk structure of interest rates, in the previous lecture, we have discussed how default risk is measured by different risk rating agencies.

And based on that, we have seen that debt instruments with better rating, high rating will have to pay low interest rate as compared to debt instruments which has bad rating or low rating. Bonds with very poor ratings are also called as junk bonds or speculative grade bonds. And, as you know, they must pay a high interest rate in the market when they borrow from the market.

Subsequently, we also discussed what is benchmark bond. We have seen that benchmark bonds are considered as those bonds which have low default rates, that is, those who get high ratings. So, in the globally, US Treasury bills are considered as the benchmark bonds. So, we

have also seen there that the yield on other bonds is measured in terms of or expressed in terms of spread over the US treasury bills.

For example, we measure that bond yield is US Treasury yield (the benchmark bond) plus the default risk premium. From these, we can derive two major insights. Insight number 1 is higher default risk higher will be the yield, right.

It means that lower the rating, higher will be the default risk premium they have to pay for their borrowings. Second is, when treasury yields move, then other yields move with them.

So, when the treasury yield for example, when it increases, you can see other bond yield also increase. Similarly, when the treasury yield declines, so do with the other bond yield as well because we assume there that the default risk premium is constant. So, if bond ratings properly reflect the probability of default, then the lower the rating of the issuer, the higher the default risk premium and hence high interest rate.

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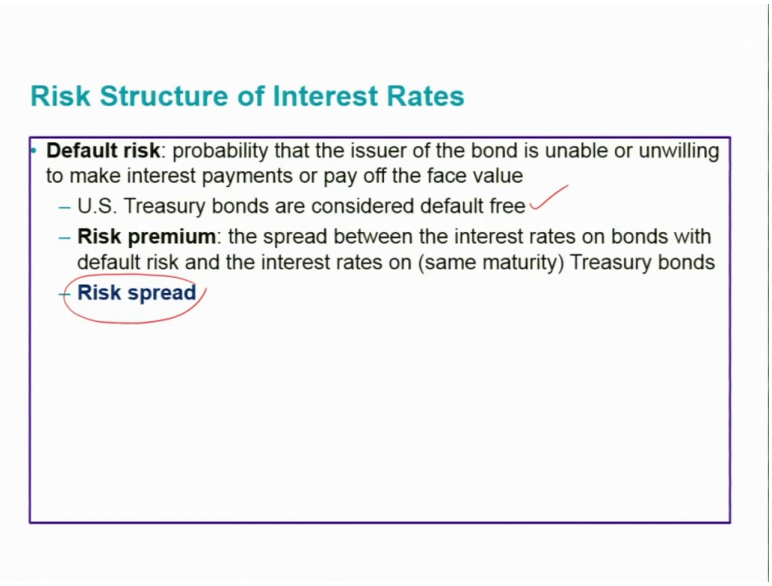

We have seen here is that default risk is the probability that the issuer of the bond is unable or unwilling to make interest payments or pay off the face value. We already seen that US Treasury bonds are considered as default free bonds. The risk premium also we have discussed, the spread between interest rates on bonds with the default risk and the interest rates on treasury bonds, treasury bills.

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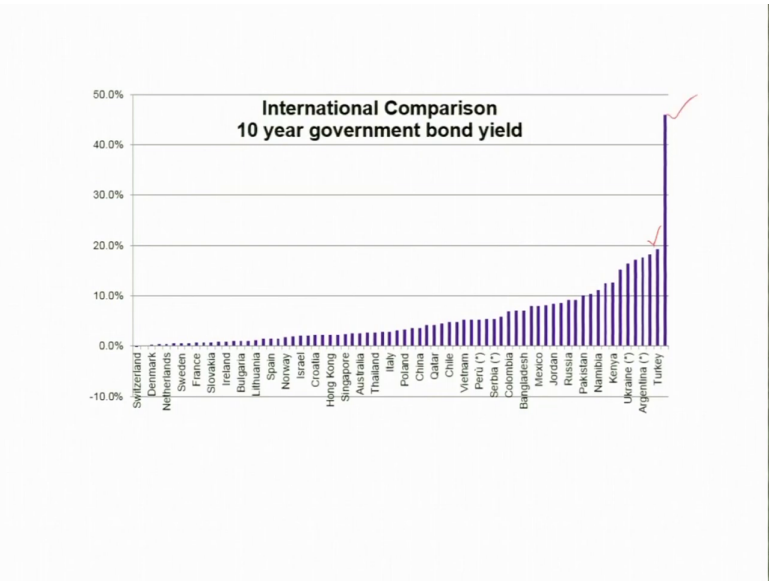

Look at this. The international comparison of 10-year government bond yield, you can see that at the bottom, Switzerland with negative yield. That means, if you want to buy a Switzerland government bond, you have to pay the Switzerland government because it is most safe investments to park your money.

So, similarly you can see that when you move well along, you can see Denmark and Netherlands, Sweden, the risk premium increases when the default risk increases. So, you can see that, for example, the country Argentina or Turkey, here, and Venezuela, you can see here, that the default risk increases.

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Country	S&P Rating	10Y Yield	Spread vs. US Bond
Switzerland	AAA	-0.08%	-2.96%
Japan	A+	0.11%	-2.76%
Denmark	AAA	0.31%	-2.57%
Germany	AAA	0.36%	-2.52%
Netherlands	AAA	0.47%	-2.41%
Finland	AA+	0.53%	-2.35%
Sweden	AAA	0.54%	-2.34%
Austria	AA+	0.58%	-2.30%
France	AA	0.70%	-2.18%
Belgium	AA	0.71%	-2.17%
Slovakia	A+	0.79%	-2.09%
United Kingdom	AA	1.42%	-1.46%
Spain	A-	1.46%	-1.42%
Malta	A-	1.49%	-1.39%
Norway	AAA	1.81%	-1.07%
Portugal	BBB-	1.87%	-1.01%
Israel	AA-	2.02%	-0.86%
Czech Republic	AA-	2.10%	-0.78%
Croatia	BB+	2.17%	-0.71%

Country	S&P Rating	10Y Yield	Spread vs. US Bond
United States	AA+	2.88%	0.00%
Italy	BBB	2.89%	0.01%
Morocco	BBB-	3.16%	0.28%
Poland	BBB+	3.27%	0.40%
Hungary	BBB-	3.63%	0.75%
China	A+	3.63%	0.75%
Malaysia	A-	4.16%	1.29%
Qatar	AA-	4.23%	1.35%
Greece	B+	4.42%	1.54%
Chile	A+	4.83%	1.95%
India	BBB-	8.06%	5.18%
Jordan	B+	8.35%	5.47%
Indonesia	BBB-	8.58%	5.70%
Russia	BBB-	9.15%	6.27%
South Africa	BB	9.20%	6.32%
Pakistan	B	10.00%	7.12%
Uganda	B	17.20%	14.32%
Argentina (*)	B+	17.60%	14.73%
Egypt	B	18.16%	15.28%
Turkey	B+	19.24%	16.36%
Venezuela (*)	SD	45.98%	43.11%

Translating these into risk spread, which we discussed as a comparison with the US Treasury bill, you can see that Switzerland their default risk premium is negative. It is minus 2.96 percentage. So, that means, as compared to the US Treasury bill, the default risk is very low; that means, the this much premium, this negative, that means, minus 2.96 percentage. This is considered as very safe investment portfolio.

Further, you can see for here, the countries like Japan, Denmark, and Croatia, you can see that the risk premium is negative in fact. See the United States which is the benchmark, so obviously, the spread is 0. Moving to other countries Italy, Morocco, Poland and keep on moving you can see that the risk premium increases.

For example, the risk premium for India, from this data, this one, is 5.18 percentage. You can see further that the risk spread increases where turkey is 16.36 and Venezuela is, this one, 43.11 percentage. So, that means, these are the countries with a high-risk premium or risk spread.

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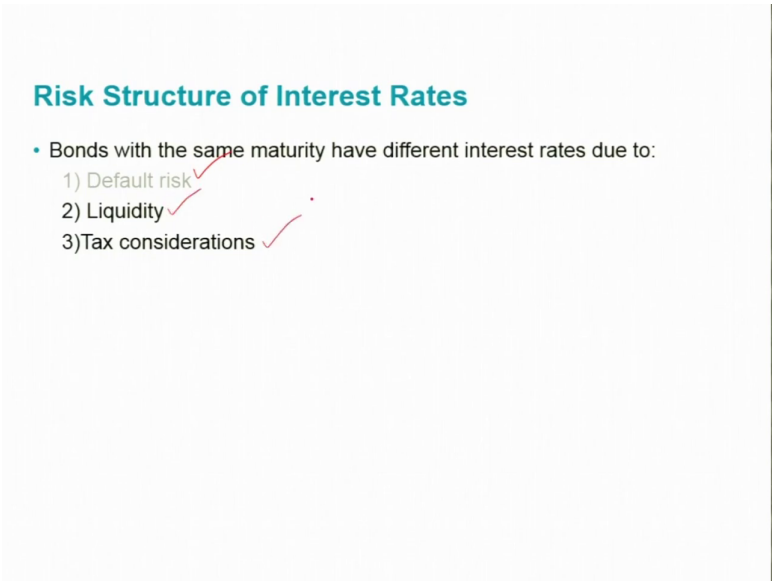

We have so far discussed one aspect of the risk structure of interest rates, that one is the default risk. Let us now discuss the remaining two, one is the liquidity aspects, the third one is tax consideration, means income tax considerations.

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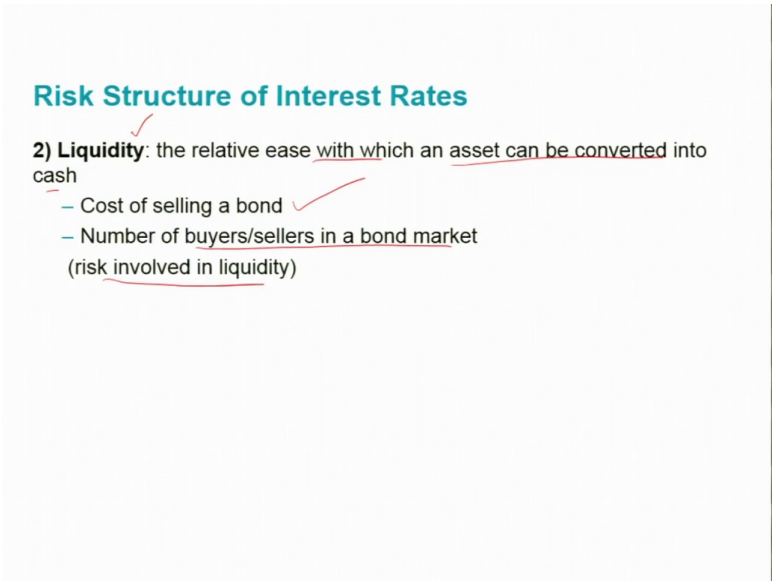

About the liquidity aspects: liquidity is the relative ease with which an asset can be converted into cash very easily, without loss of time and value.

The loss of value includes the cost of selling a bond. Suppose the brokerage is very high, for example, even whether you are looking at the fixed cost and the variable cost involved in selling cost of the bond, if it is very high you the liquidity is very low, right. So, that means, liquidity of the bond is very low when the cost of selling of a bond is very high.

Similarly, the number of buyers and sellers in a bond market also matter. That means, if the market consists of large number of buyers and sellers; means, it is a well-developed and a large market. And if you want to sell your bonds in this large market, you can easily sell your bond whenever you want. When the market is well developed, the liquid of the bond increases.

If the bond market is well developed, the companies, the corporations, firms which borrow from the market they can very easily sell their bond. That means if the cost of selling of the bond is very low and there are large number of buyers and sellers in the market, the liquidity is very high.

When the liquidity is very high then you can see that the interest rate that they must give to supply their bonds is very low as compared to less liquid bond market. To summarize, higher the liquidity of the bond the lower the rate of interest that the supplier of bonds have to pay.

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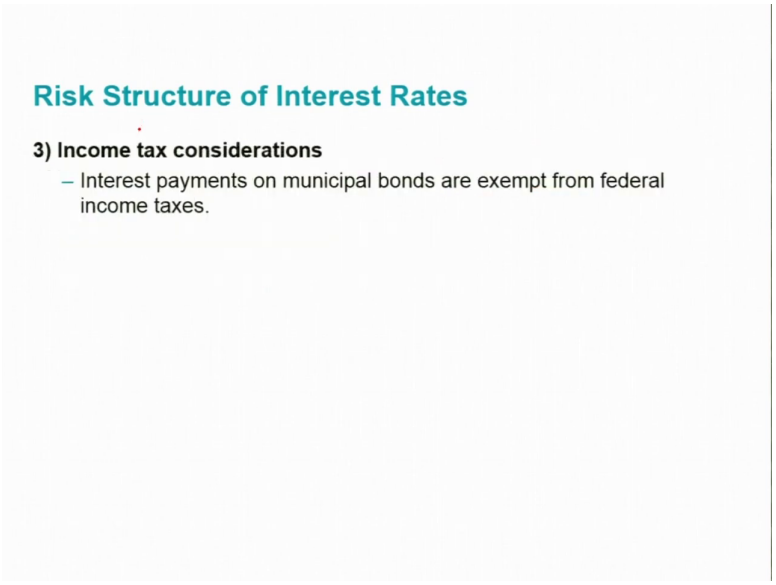

The third aspect is the income tax considerations; the income tax that the holders of the bonds must pay on the interest income. You can see that the interest payments of the municipal bonds in the US are exempt from federal income taxes.

It means, whoever is holding the municipal bonds, they do not need to pay income tax on the interest income received from these bonds.

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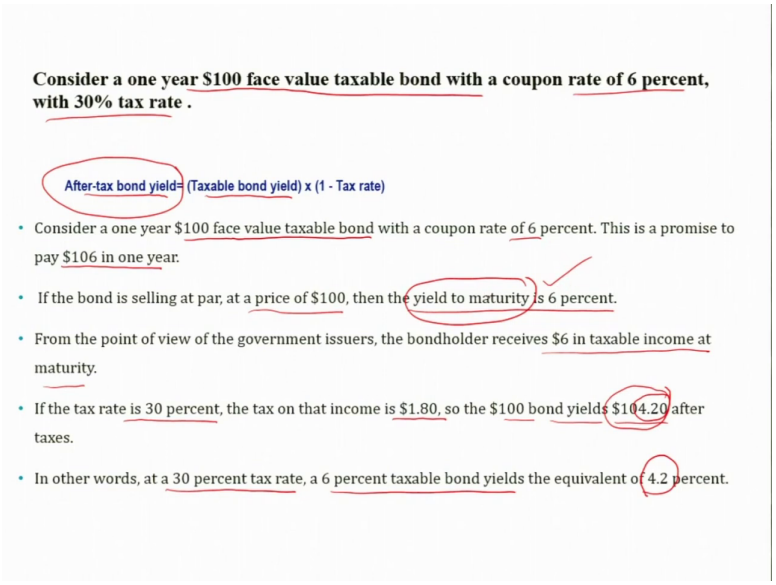

Look here, for example, consider a one year 100 face value taxable bond with a coupon rate of 6 percentage with a 30-percentage tax rate.

Here is the after-tax bond yield. The bond yield means the after-tax bond yield which is the actual bond yields that the investors are looking for. What is the actual bond yield? The after-tax bond yield is the taxable bond yield times 1 minus tax rate. Considering a one year 100 face value taxable bond within coupon rate of 6 percentage, you can see that this is a promise to pay 106 in 1 year by the supplier of this bond.

So, if the bond is selling at par at a price of 100, for example, suppose the selling price of the bond is equal to the face value of the bond, then the yield to maturity is 6 percentage; it means, the interest rate is 6 percentage. From the point of view of the government who is the issuer the bondholder will pay dollar 6 in taxable income at maturity.

If the tax rate is 30 percentage, you can see that the tax on that income is dollar 1.8, so that the 100-dollar bond yields 4.20 after the tax. So, this is the actual receipt, right.

In other words, at a 30 percent tax rate, a 6 percentage taxable bonds yield equivalent of 4.2. It means, only 4.2 percentage. So, the promised interest rate is 6 percentage that is the yield to maturity when we calculate here, but the actual yield, that is the after-tax bond yield, is 4.2 percentage.

What is the implication of it? Because as we mentioned here the holders of the bond, that is the investors are looking for the actual yield to maturity, not just at this coupon, this yield to maturity, which we have shown here. In fact, they will be looking at this one. It means, it has implication in the bond market, suppose government announce an increase in tax for a particular bond, for example, municipal bond or if there is a tax cut.

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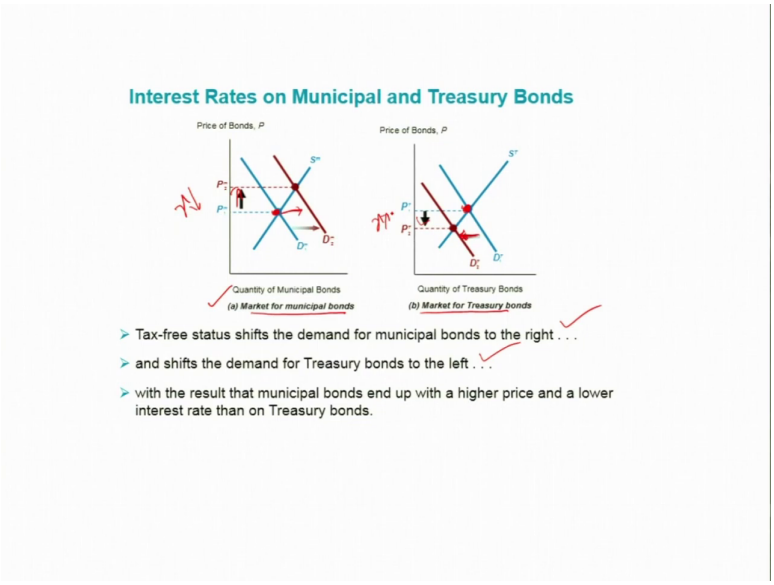

Look at this. What if government makes one of the bonds tax free? In this diagram, you can see that, in the panel A, it shows market for municipal bond and panel B shows the market for treasury bond. Suppose the initial equilibrium position is here and you can see that, the P* and this is the demand and supply in the case of municipal bond, and the initial equilibrium condition in the market for treasury bond is at this point.

Now, look at the change the government announce. Suppose there is a tax-free status, that is when the municipal bond gets the tax-free status, you can see that the demand for municipal bond shift to the right, right. So, there will be more demand for municipal bonds.

And as you had already studied, when there is an increase in the demand for a particular bond its price increases. Obviously, you also know that because of the demand and supply condition, its interest rate start declining.

Because the government is giving tax free, it will be reflected in the demand condition. There is an increase in demand, the price increases and the interest rate on municipal bonds start declining. This will also make impact because the tax cut for the municipal bond is going to make an impact on the market for treasury bonds as well. You know that now people will be demanding more municipal bonds. So, that means, the demand for treasury bonds starts declining.

You can see that when the demand for treasury bonds declines, then obviously, you know that the price also start declining. So, when the price start declining, it means, the rate of interest increases.

You know the reasons. There is shift in the demand curve, people started demanding more municipal bond, thus, the quantity demanded in the municipal bond market increases. Whereas the demand for treasury bonds declines. So, what you can see here the demand for municipal bond shift to the right and the demand for treasury bonds shift to the left. So, as a result, what you can see that the interest rate for a municipal bond start decreasing.

Finally, the market moves into a new equilibrium where the new interest rate will be established, separately for municipal bonds and for treasury bonds. The income tax announcement the tax cuts (tax-free status) make changes in the prices and interest rate in both markets, the market for municipal bonds and market for treasury bonds.

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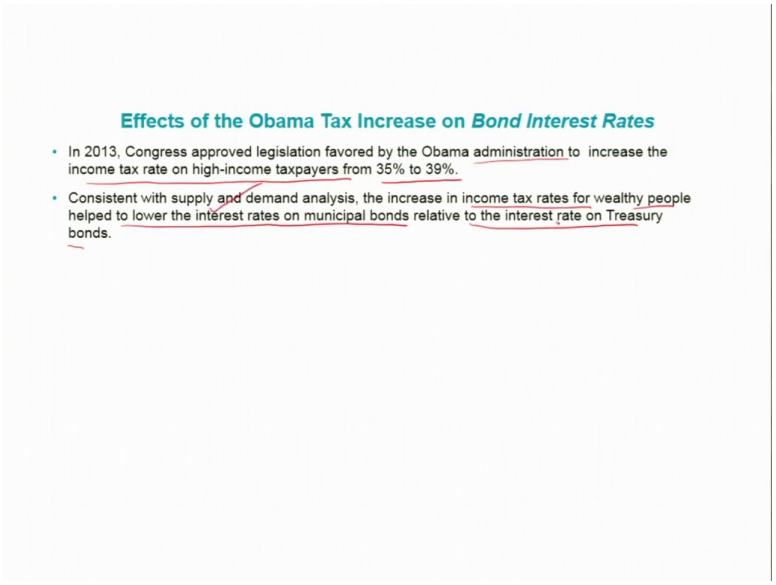

Let us now look at the effects of Obama tax increase on bond interest rate in 2013. The Congress approved legislation favored by Obama administration to increase income tax on high income taxpayers from 35 percentage to 39 percentage. So, what are the likely impact? You know that when government is going to increase income tax rate on high income taxpayers.

What is the likely impact? Based on our previous discussion, we can see that, consistent with supply and demand analysis the increase in income tax rates for wealthy people help to lower the interest rates on municipal bonds relative to the interest rate on treasury bonds.

The reason is that when income tax is increased, there will be increase in the demand for municipal bonds because people will be investing their income on municipal bonds, their demand will be increasing. And as a result, the interest rate for municipal bonds will be declining as compared to the treasury bonds.

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In the case of India, there are some government bonds that are tax free. I would suggest you visit this website to get more information. And the bonds issue, for example, bonds issued by rural electrification corporations in India and the national highways authority of India, both are tax free bonds in India.

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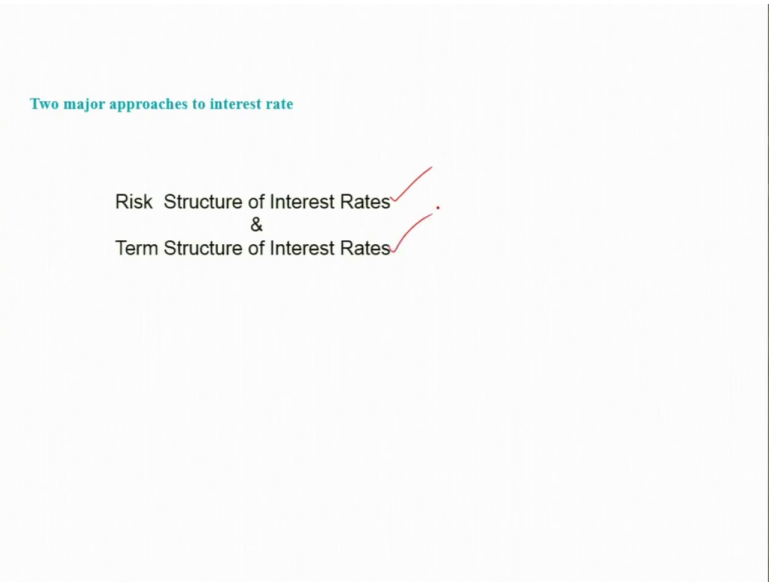

Let us now move to our next topic: the term structure of interest rate.

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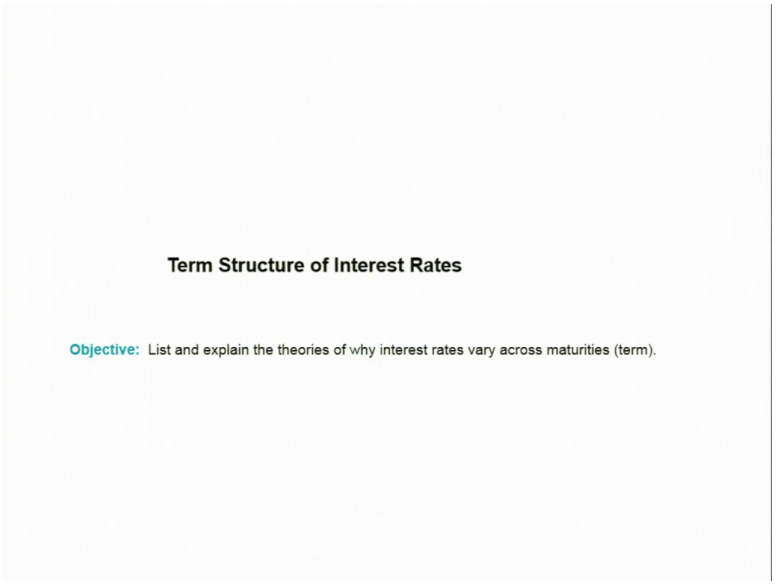

The objective here is to list and explain the theories of why interest rates vary across maturities. Maturities means term.

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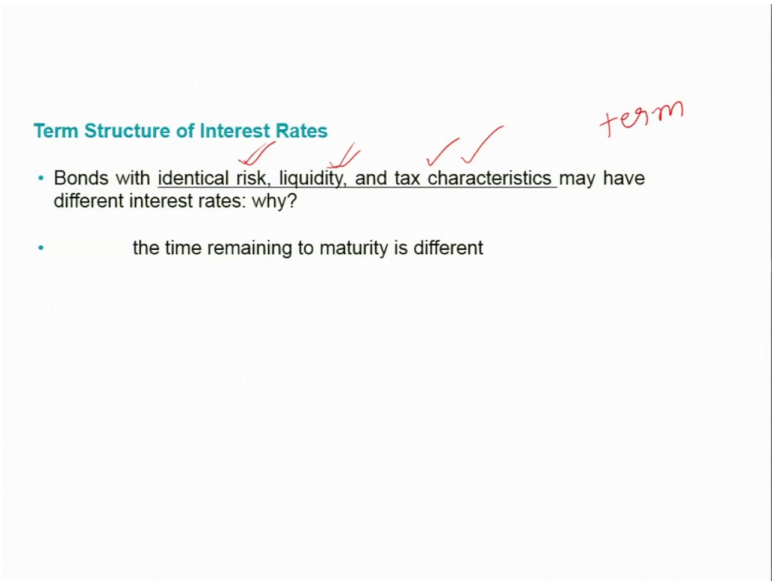

To set the stage, let us see what the main issue is here. The bonds with identical risk, liquidity and tax characteristics may have different interest rates, why?

Let us for example, look at US government bonds between short term and the long term. The difference between short term and long term is the term; you can see the commonality that

they have identical risk, liquidity, and tax considerations, because both are issued by the US government treasury.

You can see that both are having identical risk, liquidity, and tax characteristics, but you can see that, in general, the long-term bonds are having high interest rate as compared to short term treasury bills. So, the only difference here is, only the term that the maturity period- the short term and long term-, all other things are common. So, then our question is that when the difference is only in the maturity (term), then why such a difference in interest rate.

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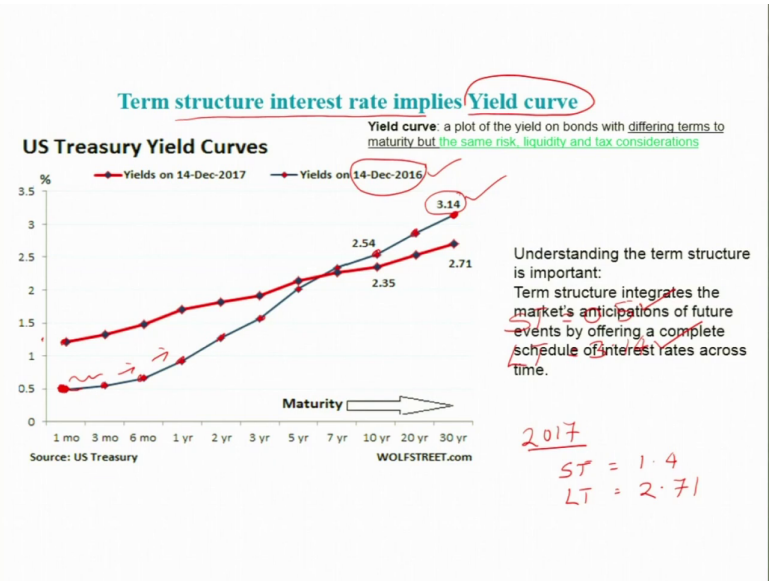

To explain this, let us introduce the concept called yield curve. So, it can better understand using the term called yield curve. What is yield curve? Yield curve is a plot of the yield on bonds yield, means the interest rates, with a differing term to maturity, but with the same risk, liquidity, and tax considerations.

From this figure, you can see that there are two yield curves. For example, the yield curve 1, this yield curve that is plotted in 2016. So, for instance on 14th December 2016, that is, on a particular day, what are the market rate of interest for different debt instrument issued by the US government.

It means, the difference here is only the period: the term. All other things are same, same risk, liquidity, and tax consideration, and is issued by the federal government. One is for example,

one debt instrument is for 1 month, another is for 3 months, 6-month, 1 year like that, 2 year, 3 year like that, 10 year, 20 years, 30 years. So, this is one yield curve.

It means, we measure we plot this yield curve based on the marker rate of interest for the bonds issue for different terms or different maturities. So, what you can see from here that there is difference in interest rate for different maturities. So, here for example, 1 month the rate of interest is 0.5 percentage and for at the same time you can see that a bond for 30-year term- 30-year maturity period- the interest rate is you can see 3.14 percentage.

So, look at for example, short term bond, you can see that the rate of interest is 0.5. At the same time, long term bond the rate of interest is 3.14 percentage from this yield curve. Similarly, exactly after 1 year when we measure again, perhaps socio-economic and political conditions are different, after 2 years, you can see that on that day when we plot an yield curve. What is the interest rate? You can see that the interest rate for a 1-month treasury bill is somewhere 1.4.

After 1 year, you can see that, in year 2017 you can see that short-term, this is traded at 1.4 and at the same time the long-term bonds, this one, is traded at 2.71. What have we shown here? We have shown two different yield curves. So, our focus for the moment is just to interpret one yield curve and to see why there is differences in interest rate over time for different maturities.

Just for example, why this is only 0.5 whereas, this one is 3.14. So, this is the focus of our discussion. It explains the differences in interest rates for bonds with different terms to maturity, but the same risk liquidity and tax concentration. Understanding the term structure is very important because term structure integrates the markets anticipation of future events by offering a complete schedule of interest rates across time.

Looking at this yield curve, you can see that, say suppose this one, this yield curve where the transaction was happening on 14th December 2016. On that day, the investors (the demander of bonds) and as well as the suppliers of bonds, on the given economic condition as well as the future economic conditions, they make the transaction at this agreed rate of interest, which the market rate of interest for different maturities on that day.

In the yield curve, not only includes the rate of interest for short term (1 month), but you can also see that the annual rate of interest for a 30-year bond is 3.14, that is the forecast they are

making for the next 30 years. So, this term structure, it integrates markets anticipation of future events by offering a complete schedule of interest rates across time. That is the present conditions as well as the future conditions of the economy, all these will be reflected in the yield curve.

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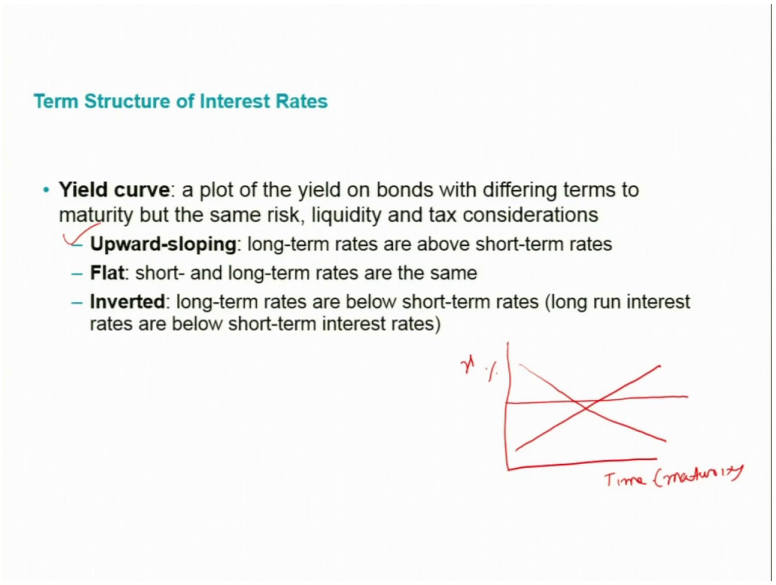

The yield curve is a plot of the yield on the bonds with the different terms to maturity and there are 3 broad categories of yield curve.

One is called upward sloping; in the case of upward sloping, you can see that long term rates are above the short-term interest rate. In this case, you can see that a yield curve would like this. This is the maturity. This is the rate of interest, right, yield to maturity, yield and this is upward sloping.

Another one is the flat curve; that means, short term and long-term rates are same. The third category is inverted yield curve, where the long term rates are below the short term rates.

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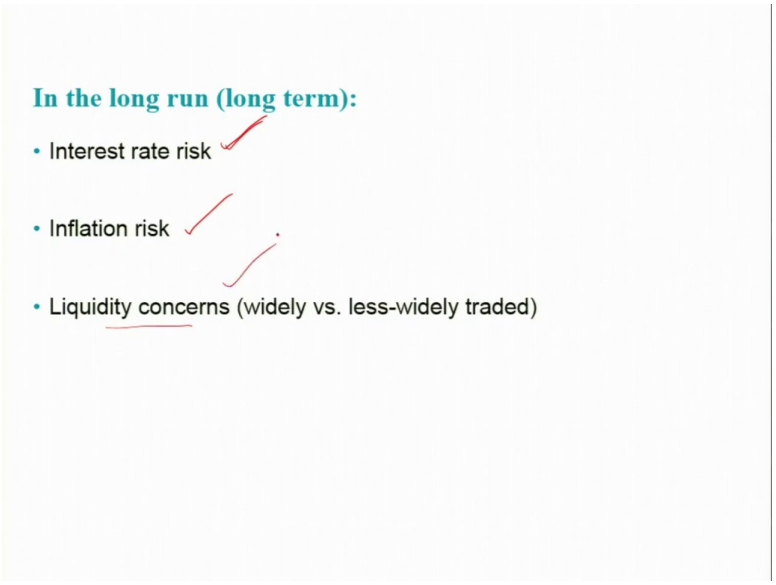

Here, we are making a comparison between short term, medium term and long term; that means, different maturities or different terms.

What is the difference between short term, and long term? In the long term, you can see that there is interest rate risk. The interest rate may increase or decrease in the future. There is uncertainty regarding interest rate. We can see that there is interest rate risk in the long term, uncertainty regarding interest rate that is one So, it is very difficult to forecast what is going to happen after 5 years 10 years 20 years and 30 years, so on, many things would happen in an economy.

In the long run, some other kinds of risk may come up, that is associated with the political and economic conditions.

And second one is inflation risk, inflation may increase, there may be an increase in inflation in the future. You can see that, the investors they are looking for real return. The holders of bonds, they are looking for real yield or actual yield adjusted for inflation. If they expect that inflation is going to increase in the future, they want a high interest rate in the future for the long-term lending.

And similarly, another aspect that makes long run different from the short run is that liquidity concerns. So, in the long run, as you can see, the liquidity of long-term bonds will be relatively less as compared to short run because the maturity period. The 10 years, 20 years

and 30 years are a very long period. The liquidity of these bonds will be less of the long maturity period. You know that the issuer of the bond will redeem or repay the bond amount only after the maturity date. As a result, the liquidity of long-term bonds will be less as compared to short term bonds.

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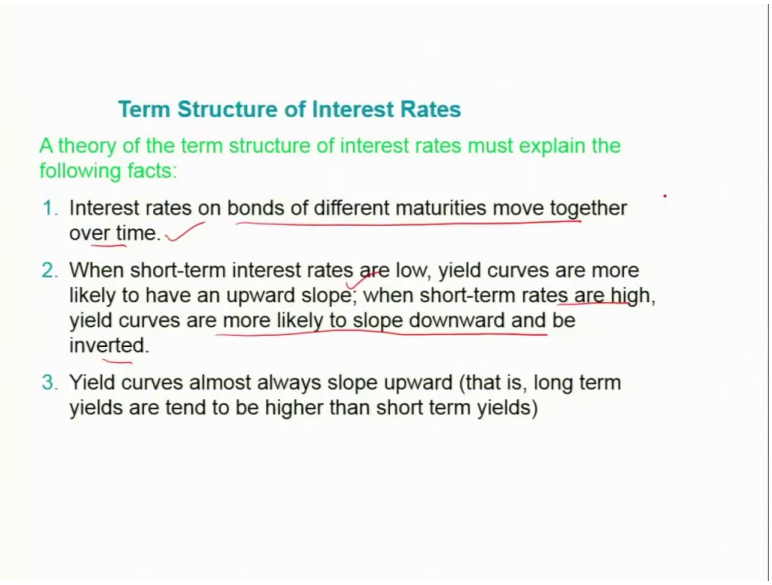

When we develop a term structure of interest rates, we set some conditions here; that means, a theory of the term structure of interest rate must explain the following facts. One is that the interest rates on bonds of different maturities move together over time. We have seen in one of the previous sessions that that interest rates on bonds of different maturities move together over time.

And second one is when short term interest rates interest rates are low, yield curves are more likely to have an upward slope. Similarly, when short term rates are high, yield curves are more likely to slope downward and be inverted.

And third and finally, yield curves almost always slope upward; that means, in normal condition, in normal economic condition, yield curves almost always slope upward; that is long term yields tend to be higher than the short-term yields.

So, when we discuss some theories of term structure of interest rate, the theories should explain all these factors, then we can say that they robust theory or theories of term structure of interest rates.

In the next session, we will discuss various theories associated with term structure of interest rates.

Thank you.

Key words: term structure, yield curve, short-term, long-term, interest rate risk, inflation risk, liquidity, upward sloping, downward sloping