

**Financial Institutions and Markets**  
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**Lecture – 14**  
**Term Structure Theories of Interest Rate - II**

So, in the previous class we discussed about the pure expectations theory which tells that the long-term yield or long-term interest rate is nothing, but arithmetic and geometric mean of the current spot rate and the forward rates. And, after that already I have shown you that we have other theories which also explain this concept of term structure interest rate, and one of them the most prominent theory is also the liquidity preference theory.

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**Liquidity Preference Theory**

- LPT can be thought of as an extension of the Pure Expectations Theory
- PET does not consider risk (i.e., it assumes a risk neutral world)
- Long-term bonds are more price sensitive to interest rate changes than short-term bonds. As a result, the prices of long-term securities tend to be more volatile and therefore more risky than short-term securities
- The **Liquidity Premium Theory** (LPT), also referred to as the **Risk Premium Theory** (RPT), posits that there is a liquidity premium for long-term bonds over short-term bonds

And you can observe that the liquidity preference theory is or can be thought of an extension of the pure expectations theory. Why you say that this is an extension of the pure expectation theory? Because, whenever we are explaining the expectations theory we are assuming that there is a risk neutral world, and people are not much concerned about the uncertainty what they are going to prevail or going to avail in the particular system. But, whenever we talk about the LPT or the Liquidity Preference Theory, liquidity preference theory tries to include that what is the role of risk, whenever we are investing in the different financial securities including bond.

In that context because, in general the long-term bonds are more risky in comparison to the short-term bonds. Then we should expect that the return from the long-term bond should be higher or the yield from long-term bond should be higher because, we expect premium out of this. Because, we are going to take more risk which may prevail in the future and to compensate that risk some amount of return should be awarded. An extra should be awarded in comparison to the short-term bonds which are available in the financial system.

So therefore, the liquidity preference theory consider risk whenever they calculate the long-term yield or long-term interest rate in the bond market. Then another thing you might have observed that here if you see the long-term bonds are more price sensitive to interest rate changes than the short-term bonds. That means, if I tell you that 1 bonds maturity period is 5 years and another bonds maturity period is 12 years. Whenever, there is a change in interest rate, you will find that the price change for the 5 year bond and the price change from the 12 year bond; if you compare then the sensitivity of the 12 year bond will be more than the sensitivity of the 5 years bond. So, you know what is the bond price already we known that, it is basically nothing, but this  $C_f / (1 + r)^t$ .

So, here if you discount it with respect to a discount rate you will find whenever this  $r$  changes; if the maturity period is less than the sensitivity of the price with respect to the original price is less for a shorter maturity bond than the longer maturity bond. So therefore, we can say that the price sensitivity to interest rate changes is more for a long-term bond than the short-term bond. As a result the prices of long-term securities tend to be more volatile and therefore, more risky than this short-term securities. Because, the interest rate sensitivity towards the long-term bond is more than the interest rate sensitivity towards the short-term bond.

That is, if there is a change in interest rate whether it is in the upper side or in the lower side, whatever price fluctuations we can get it from that particular bond; you will observe that the price change for a long-term bond is more than the price change for short-term bond. That is why the sensitivity is more and if the sensitivity is more than obviously we can say that the volatile; this particular bond price is more volatile. And therefore, the risk is more. And, to compensate that risk some kind of premium should be given or the yield from that particular bond should be more than the short-term bonds that, is what the basic physical argument behind the liquidity preference theory.

So, that is why the other name of liquidity preference theory is the risk premium theory, because we are providing certain premium or because the long-term bonds are more risky than the short-term bond; we are giving certain premium against that because of the risk aspect. So, that is also consider as the risk premium theory, which says that there is a liquidity premium for long-term bonds over the short-term bonds whether you can call it liquidity premium or the risk premium. But, the premium are given because the particular bonds exposure towards the risk is more than the short-term bond. The risk exposure for the long-term bonds is more than the short-term bonds, that is what basically the basic theme of the liquidity preference theory.

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**Liquidity Preference Theory Cont...**

The premium is over and above the average of the current and expected short rates. Thus, this theory implies the existence of the upward sloping yield curve more often than not. The liquidity premium theory is represented as follows:

$$(1 + R_N^t) = [(1 + R_1^t)(1 + r_{1t}^{t+1} + L_2) \dots \dots \dots (1 + r_{1t}^{t+N-1} + L_N)]^{1/N}$$

*Handwritten notes:*  
 Interest Premium = discount rate  
 L represents the liquidity premium

L represents the liquidity premium and it is expected to increase with maturity as the volatility increases with maturity.

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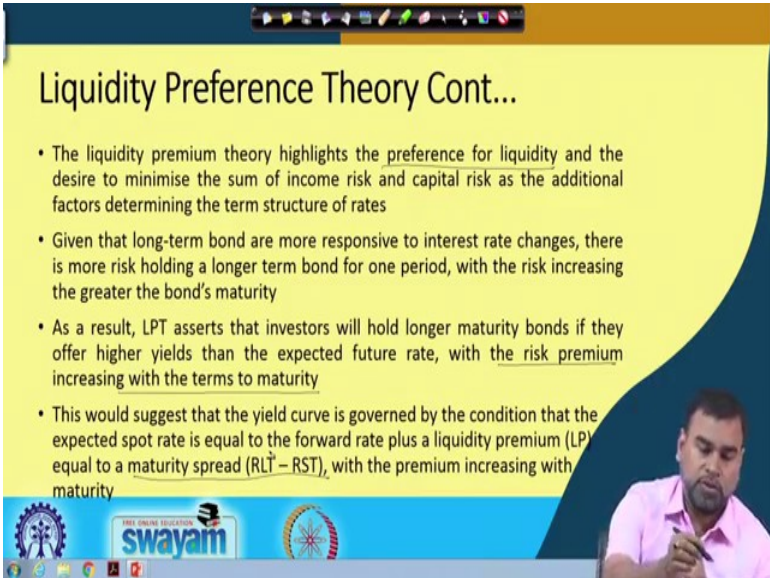
Then how basically it works? Here, what we are trying to say, if you go back to our previous calculations of the pure expectation theory; the premium is over and above the average of the current and net expected short-term rates. Just now we are talking that according to expectation theory, the long-term rate is nothing, but the average of the current spot rate and forward rates.

But, here it is telling that according to liquidity preference theory we have to add some premium into that. So therefore, whatever average we are calculating: the average plus premium basically will give you the interest rate for the long term interest rate; that is what basically the liquidity preference theory is trying to explain. Therefore, there is always existence of the upward sloping yield curve than the others shape of the yield

curve that always we see. So that means, once you are adding a premium into that what we can guess from this. Because there is establishment of the premium and some risk premiums are given to that, we can say that always the return or the yield from a long-term bond is more than the short-term bond.

So, here if you observe this  $L_N$  which is nothing but the liquidity premium. This is your liquidity premium which has been added to whatever interest rates we have calculated by using the expectation theory. So, here liquid you can assume that the liquidity premium and it is expected to increase with maturity as the volatility increases with maturity. So, more this term to maturity more will be the premium because, already we have argued that the long-term bond price volatility is always more than price volatility of short-term bonds. So, this is what the basic concept or basic notion of the liquidity preference theory.

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### Liquidity Preference Theory Cont...

- The liquidity premium theory highlights the preference for liquidity and the desire to minimise the sum of income risk and capital risk as the additional factors determining the term structure of rates
- Given that long-term bond are more responsive to interest rate changes, there is more risk holding a longer term bond for one period, with the risk increasing the greater the bond's maturity
- As a result, LPT asserts that investors will hold longer maturity bonds if they offer higher yields than the expected future rate, with the risk premium increasing with the terms to maturity
- This would suggest that the yield curve is governed by the condition that the expected spot rate is equal to the forward rate plus a liquidity premium (LP) equal to a maturity spread ( $RLT - RST$ ), with the premium increasing with maturity

Then we can move into this what basically the central theme of this. So, the liquidity premium highlights the preference for liquidity and it highlights the preference for liquidity and the desire to minimize the sum of income risk and capital risk as the additional factors determining the term structure of interest rates.

Because, you see whenever we are talking about the bond, the bond can have some other type of risk also because, the bond can give the coupon, but there must be sometimes also the income may be generated, whether may be some kind of default. So, that risk is involved in that. So, capital risk means in the end of the period whenever I or any

investor wants to or bondholder wants to sell the bond, what kind of interest rate scenario exist in the market; whether the price of the bond will be higher or the price of the bond will be low.

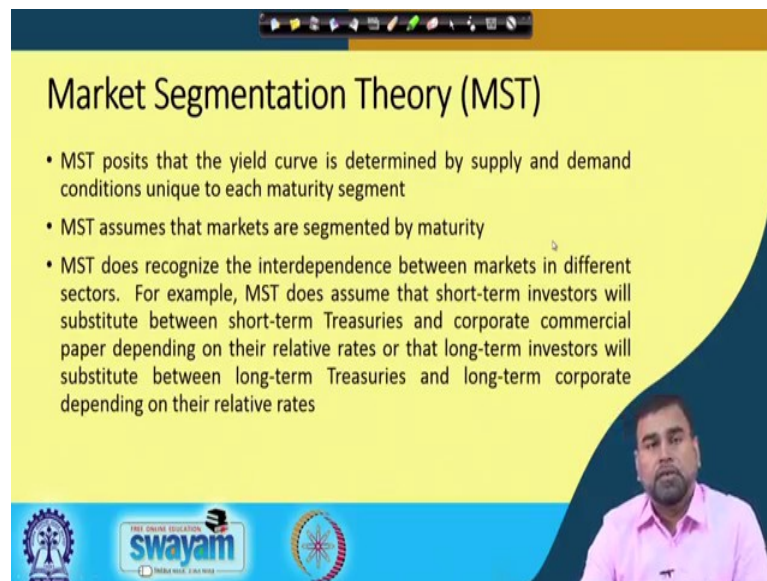
So, all kind of risk is involved into that. So, because of that from the beginning what the investor always expects that I should get more return, more yield from the long-term bond which can be reinvested in the market at appropriate time to compensate my risk what I am going to face in the future. So, because of that always the long-term bonds gives more returns than the short-term bond as for the liquidity preference theory. So, already we have explained this, given that the long-term bonds are more responsive to interest rate changes. There is more risk holding a long-term bond for one period, with the risk increasing greater the bonds maturity.

So, the risk premium always increases with the term to maturity that basically we have seen, the risk premium increasing with the term to maturity. So, then how much and what kind of return we can expect from this. So, this would suggest that the yield curve is governed by the condition that expected spot rate is equal to the forward rate plus a liquidity premium. So therefore, we are adding that it is the average of the current spot rate and forward rate, but now you are saying that it is the average of current spot rate, the forward rate and the liquidity premium. And, how this premium is calculated this is basically calculated as the maturity spread. It is the return from the long-term bond minus the return from the short-term bond which is called the maturity spread, with the premium increasing with the maturity.

So, always we say that the premium is positive and the premium increases with the maturity period or the maturity of the bonds which are existing in the market. So that means, it is very clear the liquidity premium theory tells that whatever return or whatever interest rate we can calculate from the expectation theory; we have to add the liquidity premium into that. And, why we are giving that liquidity premium because, we are taking more risk whenever we are investing in a long-term bond, because the long-term bond is more risky. Why it is more risky? Because if there is a change in interest rate, the price volatility of the long-term bond is always more than the price volatility of the short-term bond.

So, keeping that thing in the mind what we are trying to say that the interest rate from a long-term bonds should be higher than the short-term bond. And obviously, therefore, the yield curve should be upward sloping and also positive; that is what basically what we can conclude through this liquidity preference theory which is as per the pure expectation theory.

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### Market Segmentation Theory (MST)

- MST posits that the yield curve is determined by supply and demand conditions unique to each maturity segment
- MST assumes that markets are segmented by maturity
- MST does recognize the interdependence between markets in different sectors. For example, MST does assume that short-term investors will substitute between short-term Treasuries and corporate commercial paper depending on their relative rates or that long-term investors will substitute between long-term Treasuries and long-term corporate depending on their relative rates

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Then we have another theory which explain the term structure interest rate, which is basically your market segmentation theory. It is a very interesting theory. What exactly the market segmentation theory is, market segmentation theory is mostly driven by the requirements or the psychological biases or psychological preferences of the investor towards a particular segment of the particular market. What exactly it means? It means that the markets are segmented on the basis of the maturity.

So, according to market segmentation theory the yield curve is determined by supply and demand conditions which are unique to that particular maturity segment. How much demand is there for that particular short-term bond and how much supply is there for that short-term bond, that determines the interest rate of the return in the short-term bond market. And, whatever demand and supply is there for the long-term bond that will decide the interest rate in the long-term bond market.

So, in this context what we are trying to say the bond market is segmented and the preference of the investor is always there or always fixed towards a particular segment.

And, this preference arises on the basis of their requirement, on the basis of their necessity. If anybody is interested to invest in the short-term bond they will stick to the short-term bond, because they need money in the short-term period of time. And, if anybody interested to invest in the long-term bond they will stick to the long-term bond market segment, because the investment they want to make it because they need money of the requirement is for the long period.

So, that is what basically the basic theme or basic logic of the market segmentation theory. So, that is why the market segmentation theory recognizes the interdependence within markets in different sectors. That means, it assumes that short-term investors will substitute between short-term bonds; whatever short-term availability is the short-term instruments are available in that particular segment. And, the long-term investors will substitute between the long-term assets or long-term bonds which are available in that segment; whether they will invest in the long-term treasury bills or long-term corporate bonds wherever or, long-term government securities wherever means whatever bond they want to prefer they want to prefer within that maturity segment.

The long-term bond investor will not move into the short-term segment and the short-term investors will not come into the long-term segment. So, there is a pure demarcation, there is some kind of segmentation already it is available. And, the interest rate of that particular bond is decided by the demand and supply of that particular bond within that particular segment; that means, the aggregate demand and supply of the bonds is not considered for determination of the interest rate. So, because of that there is a change in the interest rate between the short-term and long-term bonds.



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### Market Segmentation Theory Cont...

**Short-Term Market**

- Supply of short-term corporate bonds depends on business demand for short-term assets such as inventories, accounts receivables, and the like
- Demand for short-term corporate bonds comes investors looking to invest their excess cash for short periods
- The demand for short-term bonds by investors and the supply of such bonds by corporations ultimately determine the rate on short-term corporate bonds

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Then if you see that whenever you talk about the short-term market, the supply of the short-term corporate bonds depends upon some of the factors like business demand for short-term assets such as inventories, account receivables etcetera that already know. Then why the demand for a short-term bond, because they want to basically fulfill the short-term obligations; the short-term obligations includes accounts receivables, inventories etcetera, etcetera.


So, to fulfill the requirement they can issue the short-term bond, when the demand for short-term corporate bonds comes, investors looking into their investor excess cash for the short period. Who invest in the short-term bond? This demand for short-term supply is coming from the business side, who wants to issue certain bonds because they want to fulfill their short-term obligations. Then who demands long-term bonds? The bondholder who needs certain kind of return in the short period of time, they basically demanding short-term bonds.

So, then the demand and supply basically works in this direction within that particular segment and the demand for short-term bonds by investor and supply of the short-term bonds by corporations or the companies ultimately determine the rate on the short-term corporate bonds. So therefore, the demand and supply here we are not concerned about that how many investors or how many issuers are issuing the long-term bond. We have only confined ourselves the particular investors who are issuing the short-term bond.



And, a particular issuer who are issuing the short-term bond and particular investor who want to invest in the short-term bond. They invest from an investor point of view, this is coming from the demand side and from the corporate or business point of view this is coming from the supply side. So, that interaction will decide the interest rate of that particular short-term bond in that particular segment.

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**Market Segmentation Theory Cont...**

**Long-Term Market**

- Supply of long-term bonds comes from corporations trying to finance their long-term assets (plant expansion, equipment purchases, acquisitions, etc.)
- Demand for such bonds comes from investors, either directly or indirectly through institutions (e.g., pension funds, mutual funds, insurance companies, etc.), who have long-term liabilities and horizons
- The demand for long-term bonds by investors and the supply of such bonds by corporations ultimately determine the rate on long-term corporate bonds

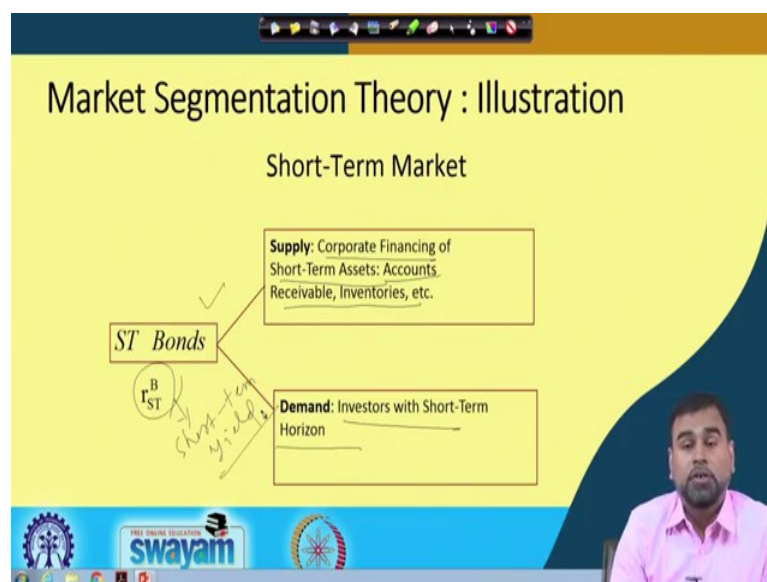
Then whenever we talk about the long-term market why this, there is a supply of the long-term bonds, because the company can need the issuance of the long-term bond. Because of the plant expansion, equipment purchase, acquisitions etcetera, etcetera so, which is basically longer term in nature; they need cash or they need money for this, that is why the issue the long-term bonds in that particular point of time with that period relatively more longer, more than 5 years, 10 years, 15 years like this. And, who basically is interested to invest in that type of bond? This is basically mostly the financial institutions like pension funds, mutual funds, insurance companies they want to invest in the long-term bonds.

Because, they have the long-term liabilities or longer term liabilities and the horizon period is also long. They want to match between assets and liabilities in the long-term and because of that the investments made by these kind of financial institutions or these kind of investors is always there for the long-term bonds. So, if they prefer to invest in the long-term bond and company wants to issue the long-term bonds because, they need

finance, they need to finance their fixed assets or fixed project like plant expansion, equipment, buying equipment, acquisitions etcetera.

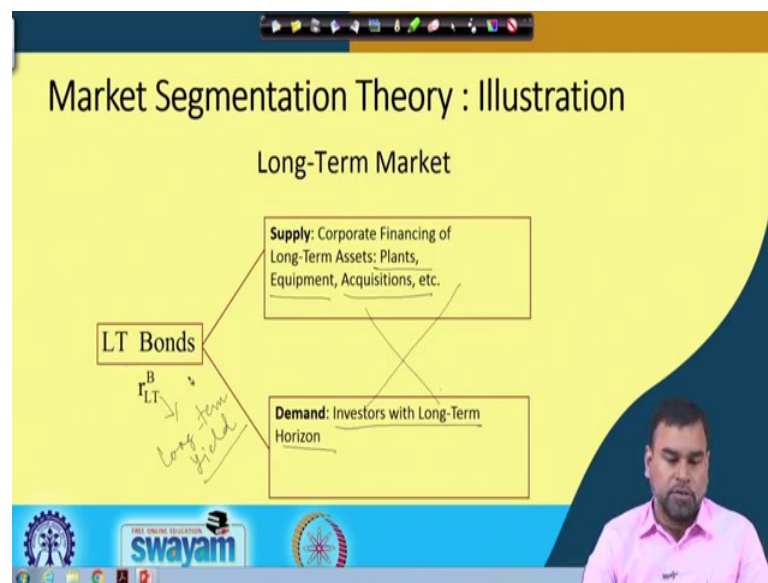
So, then that demand and supply decides the long-term interest rate in that particular segment, that mean the long-term investor does not come to the short-term segment; the short-term investor also does not go to the long-term segment. So, the demands supply forces comes from the requirements of the both demand from the business point of view or from the investor point of view within that segment itself. Therefore, there is no such kind of integration which takes place between these two. And they always try to maintain their positions in that particular segment only. So, then we have if you see that how this mechanism basically works.

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This mechanism works in this case this is your short-term bond and this is your supply side which is coming from the account receivables, inventories etcetera; corporate financing of the short-term asset, and investor with short-term horizon who needs money within a short span of time. So, this interaction supply and demand will decide the  $r_{ST}^B$  means the short-term yield. This is your short-term yield. So, this is the way the market works in the short-term market or the short-term bond market.

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So, like that if you summarize the long-term part, the long-term basically works in this direction. Here the longer supply is coming for because, the company need money for establishing new plants, buying major equipments, going for acquisitions, etcetera, etcetera. And, the investor who needs money for the long-term period they want to invest for a long time horizon.

So, the interaction between these two will decide this is what basically your long-term yield. So finally, the yield of the long-term bond can be decided. So, the market segmentation theory explains basically the interaction between the short-term and long-term bond. So, in the context they are trying to say that there is no such kind of spilling which takes place between the two different segments. So, the demand and supply forces of one particular segment decides that what should be the interest rate in that particular market.

So, if the supply and demand works in a particular segment then the interest rate can be determined in that particular segment and the market is confined to that particular segment in that particular point of time. So therefore, depending upon the demand and supply; obviously, the interest rates in two segments basically vary. So therefore, here if you see that what it is trying to say that there is no such kind of relationship between the long-term and short-term because, the markets are highly segmented. But, the question here is that; obviously, the investor who wants to invest for a long period of time, then

demand and supply of that long-term bonds or long-term securities is always there for that particular investor.

But, this is relatively risky investments. Why it is risky? Because, already we know that the future is uncertain, the macroeconomic fundamentals may change. If the macroeconomic fundamentals will change then automatically what will happen, it will have the impact on the yield of the different type of bonds which are existing in the system.

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**Market Segmentation Theory Cont...**

- Important to MST is the idea of unique or independent markets.
- According to MST, the short-term bond market is unaffected by rates determined in the intermediate or long-term markets, and vice versa
- Independence assumption is based on the premise that investors and borrowers have a strong need to match the maturities of their assets and liabilities

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So, because of that what we can assume that; obviously, the return from the long-term bonds market will be more than the returns from the short-term bond market. Even if the market is segmented so, the interest rate can be more in the long-term segment than the short-term segment. So, that is why just now I was telling you the short-term bond market is unaffected by the rates determined in the intermediate or the long-term market.

So, here you see that this independence assumption is based on the premise, that investors and borrowers have a strong need to match the maturities of their assets and liabilities. You see whenever we are investing in a particular segment, what this investor is trying to do? The investor is trying to match this assets and liabilities whatever they have to minimize the risk. So for example, if somebody wants to invest in a short period of time the reason is; they need money for their liability. And, they want to create the asset within that short period of time to compensate that particular liability, then the asset

and liabilities should be perfectly matched. So, it is always assumed that if anybody believes in the market segmentation theory, that within that segment on the basis of the requirements of the investors the assets and liabilities are perfectly matched. So, once it is perfectly matched they can haze out the risk from their particular investment.

So, it is very important that whenever the investor invest in that particular segment for whatever way or whatever objective they have to manage the risk; whether the asset and liability management is properly taking place or not, whether the asset and liabilities are matched within that particular segment or not. If it is matched and then there is the requirement fulfilled by the investor and; obviously, the investment horizon period can be confined into that segment. But for some example, if the asset and liabilities are not matched then investor are exposed to more risk.

And, that segment may not be good enough to fulfill their requirements. So, because of that again the problem can arise or the equilibrium may not establish in that particular segment. And finally, what will happen that we can say that the yield or the return which is determined in that segment may not be a actual price of that particular security. Or, equilibrium price of that particular security on that particular point of time. So, total disconnect between the long-term rate and short-term rate is a kind of extreme theoretical justification which is given by the market segmentation theory, which basically relies upon the assumptions that the short-term investor will not go to the long-term segment.

And, the long-term investors will not go to the short-term segment which may not be in the practical sense is acceptable. The reason is basically what? Those kind of mismatch of asset and liabilities always there in that particular segment and to overcome that some kind of spilling over may possible. But, still this particular theory is trying to answer the, or trying to analyze the supply and demand forces of the different segments differently. And, try to determine the interest rate in such a way by that the equilibrium can be established and the interest rate what is prevailed in that particular segment, it is also the equilibrium rate.

And, there is a difference between the long-term rate and short-term rate because of the investors preferences. And, according to the investors preferences on the basis for the term to for the different term to maturity, then on the basis of the term to maturity the

market is highly segmented. So, this is what basically the term structure interest rate theory talks about.

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### Market Segmentation Theory Cont...

- In general, the positions and the shapes of yield curves depend on the factors that determine the supply and demand for short-term, intermediate, and long-term bonds: economic state (GDP and wealth), expected inflation, credit risk, relative liquidity, and the sales and purchases by the Treasury, central bank, and foreign central bank
- Changes in these factors will cause a change in the structure of interest rates that will be reflected by different shifts and twists in the yield curves

**Example:**

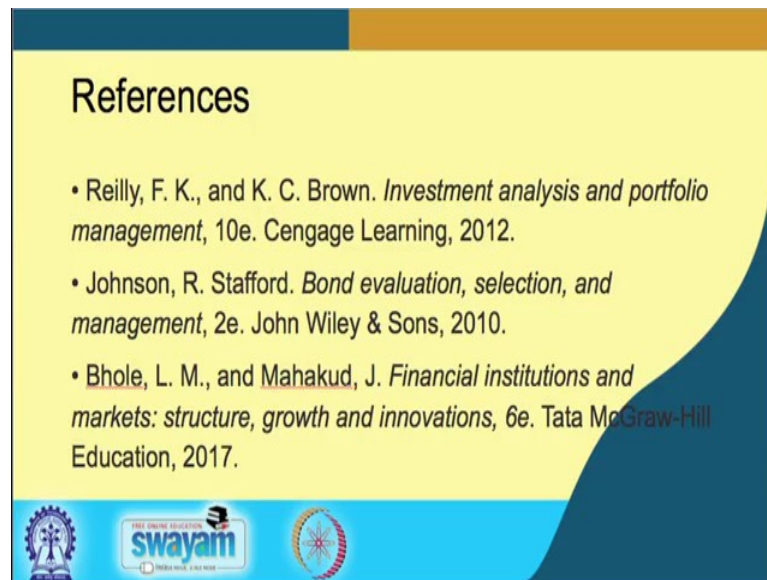
- If the yield curve were initially positively sloped, then an economic or financial change that increased short-term Treasury rates would cause the yield curve to become flatter
- If the yield curve were initially negatively sloped, then the rate change would cause the curve to become even more negatively sloped
- In general, we can describe such an impact as having a 'tendency' to cause the yield curve to become negatively sloped

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Then this is the way basically the yield curve were initially sloped, then the economic, financial rate changed. Then here if there are so many reasons for that shape of the yield curve, determine the supply and demand, intermediate, long-term bonds, economic state, expected inflation, credit risk and the sales purchase by the treasury and central bank etcetera. So, changes in these factors will change the term structure of interest rate and that will be reflected by the different shifts and twists of the yield curves.

So, this is what basically what you can say, example if the yield curve were initially positively sloped, then the economic or financial change that increased the short-term treasury rates would cause the yield curve to become flatter. If the yield curve were initially negatively sloped, then the rate change would cause the curve to become more negatively sloped. In general, we can describe that in such an impact having a 'tendency' to cause the yield curve to become negatively sloped. So, these are the different examples you can go through. So, this is the way basically the market segmentation theory can be explained.

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Please go through these particular references for this particular session.

So, next class we will be talking about the other different theories which explain the term structure theory.

Thank you.