

**Economic Environment and Business Strategy**  
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**Theories of Interest Rate Determination – II**

Hello everyone, welcome back. In the previous lectures, we examined how interest rates vary across different debt instruments due to variations in credit risk. And today, we address another key question. Why do interest rates vary by maturity even when bonds share the same credit risk, liquidity, and income tax considerations? This introduces the concept of the term structure of interest rates, which is essential for understanding bond pricing and market expectations. For businesses and investors, the yield curve signals likely movements in inflation, monetary policy, and economic conditions. It also aids in making decisions about debt issuance, investment timing, and financial planning.

In this session, we will examine why bonds with identical risk, liquidity, and income tax considerations can have different yields based on their maturity. To answer this question, we will discuss three major theories of interest rates. One is the expectation theory, the second is known as the segmented market theory, and the third is referred to as the liquidity premium theory. Let's begin with a simple yet powerful question.

If two bonds are identical in every way except for maturity, why might their interest rates differ? To answer this, let us proceed systematically. The first one here: bonds with identical risk, liquidity, and tax characteristics. That means any debt instrument if you're considering, for example, a Government of India-issued debt instrument. There are different types of debt instruments, starting with treasury bills that mature in less than one year, such as 91-day, six-month, and one-year bills. In addition, the government issues long-term bonds, including 10-year and 30-year bonds.

The main difference is that, for example, a six-month treasury bill is considered short-term. That the debt instrument issued by the government of India carries an annualized yield—for instance, five percent—whereas a 10-year bond has an average yield of eight percent. There is an annual interest rate. The issue here is that both debt instruments are issued by the government of India, which means they have identical risk, liquidity, and tax characteristics. Then, why is a six-month treasury bill different? The annualized interest rate is only 5%, whereas a long-term bond yields a much higher return; for instance, 8%.

The only difference we see here is that one has a six-month maturity, which is short-term, and the other has a 10-year maturity. Clearly, the main difference is the remaining time to maturity. Then the question arises: why is that? Because it's an annualized rate of interest. Why does a short-term debt instrument yield a lower annualized interest rate, whereas a long-term bond yields a much higher annualized interest rate? To understand this, let us introduce a concept called the 'yield curve.' This concept has been widely used in economic and financial discussions.

It is a plot of the yield on bonds, which represents the interest rate with varying terms to maturity but the same level of risk. Liquidity and tax concentration. In general, we identify three types based on the slopes of the yield curves. One is called a sloping upward yield curve, meaning that long-term rates are higher than short-term rates. The other one is flat, where short-term and long-term rates are the same.

And the third one is the inverted yield curve, where long-term rates are below short-term rates. Maybe at first, you might wonder what this means—usually, long-term rates are above short-term rates. When I show you a figure of the yield curve, you'll understand much more clearly. Look at this curve. This is a yield curve we plotted for the US Treasury; the debt instrument issued by the U.S. Treasury. Important things to remember. Let us just look at this diagram. This one is the yield. 14 December 2017.

Before proceeding, let us first recall the definition. The yield curve is a graph that shows the yields on bonds with different maturities but similar risk levels. That means, if you are plotting a yield curve, the issuers should be of the same type. For example, we are only considering the US government here. The only differences are related to liquidity and tax considerations.

The main difference is that we are using different debt instruments issued by the US government; for instance, one is for one month. For example, consider December 14th, 2017. What is the yield for a one-month US government security? What about the returns for three months, six months, and one year? Then, you can see the 10-year yield here, and for 30 years, what are the returns? As you can see, we should proceed to the red line node here. What you can see is that every point along the x-axis indicates the maturity periods of the bonds. On the y-axis, you can see the yield and the rate of interest.

If you look at this data on a specific day, December 14, 2017, a one-month US government security yields approximately 1.25%, while a 30-year US government security yields 2.71%. These figures represent annualized returns: 1.25% for the one-month security and 2.71% for the 30-year security. Then, one year earlier, for the same types of government securities, the yield data showed that on December 14th, 2016, the interest rate for a one-year government security was 0.5 percent, whereas for a long-term security, such as a 30-year government bond, the interest rate was 3.14 percent.

You see the difference between December 2016 and December 2017, one year apart, using the same instrument.

Over time, you can observe a difference, which here is 0.75, indicating the difference in interest rates. What is more important is that when we discuss the yield curve, we think of one yield curve; for example, the one I mentioned, the red line. This represents the yield curve plotted on a specific date, in this case, December 14, 2017. You know that this is the yield curve for U.S. government securities, so I emphasize again: it carries the same risk. It has the same liquidity and the same income tax considerations. The point here is that the term structure, which refers to the time period, integrates the market's anticipations of future events by offering a complete schedule of interest rates over time. Here, I have shown you two yield curves: one for December 2016 and the other for December 2017. Again, you can see that even for the short term, the one-month security rate was only 0.5% a day in 2017. After one year in 2017, the interest rate increased to 0.75%. For the third-year bond, one year ago, the interest rate was 3.14%, but after a year, when the government issues long-term securities, it needs to pay only a 2.71% interest rate. Some important points to note: the yield curve of the US Treasury encompasses T-bills, T-notes, and T-bonds within a single yield curve. Another yield curve can be that of an AAA corporate bond. At that time, instead of referencing the US Treasury yield, we would say an AAA corporate bond, as it carries the same level of risk. Again, we will plot the corporation's issuance of short-term, medium-term, and long-term bonds on a single curve. A yield curve can be constructed every day whenever the US government issues a new security, or, on that particular day, based on already issued bonds, what the rate of interest is for different terms of securities.

Every day marks the date of issue of the new bonds or bills, including short-term, medium-term, and long-term bonds. Ultimately, the goal is to narrow it down to the key point. The only difference between a one-month security and a 30-year security is the time period; one is short-term, the other is long-term. What are the risks in the long run? In the long run, there are interest rate risks, inflation risks, and liquidity concerns, as the short term can be easily traded compared to the long term. In the previous lectures, we examined how interest rates vary across different debt instruments due to variations in credit risk.

A typical theory, an ideal theory of the term structure of interest rates, must explain the following facts. First, we observe that interest rates on bonds of various maturities tend to move together over time. When short-term interest rates are low, yield curves are more likely to slope upwards. When short-term interest rates are high, the yield curve is more likely to slope downward and be inverted. Yield curves typically slope upward during normal economic conditions, indicating that long-term yields tend to be higher than short-term yields.

So, in other words, when we have an upward-sloping yield curve, what does it mean? It indicates that the short-term interest rates are lower than the long-term interest rates. For example, you might see a 1% rate here and a 5% rate here. This reflects the maturity period, such as three months, for instance. Three months, for example, versus ten years; so, what you can see here is that when we say yield curves almost always slope upward, we mean the short-term interest rate is lower than the long-term interest rate. These are the three key facts that the typical theory should be able to interpret.

Here, I am showing you another figure that the US government issues, specifically two debt instruments: a three-month Treasury bill and a 10-year Treasury bill. So, this is not a yield curve. Why? What we are seeing here is that for each debt instrument, for example, a three-month Treasury bill (the blue line), we are plotting the data across the years. You can observe the movement of interest rates similarly for a 10-year Treasury bond, which we have also plotted over time.

Both are issued by the U.S. government, but this one is plotted against the time period, while a yield curve looks like this. This example, which I mentioned earlier, refers to this three-month treasury bill and its duration. It also indicates this green line and figure. On a specific date, December 2017, we marked this point. Additionally, in this figure, we used "across" on the x-axis.

As I mentioned, to understand why a term structure of interest rates exists and why interest rates vary across different maturity periods of debt instruments. To explain this, we have three theories. One is called the expectation theory. The second one is called the segmented markets theory. The third one is called the liquidity premium theory.

Let's begin with the expectation theory. According to the expectation theory, the interest rate on long-term bonds equals the average of expected future short-term interest rates over the bonds' life. The investors view bonds of different maturities as perfect substitutes. For example, they consider a one-year bond equivalent to a series of one-year investments over time. Versus a 10-year security with a maturity, assuming they are perfect substitutes, the yield curve reflects market expectations about the future direction of short-term interest rates. To illustrate this theory, let's consider two investment strategies: purchasing a one-year bond.

When the bond matures in one year, buy another one-year bond at the end of the first year. That is one strategy. Ideally, you want to invest in both years, but what you are doing is purchasing a one-year bond, and when it matures in one year, you purchase another one-year bond. The second investment strategy is to buy a two-year bond and hold it until maturity. This means that you purchase a two-year bond now.

For example, if the current rate on a one-year bond is six percent and you expect the one-year rate next year to be eight percent, then the expected return from the next two

one-year bonds is equal to the average of the first one-year bond and the expected rate of interest in the second year. That is the first year we stated that this is a 6 percent rate; in the second year, we announced that the expected rate of interest for another one-year bond would be 8 percent. In this case, the average, when you take the annualized rate of interest, is 7 percent. Therefore, the interest rate on a two-year bond must also be 7% to keep you indifferent between the two strategies. Please provide a simple example, assuming an investment of \$1.

I have provided explanations for today's interest rates on a one-period bond, the interest rate on a one-period bond expected for the next period, and today's interest rate on a two-period bond. All three data points are given to you; then, according to expectation theory, the rate of interest will be the average of the annualized interest rates for the first and second years, divided by the number of years, which is two. Here, the interest rate on a two-year bond must equal the average of the current one-year rate and the expected one-year rate for the following year. The key insight here is that the return from holding a long-term bond to maturity equals the expected return from rolling over a series of short-term bonds. If you put it a little more systematically here, I have one figure to show you: the one-year interest rate today, the one-year interest rate one year from now, and the one-year interest rate two years from now.

Then, the three-year annual interest rate is the average of three one-year interest rates, which means this. Now we have the second theorem. The second theorem is called the segmented markets theory. Here, unlike the expectation theory, bonds of different maturities are not substituted at all. As stated in the previous theorem, people are indifferent between the short term and the long term; however, it's clear that bonds are not a substitute at all.

Investors have strong preferences for bonds of one maturity over another. In other words, the market for bonds of different maturities is wholly separate and segmented and cannot be substituted. There is a clear difference between short-term bonds and long-term bonds. So, investors prefer a liquid portfolio and therefore favor short-term bonds over long-term bonds.

As a result, demand for short-term bonds increases. This higher demand leads to an increase in bond prices, while interest rates decrease. Here, if people have a strong preference, if you hold short-term bonds, you know that there will be high demand for them. As a result, the bond prices will increase, and the interest rates for short-term bonds will decline. In contrast to this, you know that for long-term bonds, compared to short-term bonds, there will be less demand. As a result, the price of a long-term bond will be lower than the price of a short-term bond.

Then, you understand that when the price declines, the interest rate increases, and the annualized interest rate for long-term bonds increases. That means that when people prefer short-term bonds due to lower interest rates and inflation risk, a high demand for short-term bonds emerges. This high demand leads to higher prices, which in turn results in lower interest rates for short-term bonds. As I just explained, in contrast, long-term bonds will have less demand, resulting in lower prices but higher interest rates. In this case, you can see that a yield curve, which typically slopes upward from left to right, will also be upward sloping.

In this case, you can see that the interest rate for each bond with different maturities is determined by the demand and supply of that bond. We have already discussed how demand, for example, can lead to changes in bond prices, which in turn reflect on the interest rate. To sum up this theorem briefly: short-term bonds are more liquid, have less inflation risk, and lower interest rate risk. That's why there is a higher demand for short-term bonds, leading to higher prices and lower interest rates compared to longer-term bonds. So, if investors generally prefer bonds with shorter maturities that carry less interest rate and inflation risk, this explains why yield curves typically slope upward.

Now, let's move on to the final component: the liquidity premium theory, also known as the preferred habitat theory. An offshore is actually an extension of the expectation theory by adding more perspectives on how the risk preferences of market participants influence long-term outcomes. The main assumption here is that bonds of different maturities are partially substitutable, meaning they are not perfect substitutes. Usually, people prefer short-term bonds over long-term bonds. The reason, as we discussed a few minutes ago, is that people generally favor short-term bonds.

To incentivize them to demand long-term bonds, a risk premium is necessary. This is where the liquidity premium comes into play, which is the core idea of this theorem. The main point is that the interest rate on a long-term bond equals the average of short-term interest rates expected to occur over the life of the long-term bond, plus a liquidity premium that responds to supply and demand conditions for that bond. To explain this, the theory of liquidity premium suggests that the rate of interest has two components. The first component is derived from the expectation theory—the first theorem we discussed.

To determine this, you take the number of years and then divide the annual interest rate for each year by the number of years. This is the same as what we discussed in the first theorem; thus, according to the expectation theory, plus. The liquidity premium exists because, for people to demand bonds in the long run, they require some additional incentives. That additional incentive is a premium. That means offering a top interest rate to motivate them to buy long-term bonds.

Typically, the liquidity premium is always positive because of the time period involved. The main risks include inflation risk, interest rate risk, and some liquidity risk as well. These risks tend to increase as the term to maturity approaches. Here, I am providing a numerical example: a table showing one-year interest rates and the liquidity premium for the next five years. Here, we display the first row, which shows one-year interest rates.

The interest rate for the first year is five percent, the second-year bond is six percent, the third-year bond is seven percent, and then eight and nine percent for the following years. What I have done here is to show that these are all annual interest rates for a one-year bond. That is the one-year bond in year one, a one-year bond in year two, and so on. You should read here that there is a one-year bond in year five. Therefore, the liquidity premium in the first year is zero, as it is a short-term bond.

But if you want to demand a two-year bond today instead of demanding a one-year bond now, waiting, and then buying a second-year bond later, you should receive not only the average premium of this one but also a liquidity premium. The longer the time, the higher the liquidity premium. As the maturity period increases, the liquidity premium generally also increases. Here, what is the interest rate for a 2-year bond? To answer this. First, you need to calculate the average: 5% plus 6%, divided by 2, plus the liquidity premium of 0.25%. This results in 5.5% plus 0.25%. Therefore, you should determine the interest rate for a five-year bond based on this calculation. Then, you need to calculate the average of all five years and add the 1% liquidity premium. Here is the graphical illustration. This first one is the average premium.

For example, let's consider that 5% is the average annual rate. Then you are getting the average premium here. And this one, this shaded area, you can see is increasing, gradually increasing over time. You can see that it's increasing. That is the liquidity premium.

That means that as the years to maturity increase, so does the value. That means this much; this much is the liquidity premium, the INT. This theory is also called the preferred habitat theory because it combines the market segmentation theory and the expectation theory. Investors care about both expected returns and maturity, so they prefer bonds of certain maturities over others. Investors have different investment horizons, and to buy bonds outside their preferred investment horizon, they need a compelling reason. To motivate them to invest outside their preferred habitat, they need a meaningful premium.

That is the extra premium they need to pay if they plan to invest for the long term. Therefore, investors typically prefer to invest in short-term bonds. To encourage them to invest in the long term, they need to receive a much higher premium or interest rate than

for short-term investments. This is because demand and supply forces influence the rates, which is why, in the long run, interest rates are higher than those of short-term bonds.

The range also highlights the key findings from the yield curves. This theorem clearly explains why, in general, yield curves tend to slope upward. This is due to a larger liquidity premium as the term to maturity lengthens. Here, I'm simply emphasizing the importance of the structure of interest rates.

One is a testable prediction. Second, it provides numerous policy insights. Third, it also discusses and reflects on market expectations. Before concluding, let me show you some examples of the maturity yield curve. An upward-sloping curve has a less flat slope, while an inverted yield curve is different. Usually, this doesn't happen in the normal time period; it typically occurs during a recession, signaling something to the market. I'm also showing you some figures for the yield curve of Indian government securities.

This one is from July 2018. This one was in August 2018. This is for the U.S., and before concluding, I want to briefly reflect on the inverted yield curve. Typically, an inverted yield curve is a signal of impending recession. In the inverted yield curve, you can see that long-term rates fall below short-term rates, reflecting expectations of rate cuts and slowing economic growth. Signals tight credit and reduced economic activity as investors anticipate weaker growth and future rate cuts.

Let me explain why investors would accept lower long-term yields. The theories we've discussed generally support the idea of an upward-sloping yield curve. But why would investors accept a lower long-term yield—that is, an inverted yield curve? It typically occurs when investors anticipate a weakening economy, and a recession is on the horizon. They anticipate that inflation will fall, meaning there is an inflationary risk. If that's the case, central banks will likely cut policy rates, and short-term yields will decline, leading to a flight to safety in this environment.

Investors move money into long-term government bonds, which are seen as safer assets. This means there is increased demand, leading to a hike in the demand for long-term bonds. This demand drives up long-term bond prices, which in turn pushes down long-term yields. As you already know, since bond prices increase, yields decline. This is the summary of the reasoning chain: a recession is expected, then rate cuts are anticipated.

Investors shift into long-term bonds, resulting in increased demand. Consequently, the interest rate declines. If long-term yields are less than shorter-term yields, then we will see an inverted yield curve. Thank you for watching this video. See you in the next session. Thank you.