

Economic Environment and Business Strategy
Prof. Sukumar Vellakkal
Department of Economic Sciences
Indian Institute of Technology Kanpur
Week- 04
Lecture- 17

Interest Rate Determination: Market Forces and Policy

Hello everyone, welcome to this session on the bond market and the determination of interest rates. In this lecture, we will examine how demand and supply forces determine interest rates. And bonds are, as we have already defined, debt instruments issued by governments and corporations with or without periodic payments, also known as coupon payments. A key concept in the bond market is the inverse relationship between bond prices and interest rates. In the previous session, we observed that when interest rates rise, bond prices fall. When the rates fall, bond prices rise.

These relationships play a key role in monetary policy and financial decision-making. In this session, we will examine the factors that drive the supply of and demand for bonds, as well as how factors such as government borrowing, inflation expectations, and investor behavior influence these curves. We'll also examine how these shifts affect market equilibrium, bond prices, and interest rates. Let's begin by identifying the key participants in the bond market and the basic supply and demand framework.

I also want to connect this to what we discussed in a previous session about the supply and demand framework, which we will use here. I hope it will be much easier for you now to understand how interest rates are determined. Or how market bond prices are determined. Let us move to the bond market. Who are the participants? Here, we will list and describe the factors that affect the equilibrium interest rate in the bond market.

Here, the supplier of the bond is the borrower, who is also the issuer of the bond. Mainly, sovereign governments and firms are the primary suppliers of bonds. They are the main borrowers of funds from lenders, so the demand for bonds mainly comes from lenders. The primary demand for bonds originates from households and financial intermediaries, including banks, pension funds, mutual funds, and other institutions. So, the demand here is for bonds.

I would like to emphasize that, in India, most bank investments are primarily in government bonds. In other words, the demand is for bonds. You are aware that the money held within the banking system is owned by the general public. In that way, our money.

Though we are not directly investing, we can do so; many people do, but most people don't invest directly. The banks will invest because we deposit our money with them, and they will use this money to invest in the bond market. Let us examine how market equilibrium is determined through the interaction of supply and demand in the bond market. What you can see here is that at lower prices, since we have already observed the inverse relationship, a lower price corresponds to a higher bond price, assuming other factors remain constant.

This is a *ceteris paribus* assumption. The quantity demanded of bonds is higher in a direct relationship. That means you can buy more at a lower price. The quantity demanded of bonds is higher in an inverse relationship, as you can see there. A lower price leads to a lower quantity of bonds supplied, indicating a positive relationship.

Let's look here: you can see that there is an inverse relationship—a downward-sloping demand curve. This is the bond demand curve, and this is the bond supply curve. As you can see here, when the price is low, households, banks, and other financial institutions will demand more. They are going to demand a large quantity of bonds. Why? When the price is low, the interest rates are high.

That means that when the demand for bonds increases, their price also increases, and the interest rate declines. In contrast, when the price of the bond is high, the supplier will supply more bonds; they will issue additional bonds in the market. This means higher bond prices lead to lower interest rates. As bond prices increase in the market, bond suppliers are willing to borrow more because they can pay lower interest rates. We have already seen the inverse relationship between bond prices and interest rates.

The equilibrium position here is where the demand for bonds intersects with the supply of bonds. At this point, you can see that it happens when the amount people are willing to buy equals the amount, they are willing to sell at a given price. So, at this point, you can see that it occurs. The demand for bonds equals the supply of bonds, which represents market equilibrium. At the given bond price of \$ 850, the quantities demanded and supplied in this market are \$ 300 billion.

When the price is 850, the corresponding rate of interest is 17.6 percent. If the bond demand exceeds the bond supply, consider points A or B. These points are not the equilibrium; the equilibrium is at point C. So, at this price, what will happen is that if the demand for bones is greater than the supply, there will be excess demand.

Mainly, demand exceeds supply here. You can see this on the graph, where, within this price range, demand (BD) exceeds supply (BS). This indicates excess demand, which will likely lead to a price increase. The amount supplied by the firms and the government bonds issued by them is limited to this amount. But households and banks are willing to lend.

They want to lend in the finance market and the debt market. They want a 33 percent interest rate at this rate. When the bond price reaches \$ 750, they want to lend \$ 500 billion. However, at this low price or high interest rate, the bond supply is only \$ 100 billion, which means the government, or firms want to borrow only \$ 100 billion. However, households, banks, and other financial institutions want to demand bonds worth 500 billion.

Clearly, when there is excess demand, the price will rise, and the interest rate will fall. This creates upward pressure on bond prices, or, in other words, downward pressure on interest rates. Similarly, in contrast, when the bond demand is less than the bond supply, this occurs at point A. You can see that there is an excess supply of bonds in this market. Bond demand is only 100, while bond supply is 500.

At this point, the bond price is very high, at 950, but the interest rate is 5.3%. As a result, there will be downward pressure on the bond price. Because they want to be the suppliers of bonds, they aim to borrow \$ 500 billion from the market, but lenders only wish to lend \$ 100 billion. To incentivize the market, suppliers are mainly willing to lower their prices, which means they are prepared to pay a higher interest rate.

This creates downward pressure on the price, or in other words, upward pressure on the interest rate. Therefore, changes in equilibrium occur when there is a shift in either the supply or demand curve. We can also see that the market equilibrium price will change. But for now, you have just recalled that the supply curve or the demand curve shifts when the price remains constant. So, when the price is, for example, at a given level—say, 100 for the price of this bond—then, assuming the price remains constant, if the firms or the government want to borrow more at the same price, there will be an increase in the supply of bonds, which will shift the bond supply curve to the right.

Here, you can see how the shift occurs and what factors drive changes in the supply of bonds at a given price or market interest rate. One factor is the government budget, which refers to changes in government borrowing. For example, if there is an increased budget deficit, it will shift the supply curve to the right. What does an increased budget deficit mean? A budget deficit is the amount that the government needs to borrow. When government expenditure exceeds government revenue, the remaining amount must be covered by borrowing from the market.

That is often, approximately 30% of the Government of India's budget is equal to the budget deficit. They usually fund such large amounts of money mainly through the debt market by issuing or supplying bonds. So, if the budget deficit increases, it means that when the government spends more but revenue does not grow, the budget deficit continues to grow year after year. Then, what you can see is that the government has to

finance this budget deficit by borrowing from the market. As a result, at the given market interest rate or price, it continues to borrow by issuing more bonds.

Consequently, the supply will shift to the right. The second one is changes in general business expectations. Suppose the overall economic and political environments in the country and globally are very optimistic. This means that the expected profitability of investment opportunities increases for firms. During that time, firms want to expand their production capacity and produce more goods and services.

In this expansion, they need funds and capital. At the current market interest rate, they are willing to supply more; as a result, the supply curve will shift to the right. Similarly, if there is expected inflation, an increase in expected inflation shifts the supply of bonds to the right because higher expected inflation means a lower real interest rate. This lower rate indicates a lower real cost of borrowing. As a result, if firms anticipate that inflation will rise in the future, they expect the future value of money to decline, so they will borrow more.

Because in the future, they need to pay the agreed amount, the value of that repayment will be lower due to expected inflation. I am providing you with a summary of the shifts in the supply of bonds and what will happen. Therefore, I am simply demonstrating that when there is an increase in the budget deficit, investment profitability, and expected inflation, it determines the current market rate of interest. Instead of borrowing this much, they will borrow more. They plan to release additional bonds to the market.

Similarly, here as well. So, what happens to bond prices when the supply curve shifts? That means, other things remaining constant. Here, suppose they issue more bonds. Suppose the price is, for example, P_0 . Obviously, you know that there is also a corresponding interest rate. The market's demanded and supplied quantity of bonds is Q^* at the price P^* .

Due to the factors, we mentioned just a few seconds ago, the supply curve shifts to the right. Let's see what happens. When the supply curve shifts right, you can see that the price declines. A decline in bond prices means that the interest rate will increase. When the interest rate increases, the demand for loans also increases, meaning lenders are willing to lend more; they will lend up to this amount.

Furthermore, if there is a leftward shift, it means they are issuing fewer bonds. The quantity of bonds issued is less, and in this case, you can see that the price increases. In other words, the rate of interest declines. When the interest rate declines, the demand for bonds also increases. Here, in the first case, when the bond price decreases, it means the interest rate would increase in this scenario, and vice versa.

Let's examine the shift in the demand curve for bonds now. Why do lenders want to lend more at the current market price or at a steady interest rate? An increase in demand for bonds shifts the bond demand curve to the right. Like what we studied in the simple demand framework, when there is an increase in demand for bonds at the current market price or interest rate, households may have more money and want to lend. At the same interest rate, they are now willing to demand more and lend more. Several factors drive the shift in demand for bonds.

One is an increase in wealth. Suppose you're a regular lender and your wealth has grown. In an expansion with growing wealth. The GDP has been growing exponentially, and everyone's standard of living has increased. As people save more and wealth increases during an expansionary economy, the demand curve for bonds shifts to the right. Similarly, if the expected rate of inflation decreases, it raises expected returns for bonds, causing the demand curve to shift to the right.

A decrease in expected future interest rates also makes bonds more attractive, shifting the demand curve to the right. When I say there is a decrease in expected future interest rates, it means that the expected future price of bonds will increase. That means in the future, after five years, you think that the bond you are going to buy today will have a considerably lower rate of interest after five years. That means the price of your bond will increase because of the inverse relationship between the interest rate and bond price. Because of that, you will invest more in the bond market since the price of the bond, when you sell it in the market, will be higher.

Because of that, you make more capital gains. Similarly, some additional factors increase expected returns compared to alternative investment opportunities such as equities. Then, you will invest more to reduce risk. When the riskiness of bonds declines, the demand curve for bonds shifts to the right. A similar increase in liquidity means that the liquidity of bonds also rises, allowing you to transact and sell your bonds easily at any time. This indicates that the secondary bond market is well-developed, enabling you to transfer or sell your bonds quickly.

As a result, increased liquidity makes bonds very attractive, and consequently, the interest rate may remain at the current level. you are willing to demand more bonds. Here again, let's examine what happens to the bond price when the demand curve shifts, assuming all other factors remain constant. The example in this case is where the bond price is P^* , and the quantities demanded and supplied are Q^* . Suppose there is more: an increase in demand causes the demand curve to shift to the right.

You can see this is the new equilibrium position. As you can see here, the prices are increasing. Price increases mean nothing but that the rate of interest has declined. The rate of interest has declined. That means that when households demand more bonds or

when lenders, such as banks, demand more bonds, the demand curve shifts to the right. Obviously, this causes an upward pressure on price because increased demand means lenders are willing to accept lower interest rates.

In this scenario, firms do not want to borrow; therefore, there are no changes on the supply side, so the current price is p^* and the associated interest rate remains the same. However, now that households and banks have more funds, they are demanding more bonds than before, which, as a result... They are pumping more money into the bond market; as a result, the interest rate will decline, and bond prices will increase.

You can see the prices go up, which means the interest rate has decreased. Similarly, other factors, such as responses to changes in expected inflation, will also affect the market rate of interest. This is the initial equilibrium position at this point. Assume that there is a rise in expected inflation; then the first step here is to shift the bond demand curve leftward, as shown here.

The bond supply curve is shifting to the right. You can see that the new price will be P_2 . This is the new price, indicating a decline in the original price. When prices decline, it indicates that the rate of interest has increased. This is the new quantity because we have made equivalent changes in both demand and supply. However, as a result, what we observe is that the change is not perfectly equivalent because, due to this change, prices decrease while the interest rate increases.

Similarly, there is a reaction to the expansion of the business cycle. Step one: A business cycle expansion shifts the bond supply curve to the right because firms are now willing to invest more in the production of goods and services. That means they will make more investments in factory resets, expansions, and the purchase of additional capital equipment. Step two is to shift the bond demand curve to the right, but by a smaller amount. So, because their income also increases during an expansionary business cycle, it takes some time.

So, the price of the bond falls, and the equilibrium interest rate rises here. What we have seen here is that, during this discussion and in just a few minutes of the previous session, we highlighted the inverse relationship between interest rates and bond prices. Let me now illustrate this with an example to make it very clear to you.

Suppose a coupon bond means... You can simply choose a 5-year or 10-year bond issued by the Government of India. For example, a 10-year bond is a coupon bond. Any bond issued by the Government of India with a maturity of over one year is typically a coupon bond. When a coupon bond is priced at its face value, the yield to maturity equals the coupon rate.

Suppose the coupon bond is sold today at its exact face value. Next, we will examine the yield to maturity. The rate of interest will be the coupon rate. The price of a coupon bond and the yield to maturity are negatively related, as we've already seen. Let's consider this example. What happens if the current market interest rates change? Meaning i is not equal to the coupon rate, which is a fact.

In this case, the illustrative example using the table yields to maturity. The yield to maturity is the market interest rate on a 10-year coupon bond that matures in 10 years. That has a face value of 1,000. What I have observed here is that we are changing the yield to maturity.

We are adjusting the yield to maturity. In the context of yield to maturity, we're considering changes. Suppose the current market interest rate is 10 percent, and the coupon rate is also 10 percent. We keep the coupon rate constant because it's already set in the bond. The bond specifies that the coupon rate is 10 percent, and the face value is also predefined at \$1,000. Then, when the market rate of interest declines, you'll see it drop like this.

As a result, the bond price increases. Look at the first row: the face value is 1,000, and the coupon rate is 10 percent, but the market rate of interest has now fallen to 7.13. Right, whoever is holding this bond will get a five percent rate for six months, but ten percent annually. They will receive ten percent annually, but the market rate in the industry is only 7.13%. That means whoever is holding this bond. You are going to get 10 percent, but the market is offering only 7.13 percent. In that case, when the government sells this bond, it won't sell it at \$ 1,000; it will sell it at \$ 1,200. However, if the current market interest rate is higher than the coupon rate, say 11.75% or 13.81%, then the bond effectively pays only 10%. Under these conditions, the issuer will receive less than \$ 1,000, and the buyer might be willing to pay only \$ 900 or \$ 800. Similarly, what you have seen is that when the yield to maturity—the ongoing market rate of interest—is less than the coupon payment, then the bond price will increase. Conversely, when the ongoing market rate of interest exceeds the coupon rate, the bond price will decline. And when the yield to maturity and coupon rates are the same, the bond will be priced at its face value. Therefore, a bond with a \$ 1,000 face value will be sold at \$ 1,000, due to the inverse relationship between bond prices and interest rates. In this case, the inverse relationship, we can also explain this point using a perpetuity bond. That means the lifetime lasts indefinitely. Suppose a government bond has a market price of 1,000, and the annual coupon payment is 50 because the rate is not specified. Any rate clearly states that 50 means 5%.

This is a perpetuity bond with no principal payments. Return is only via resale. The key motivating question here is what happens to capital gains or losses when the market interest rate changes. What I see is that, at the time of purchase, you assumed you bought

this perpetual bond two months ago. At that time, the market interest rate was five percent, and the perpetual bond, for instance, had an annual coupon payment of five percent as well. That means the bond's resale value or price will be the same. The capital gain or loss remains the same because the 5 percent is the market interest rate, and the coupon payment is also unchanged.

Therefore, someone purchasing this will pay a price equal to the face value, which is the bond's price itself. But what if, after one month of buying, the market interest rate rises to 10 percent? That means anyone investing \$1,000 in the market will get \$100, right? But this bond, if someone buys it, will only pay \$50, right? The idea here is that when the current market interest rate is 10 percent, investing \$1,000 will yield a \$100 return. However, this particular bond, they are paying only 50, which means they are effectively paying just five percent. To earn this five percent, or 15, you only need to invest 500 instead of 1000.

To get a 10 percent rate, you also need to invest just 500. This implies that anyone willing to buy this 1000 bond is only willing to pay 500. So, that means if you invested in this bond two months ago at a current market rate of 5 percent, and today, after one month, the market interest rate has increased to 10 percent, then you have incurred a capital loss of 500. That indicates you have made a loss. Today, for example, the interest rate is 2%. That means this bond, when you are, because the condition remains the same, the \$1,000 bond, this perpetual bond will be providing you with \$50.

However, when the market interest rate is 2%, you need to invest \$2,500 to earn a \$50 return. That means the bond you bought two months ago can now be sold for \$1,500. Here are the key insights: when interest rates rise, bond prices decline, resulting in a capital loss; when interest rates fall, bond prices increase, resulting in a capital gain. I'm showing you some screenshots and text I collected from the newspaper.

Simply look here, where I was referring. Just read it as an example: 7.7% 10-year benchmark. So, what does it mean? The 7.7% is the coupon rate for the 10-year period until maturity. These changes occur due to shifts in the market interest rate. You can accordingly keep this idea in mind: create a financial daily record, adhering to this principle.

I'm also referring you to some additional screenshots from the RBI website. They have defined what is meant by the different types of government security, and related information is provided here. I am also providing some additional information about the Fisher effect, which we discussed in a previous session. To clarify, the Fisher equation states that the nominal interest rate equals the real interest rate plus the expected inflation rate. In this session, we have discussed the demand and supply framework, and using that framework, we see how the market rate of interest is determined, or, in other words, how

bond prices are determined. And subsequently, using an illustrative example, we discussed the idea of the inverse relationship between bond prices and interest rates. Thanks for watching this session. See you at the next session. Thank you.