[SQUEAKING]

[RUSTLING]

[CLICKING]

RICARDO J. CABALLERO: OK, so let me continue with the topic of the previous lecture, which is asset pricing. And we said the tricky thing with asset pricing is that the payoff of having an asset comes in the future. And that implies at least two things.

The first one is that we need to have a method to value returns in the future as of today, OK? So what is it equivalent to? After all, if you want to buy a financial asset, you need to pay for it today with dollars of today, and you are expected to receive some payoff in the future. You need to be able to compare these two things.

And the second is that-- is related, is that because this payoff is in the future, you need to have expectations about it. So those are the two concepts we play with. And it's a third related concept, which is, because it comes in the future, many things can happen in between. And so there is also a concept of risk. Those are the three elements we discussed.

And remember, we did-- I'm going to go very quickly over what we did in the previous lecture because I could see some faces. So let me go quickly over that and then continue with equity, which was the next step. So the first step says, OK, ignore the expectations part for now and risk and so on. Assume that you know the future.

And we ask the question, well, how do we value $1 next year? In particular, we want the question, is it equivalent to having $1 today? And the answer quickly became no, because imagine that you had the dollar today. Then you can invest it for a year, and you get the return of the one-year interest rate return. So with a $1 today, you can do more than with $1 in the future.

In fact, that calculation gave us the exact recipe to valuing $1 in the future, because in order to get $1 in the future, I don't need $1 today. I need 1 over 1 plus the interest rate. I invest this in the one-year bond, and I get a return of that over that amount. That gives me exactly $1 in the future, OK?

So that gives us a very natural way of valuing $1 next year. It's just 1 over 1 plus the interest rate. And by the same logic, if I have $1 today, and I want to invest it for two years, well, I'm going to earn that interest rate for the first year. And then I'm going to earn that interest rate on the full product, not on the original $1. On the 1 plus i t dollars, I'm going to earn 1 plus i t plus 1.

And so I can generate a lot of-- [CHUCKLES] if the interest rate is 10% on average, $1 today generates $1.21 two years from now. So that tells you, by the same logic, that 1 over $1.21 today is equivalent to $1 in the future.

So then we said, let's pick a very general asset, an asset that has-- that pays Zt dollars this year, then Zt plus $1 one year from now, Zt plus $2 two years from now and so on and so forth, up to n years ahead. What is the value of that asset today?

Well, you apply exactly the same logic that we apply here for every single year in the future. And you get-- that's the-- that's called the present discounted value of those cash flows. That gives you the value today.

Present, discounted-- those are the discount factors, 1 over-- and then that's the value that you get out of that. So that asset has that present discounted value of future cash flows. And that should be more or less the price that you are willing to pay for that asset, OK?

And then we introduce expectations. OK, but we're talking about cash flows in the future. In many cases, we don't know. Well, we don't know two things. First, we don't know where the cash flows may be. In a very safe bond, you do know the cash flow. [CHUCKLES] But in almost any other asset, you don't know exactly the cash flows you receive.

And you don't know what the future interest rate, one-year interest rate will be. So that took us to the concept of expected present discounted value, in which you just replace all the things we don't know today for the expectations of those things. So we don't know the cash flows in the future.

That's the reason-- we have an expectation. That's what you put there. And we don't know the future-- we know the current interest rate, but we don't know the future one-year interest rate or two-year interest rate, end-year interest rate and so on. So we put an expectation there, OK? So that's that.

And then I gave you some special cases. That's a case in which the interest rate is constant. That's a case in which the payoff in the future, the coupons, are constant. And that's a case in which both are constant, the interest rate and the payoffs in the future and for a bond-- for a financial asset that lasts for n years, that matures in n years.

That's the case in which an asset that does not mature, that goes on forever under these conditions. And then I said, well, suppose that we look at the x dividend price. That means after this year's dividend or this year's payment, then that's the value.

And I made the point there that shows immediately something that will be present in almost any asset price, which is, as interest rate goes down, asset values tend to go up, OK? And the reason for that is because assets pay something in the future. And if the interest rate falls, then you discount less the future.

So whatever you're going to receive is valued more because you discount less the future, OK? So that's the effect. In fact, in this particular case, if the interest rate goes to 0, the value of that goes to infinity because you don't discount the future, and you're going to receive infinite payments in the future, OK?

Then we look at the specific financial assets. And we first look at bonds. And we said one important distinction, something-- whenever you buy a bond, one of the things you want to know is the maturity of that bond. Is it a one-year bond, a two-year bond, five, 10, 30? Those are the typical US Treasury bonds, at least. You want to know the maturity of the bond.

So then we went into pricing different bonds. We say, well, a bond-- the simplest bond is a bond-- is a one-year bond that-- suppose we have a bond that pays $100 at the end of the year, and then it matures. Well, the price of that bond should be the present discounted value of the flows of that bond, which is $100 divided by 1 plus the one-year interest rate at time t, OK?

And notice again here, by the same logic of what I explained before, is that, if the interest rate, one-year interest rate, goes up, the price of that bond will decline because that bond pays you one year from now. And one year from now, when the interest rate is higher, it's worth a little less than it was when the interest rate was a little lower, OK?

And then we look at a two-year bond, a bond that pays nothing up to two years from now. And we say, well, two years from now, it pays $100 and then matures. Well, the price of that bond will be this, OK? And notice that, in this case, the price of a two-year bond at time t goes down if either of the one-year rates goes up, OK? It can be the first-- this year's one-year rate or maybe the expectation that the one-year rate next year will go up, OK? Good.

Then I introduce an important concept, which is this concept of arbitrage pricing, which is-- two instruments should give you sort of the same interest rate-- we're leaving risk considerations aside. It should give you the same return when you compare them over the same maturity, OK? So in this particular example, I said, look, a one-year bond and a two-year bond that you invest-- you hold for only one year should give you more or less the same return, OK?

So that means that this is the return you get from $1 invested in a one-year bond-- should be equal to the return you get by investing in a two-year bond and selling that bond after one year. And that's the expression we had here. If you-- this is what you pay for a two-year bond. And this is what you expect to be paid for that bond when you sell it one year from now.

Notice that, one year from now, the two-year bond will be a one-year bond because one year will have expired, and at that point, it will be a one-year bond. That's the reason we have a subscript P1t here. So that means that we can solve from here that P2t is simply that.

But there is an expression like the one we had for the one-year bond at time t. There is one for t plus 1. We put expectations because we don't know the actual interest rate in the future. And then I stuck this into there. And we got exactly the same price that we got with the net present-- expected present discounted value approach, OK?

And so this asset pricing-- this arbitrage way of pricing things is an incredibly powerful tool that is used very extensively in finance. These are simple calculations. But when an asset gets to be tricky, much more complicated, this is very useful.

Then we talk about bond yields. And bond yields are defined as the constant interest rate that is consistent with the current price of that particular bond. So in the case of the two-year bond, we call the two-year rate, that interest rate that is constant over the two periods. That's the reason I square it. It's not i1t times 1 i1t plus 1. I square it.

It's not constant over time. The two-year interest rate may be moving a lot. I mean, the Fed just hiked by 25 basis points. I'm sure all the rates are moving at this moment. So the rates can be moving at all points in time.

But what we define as the yield is, at one point in time, you tell me the price of the bond, you tell me the payoff of the bond, then what is the constant interest rate that makes this price-- this expression equal to the actual price? That's the way we define the two-year rate. That's the two-year rate.

And if you have a bond that pays 100 n years from now, then there would be a constant interest rate, i n, that gives you $100 divided by 1 plus i nt to the n power. That will give you-- when you set that equal to the price, the actual price of the bond, the one you get out of expected present discounted value or out of arbitrage, then you have found the yield or the yield to maturity.

We know what the-- we already got the price from the previous slide. We know that the price of this bond is going to be 100 as a two-year bond divided by this product of 1 plus interest rate, one-year interest rate. So this has to be equal to that. That's the way, actually, you calculate the two-year yield.

And numerators are the same. That means the denominators have to be the same. And this implies approximately that the two-year rate is a sort of average of the expected one-year rates, OK? So in this case, the two-year rate is a sort of average of the one-year rate.

That means that, when the-- when you expect the interest rate to be-- the one-year rate to be rising over time, then the two-year rate will be above the one-year rate today. That's when the curve is-- we say the curve, the yield curve, is steep. Remember I showed you this in-- there?

When the curve looks like that, so steep, means that the later-- the two-year rate, the three-year-- well, here, in particular, the three-year rate is-- the two-year rate is higher than the one-year rate. The three-year rate is higher than the two-year rate and so on and so forth. That happens when you expect-- the market expects the interest rate to be rising over time, the one-year rate to be rising because remember, the two-year rate is the average of the current one-year rate plus the expected one-year rate one year from now.

For that average to be higher than the one-year rate now, it has to be the case that the expected one-year rate one year from now has to be higher than the current one-year rate, OK? So that's when you tend to get-- that's when you get an upward-sloping term structure. And when you get a downward-sloping term structure, which is the way it looks right now-- actually, right now, it looks very downward-sloping. There you are. It looks very downward-sloping-- is people expect that we're getting to the peak of current policy rate of short-term interest rate.

And so people expect now for the interest rate to decline going forward. And that's the reason the two-year rate now is lower than the one-year rate. And the five-year rate is lower than the two-year rate and so on. And as you can see here, it's very steep.

Then we said, well, let's add risk because yeah, sure. Here we assume that you were indifferent between investing in a completely safe one-year bond and a two-year bond in which you had to make an expectation about the price. But that price could move around. So there is risk on that price, on the price of one-year-- the one-year bond as of today.

So we added risk. And there are two types of risk in bonds. One is default risk, that they had promised that they would pay you $100, but it may happen that they cannot pay you the $100, the corporation or the government or so on. Argentina defaults its bonds regularly, for example.

Many of the regional banks that have gone under will default on their bonds as well-- so that kind of risk. But we'll remove that risk, and we'll focus, for now, on the-- I'm going to focus mostly on the price risk because I'm going to be talking mostly about US Treasury bonds. US Treasury bonds have no default risk, we think. I mean, there could be an event in a few weeks from now, but no one expects that to be a lasting event. I mean, if it is, there is a real mess.

But in any event, but there is also a price risk because you have to hold this and then sell it at one year. And you don't know exactly the price, what the price will be. There is a risk associated to that. So that means that, really, you shouldn't equalize the return on the one-year bond to the return you expect to get in the two-year bond. You should add a little compensation for holding the two-year bond, for going the two-year bond route.

And so rather than expect to make 1 plus i1t the two-year bond after one year, you should expect to earn a little more. And that's what this xb being positive reflects. And so in that case, the price of the two-year bond is a little different from what we had. In fact, it's a little lower than what we had because that's the way you compensate for risk.

I sell you an instrument a little cheaper than it would have been in the absence of risk. So you expect to get a little-- a slightly higher return out of that. So this price is lower than the price without the risk premium here, no? That means-- but it still is promising you $100 So that's exactly how you get more return out of it, because you're buying something at a lower price, OK?

So I can do the same logic now and see what the two-year rate is. But now that I have this-- take into account this risk, and you have that the two-year rate now is the average not only of the expected one-year rate, but also includes a risk premium. And that tends to be the case, that the further out in the curve you are, the larger is the risk premium. It's called term premium because term is the same as maturity, OK?

Actually, sometimes that is negative, actually. And recently, up to very recently-- now it's positive. But until very recently, that xb was negative. And the reason for that-- you don't need to understand that now-- is because long-term bonds were great hedges. Meaning, if there is-- for any major event, for a financial crisis or something like that, because in a financial crisis or a major disaster, interest rates tend to fall.

And when interest rates fall, the price of bonds goes up, [CHUCKLES] OK? And so that was a good hedge. If you wanted to protect your portfolio of equities and so on against a major catastrophic-- major event like a financial crisis or a war or something like that, it was not a bad idea to have some long-term US Treasury bonds in your portfolio, because they would tend to go up precisely when everything else was going to be losing money and so, as a result, tend to be negative.

Now that's not the case, because now one of the biggest risks is inflation. And so if there is an inflationary spike, then interest rates will go down-- up, not down. And that means the price of bonds will decline. So they will decline at the wrong time, OK?

So the price of bonds, of long-term bonds, now will tend to decline when everything else is also plummeting. I mean, if we get a negative, if we get an inflation surprise, and inflation is a lot higher than people expected, asset prices are going to decline, all of them, including long-term bonds. And that's the reason now this xb is positive.

OK, so that's-- so I think that's where we were at in the previous lecture. Any questions about that? Then I'm going to-- next step is to talk about equity. No? Yeah?

AUDIENCE: Why don't we add the risk premium to the interest rate on your note?

RICARDO J. CABALLERO: Well, because next year, that one-- for this particular bond, that bond will have no risk because it will be one year to go. And at the end of that year, you're going to get the $100. So there is no risk, that $100. If it was a three-year bond, then you would have-- in two of those, you would have risk premium. But you wouldn't have it in the last one, because in the last one, you don't have the-- you're going to receive the $100. [CHUCKLES]

If the bond could default-- because I'm only looking at price risk in the bond. If the bond could default, then I would add an extra term there because it's default risk. But here I'm just looking at price risk. And I'm assuming the unit of time is one year. So just one year before it expires, there is no more risk because there is no price in between, and you're going to receive $100 at the end of a year.

In reality, time is continuous. So every second, there is a little bit of a risk. So you have a little bit of that risk all the time except for the last second. But I'm looking at a simple example, where things happen every one year only. In the book, I think they mess up, actually. They put the risk premium in the wrong place. There was another question. No? OK.

So let's look at the stock prices now. So stock prices have two key differences with respect to-- well, several differences, but two that I want to highlight. The first is that they don't pay coupons, fixed amount. They don't promise you to pay $100 two years from now or anything like that. They pay dividends.

They tell you we have a policy of paying dividends. And even different companies differentiate themselves by how much they promise to give you on average in dividends. But it's a promise that, if everything goes as planned, they'll pay you those dividends. [CHUCKLES] It's not a commitment to pay you a dividend.

It's very different from a bond. A bond says, I'll pay you a coupon of this amount every six months. And if you don't pay that coupon, that's a default. There's nothing like that in equity. Equity, you buy shares of Apple, and you look at the history of dividends, what the CEO tells you the last time, in the last release. And you think, OK, these are more or less going to be my dividends.

But there's no commitment. They will always tell you what's their plan. But it's a plan. It's not a commitment. So that's the first thing. It doesn't have fixed coupons or anything like that. There's no commitment.

And in that sense, there is no sense of default, because there was no commitment. So there is no default. If a company has to cut dividends to 0, that's not a default. That's conditions change. That's it. There was no commitment to that.

The second feature is that they don't have a fixed terminal date. 99.9999999% of the bonds do have a terminal date. They have a maturity. There is a few exceptions, which are called perpetuities, that-- I think the US has none, for example. But most bonds have a maturity, OK?

Equity doesn't come that way. Nobody tells you buy a share of Apple. You don't buy shares of Apple that will be retired 30 years from now, OK? There will be there as long as Apple exists.

Of course, if you had shares of First Republic Bank, you have nothing now [CHUCKLES] because that-- but that was not the original plan. It First Republic Bank had been more successful, you would have-- the shares would have survived for a very long period of time. So there's no sense of maturity. In principle, equity can last forever.

So I'm going to use arbitrage to price equity. So let me-- so it lets me have the following portfolio of options here. One is our old one-year bond. So you can invest your dollar today in a one-year bond. The alternative, I'm going to say, there is some equity out there. And I'm going to call the price of that equity Q and the dividend of that equity D, OK?

So this price is a stock by arbitrage. So equity is risky. I mean, it's much riskier than bonds unless you are into Argentinian bonds or things like that. But I mean, it's much riskier than bonds. So there is always a risk premium. And actually, that in itself is a trade, should trade at risk premium of equity market.

So I'm going to put an xs here. So what do you expect to get from holding-- arbitrage means the same holding period. So I'm going to compare investing in a one-year safe bond versus buying equity today, buying a stock, holding it for a year, And then selling it there because that's the same-- I cannot do arbitrage depending from different holding periods. That's a one-year holding period.

So I'm saying this is what I'm going to get from the bond. I'm going to require some risk compensation for that because risk equity is risky. So I'm going to want that. And this is what I'm going to get. That's my return on equity I get.

This is what I'm going to pay today for the stock-- say, for a share of Apple. And when I get this, this is the dividend I expect to get at the end of the year. And then this is the price at which I expect to sell that share one year from now, OK?

So that's the return I'm expecting to get from holding the share of Apple for one period. And that's what I need to compare with holding for one year, one-year bond. But I want also to be compensated for a risk, OK? Good. Is this clear? OK.

I don't know whether silence means yes or no. But this is-- we did something like this with the two-year bond, except that we didn't have a dividend there, because there was no coupon that they won. We only had a final payment of 100. But we did this already when we compared the one-year bond with holding the two-year bond for one period.

We had exactly that, except that there was-- the expected dividend. there was 0 because there was no payment at the intermediate date, OK? Good. So we know this concept already. The only difference here is, again, that there is expected dividend and, second, that we have a risk premium here, which we added for bonds. But for equities, I said, it's typically much larger than for bonds, especially if you're talking about Treasury bonds.

So I'm going to reorganize this to solve out for the price, this Qt here. That's what I want to figure out, what is the price of the share of Apple, OK? Well, I can reorganize this, which means move to the left, divide these two guys here by 1 plus i1t plus xs, and I get this.

So the price is equal to the discounted expected dividend-- I have to discount it because I expect to receive it one year from now, and I want also compensation for risk-- plus the discounted value of the money I'm going to get from selling the share of Apple one year from now, which I also discount by the interest rate, but also with a risk premium because that's a risky investment. So that's what we have.

Now notice that, at t plus 1, I will have an expression like that as well, again. When we did the two-year bond, we didn't have an expression like that, because after one year, the two-year bond was going to be a one-year bond. And so we didn't need to think-- put a price there. We just put the $100, OK?

Here is different because we said this equity never expires. Unless the company goes bankrupt, it's there. So in the next date, I'm going to have an expression exactly like that. I'm just going to have an expected dividend at t plus 2 and the expected price at t plus 2 and so on and so forth.

That means I can replace this expression here by an expression like this shifted all by one year. And I can keep doing that. If I do that, I'm going to get, then, two expected divisions here, and then I'm going to get a-- so I'm going to get something like this, but shifted by one year and discounted by two terms in the denominator. And then I'm going to get an expected Qt plus 2 around here, OK?

Well, I can do a substitution of that, as well, again, by everything shifted by two years and so on. So I can keep going. And I can keep going and going and going and going on forever. So if you keep doing it, you're going to end up with an expression that gives you the price of the asset as the expected present discounted value of all the future dividends you expect.

You see? I'm summing here, Dt plus 2, 3, 4, 5. And it doesn't stop here. It stop here, I'm going to have here a Qet plus n plus 1. Well, I can replace that thing again. And I can keep going and keep going forever. So you're going to integrate the expected dividends, discounted expected dividends, to infinity.

Now, each future dividend is discounting more and more heavily because the denominator is growing and growing and growing because it's further out in the future. It's worth less and less, OK? But still, it can go on forever.

And in fact, even if you substitute this stuff a million times, there is going to still be a little price at the very end floating around [LAUGHS] discounted. It will never go away. So it never ends. There is no maturity. They keep going, OK?

Now we did everything up to now for nominal-- in nominal terms you can do it-- and that's the reason I didn't want to spend much time with it. You can do everything in real terms as well. And all that happens there is just remove the dollars, and just be careful to replace the nominal interest rate by the real interest rate-- but nothing deep there. I can-- you can go to real pricing, nominal pricing, and so on.

But the important concept is not that. It's the fact that this-- in principle-- we call that, by the way, the fundamental value of equity or of a stock. It's the expected present discounted value of all the dividends. And you have to discount it by the appropriate discounting factor, which includes interest rate and risk premium.

But that's what we call, typically, fundamentals. And we differentiate that from what we call sometimes-- I'm going to show you an example later on bubbles, when the price seems to exceed any reasonable sense of fundamentals. OK, good.

OK, let me sort of start going back to things that we worry about in this course. And in fact, it's a big issue. I don't know what is happening to markets now. What the Fed did was very anticipated. But markets often find a way to react to things, even if things were anticipated.

What happens-- so let me ask you a following question. What is the effect-- what do you think is the effect of an expansionary monetary policy on the asset prices we have discussed, so bonds and equity? Let's start with bonds first. What do you think is the effect of an expansionary monetary policy-- that means a reduction in the interest rate-- on the price of your one-year bond, two-year bond, any year, you pick?

We already talked about that earlier. [CHUCKLES] Goes up. The price of a bond is inversely related to the interest rate because if I cut an interest rate, it means-- a bond is something that pays-- the payoff is in the future. That thing in the future is worth more if the interest rate goes down. There is less discounting of it.

So the price of the bond, any bond here, will go up, the one-year, two-year, three-year, five-year. All of them will go up-- assuming that nothing changes as a result of the monetary policy. What happens is sometimes markets think, oops, the Fed messed up. And that leads to lots of changes in all the term structure and things like that because they expect the market to react in strange ways to this mistake made by the Fed.

But here I'm saying, suppose that the Fed just cuts the interest rate once, and everyone believes that the Fed will continue to do so and so on. Well, then you're going to get that-- the price of bonds will go up. What will happen to the price of stocks? Yeah, you want to answer. [LAUGHS]

AUDIENCE: It would go up.

RICARDO J. CABALLERO: Up. But-- well, but it's important to say that it will go up probably for two reasons. The first one is that-- it's also the case that a lot of the price of an equity, actually even more so than a bond, has to do with expected payoffs in the future. So if I lower interest rates, just the effect of discounting will tend to raise the price of-- so even if I don't change the expected dividends at all, the fact that the interest rate goes down, for the same reason that the price of a bond went up, the price of equity will tend to go up, OK? So that's exactly-- it's the same logic.

But there's an extra kick here for equity, which is what? That bones did not have, but equity does. At least it's an equity that is positively related to aggregate activity. But that's what I'm assuming here.

AUDIENCE: [INAUDIBLE] bond is [INAUDIBLE] fixed amount before stocks and can't guarantee that pays you the same dividend.

RICARDO J. CABALLERO: Well, yeah, that's the logic. Here, the expansionary monetary policy is cutting interest rates. But as a result of that, output is going up. When output is going up, sales will go up, revenues will go up, dividends will probably go up as well.

So monetary policy can have very large effect. I mean, people in financial markets are looking at the Fed all the time [CHUCKLES] because it can have a big impact on the price of those assets. And on equity, in particular, it can be very strong. And in fact, that's one of the ways monetary policy works.

When the Fed cuts interest rates, it inflates the value of asset prices. And that creates more wealth. People feel richer, consume more, blah, blah, blah, blah, blah. Firms feel also richer. [CHUCKLES] They invest more and so on. That's deliberate, in a sense. That's one of the main mechanisms through which monetary policy affects aggregate demand. It just creates wealth.

And when there's too much demand, too much aggregate demand, like is going on now-- that's the reason we have inflation and so on. In 2022, the Fed went out and deliberately destroyed wealth [CHUCKLES] because that's what [INAUDIBLE] Raise interest rates a lot, the price of equity came down, even houses began to wobble. The price of Treasury bonds sort of collapsed and so on and so forth, OK? Good.

Another experiment that we did sort of early on, lecture 3, 4, around there is what happens-- what do you think happens when there is an increase in consumer spending? So suppose that now-- remember, we had a C0 floating around, an autonomous consumption component. And so suppose that that goes up. What do you think happens to asset prices? And this is a big issue these days, actually.

AUDIENCE: That depends on how the Federal Reserve reacts to it by raising or lowering interest rates.

RICARDO J. CABALLERO: Exactly. That's right. That's very good. It depends a lot-- I mean, when financial markets receive news-- every day, they are releases of news of all sorts of things. And in financial markets, they-- people always think, OK, this is the news. The obvious thing for this is good news because this will tend to increase output. Output will increase dividends. That's a good thing for stocks.

But the immediate reaction is, whoa, but what will the Fed do about this? Does the Fed like that we have more aggregate demand or not? [CHUCKLES] OK? And so that's key here.

So suppose that, in this case, the Fed did not like-- the Fed-- like today, the Fed doesn't want more aggregate demand today. There's no central bank around the world-- maybe in China, but there's no other central bank around the world that wants more aggregate demand, OK?

So if the release is consumer are very bullish now, that's not good news. I mean, the financial markets immediately are saying, uh-oh, we have a Fed that is watching for inflation. This means they're going to hike interest rates, OK?

So what happens to the price of bonds, then, in this environment when C0 goes up, and the Fed doesn't like it, and the markets know that the Fed doesn't like it? The Fed may take a month to react to it. But markets react immediately, say, whoa, this is what the Fed will do one month from now.

So what do you think happens to the price of bonds? If we get news that consumers are very bullish, and it turns out that we also have inflation of 4% or so. So we know that the Fed doesn't like more aggregate demand. What do you think will happen to the price of bonds?

Well, [CHUCKLES] again, The news happened, say, a week ago. And the Fed moves one week later. So markets are going to anticipate that, in this case, the Fed will hike interest rates. If the Fed-- if the markets anticipate that the Fed will hike interest rate, interest rates will go up immediately-- not the rate that the Fed controls, but the one-year rate, the two-year rate, the three-month rate. All those rates are going to go up immediately as a result of that, OK?

And that, we know, reduces the price of bonds. Bonds and interest rates are-- the price of a bond and the interest rates are inversely related. So the anticipation that the Fed will hike rates will lead to higher interest rates at all horizons. And that will reduce the price of bonds, OK?

So this thing that-- and for equity, well, look what happened for equity here. Well, for equity, you say, OK, well, I get the same discounting effect of the bond, which is bad news, goes down. Ah, but the good news is the dividend because now I have more consumers. Well, that depends on how much the Fed dislikes this stuff because if the Fed does this, that means it offsets-- it fully offsets the effect on aggregate demand, increases the serial shift [INAUDIBLE] to the right. That would have increased output to here.

The Fed doesn't want more output, so it will hike interest rates up to the point in which output doesn't go up. That means dividends are not going to go up either. So we get just the negative effect of the discounting, and we don't get the benefit of the extra activity that would have come from having consumers that are more optimistic and so on, OK?

So this is-- actually, this has happened a lot over the last few months. This is an environment people call-- it's an environment where good news is bad news. Good news about aggregate demand, consumers are happy, blah, blah, blah, blah. It's bad news.

Or labor markets are very tight, wages are going up, all things that sound wonderful in other environments sound-- is terrible news for the financial markets, OK? For most, I mean. There is difference in different sectors and so on. But for the aggregate, for the average, it's bad news.

So this is an environment where good news is bad news, good news about aggregate demand. You have to be specific about what. Good news about aggregate demand is bad news for asset markets.

It's not always like that. If you're in a recession, the Fed doesn't want to fight that. It wants to have more aggregate demand. So if you get good news about aggregate demand, that's very good news for asset prices because the Fed will not offset that, and you get the positive effect of the extra dividends and things of that kind, OK?

Another component that moves asset prices a lot-- so monetary policy moves asset prices a lot, OK? But monetary policy doesn't happen in some separate, isolated space. It reacts to news about the economy, about consumers, about firms, about regional banks, all sorts of things, OK?

Another big driver of asset prices is this guy here, of equity in particular, is this risk premium. So that risk premium can move a lot. And it's an important driver of asset prices.

This index, this is the-- it's called VIX. VIX is-- I'm not going to explain what it is. But people call it, so you get the picture, an index of fear in equity markets. It's done-- well, I'm not going to tell you what it is. It's based on option prices and so on.

So this is when people realized that COVID [CHUCKLES] was coming. And so what you see is that this thing exploded up-- big risk-off, thus a massive spike in the little xs. Well, not surprisingly, look what happened to equity-- collapsed by 35% or so.

Part of that was expected deviance, blah, blah, blah, blah, blah, blah. But a lot of it was the risk-off. And it's called risk-off when markets are very fearful. They don't want to take risks, risk-off, OK?

The recovery, actually, also had a lot to do with the recovery on the risk environment. People sort of got used to the thing. But that recovery also was a result of very aggressive monetary policy.

The Fed tried to offset this by cutting interest rates very aggressively, and that also gave a boost to asset prices. In fact, they did so much that we ended up with a big-- lots of overvaluation in asset prices. And then, as a result, when they hiked rates, we had a big decline in asset prices as a result.

What is this? Look, this is-- over the weekend-- over the weekend-- we talked about this in the previous lecture. Essentially, the First Republic Bank went under, and JPMorgan absorbed it. So people thought that-- and Monday was good because people thought that this mini crisis was over.

Well, yesterday, it turns out that two other regional banks, the shares began to collapse in the same way as the First Republic Bank shares collapsed the week before. So panic immediately set in. So the VIX, the fear index, [WHISTLES] this is intraday. So markets open here, And the shares of these two banks began to decline very rapidly.

And so VIX went up a lot. And what-- this is-- this is the main-- this is the SPX, the main-- S&P 500. It's the main price index, equity price index, in the US-- immediately declined. So that's the xs moving.

Here, xs move up, the little x. And then it began to come down, and the markets began to recover. So this risk on and off is a very big driver of equity prices.

This is one of the banks, actually, that was in trouble. You see that-- by the end of the day-- this is PacWest. PacWest had declined by 28% by the end of the day. But you see things look very weird here. They don't look like normal prices.

Here they look like normal prices. They're moving all the time. Here, they don't. What happens is that these prices decline so rapidly that they trigger what is called circuit breakers. So you cannot trade those shares when they decline too rapidly.

And that's done deliberately so this little x doesn't get completely out of control, people to calm down. And so it triggered it several times. The whole idea is that people calm down, [CHUCKLES] that they don't-- is there a question?

AUDIENCE: Yeah, just on the last slide--

RICARDO J. CABALLERO: The previous or this one?

AUDIENCE: Yeah, the previous one. Is-- [INAUDIBLE] are either of them dependent on the other? Or are they more just showing the same sort of trend?

RICARDO J. CABALLERO: No, no. OK, that's a good question. This is the risk component only. So this is more independent-- what I'm saying, when this guy goes up, if nothing else happens, this will decline because you are discounting things more heavily.

But it is true that there were some common elements. There are also common elements, which is people got very worried about having another regional bank collapsing and so on. And so that also created fear about the economy, which is an independent reason for this to decline.

And normally, in recessions as well, this risk appetite is lower. So you're right that it's a common component. But the point I was highlighting is that this VIX sort of is a big driver. It has a big impact on asset prices.

But it's not the cause. It was an event that caused both. But the fact that this event came with this big spike in the VIX meant that the impact on the equity index was larger than if it had been only news about the economy, meaning that there was a recession ahead or something like that.

And let me just finish with the opposite phenomenon. I was [INAUDIBLE] episodes of fear. But sometimes markets get very carried away the opposite direction. And here I'm showing you examples. I put together this picture many years back, and now Deutsche Bank keeps updating it, which is it shows you some-- it seems that the world needs a bubble somewhere. [CHUCKLES]

And here, it shows you several sort of big asset valuations. Look, 500%. Here is the Nikkei. I mean, it was enormous appreciation of the Nikkei. Here was bitcoin. Then it collapsed. They always end up bad. Whenever you see this big sort of spiking up, they almost always end up quite poorly.

Now, this is-- it's much more likely that it happens in equity than in bonds. In bonds, it cannot happen because there is a terminal date, a terminal value. So what happens with these kind of things, people dream that their value will go to infinity. And it could because the thing will last to infinity, and the price could go to infinity.

For a bond, that cannot happen, because there is a terminal date, and at that date, they going to pay you $100. So it can't happen. But for equity, people's imagination can run very wild.

In fact, there is a famous bubble, the South Sea Bubble. It's a company in the UK. It's famous for many reasons, but one of them is that Isaac Newton got involved in this one. He got carried away.

He sold. He made a profit. He sold the shares at 7,000. He profited 3,500 pounds, which must have been an enormous amount of money at the time. Prices kept going up-- couldn't resist, went back in, ended up losing 20,000 pounds, which must have been a lot of money.

So he famously said, "I can calculate the motions of the heavenly bodies, but not the madness of people." This is all about expectations, OK? [CHUCKLES] Let me stop here.