[SQUEAKING]

[RUSTLING]

[CLICKING]

RICARDO CABALLERO: OK, let's start. So by now, you know the IS-LM model, and if you don't fully control it, please spend a lot of time on it. As I said, 2/3 of your quiz will be about that. But we're going to start adding a few-- it's a very basic model, but still we can squeeze a lot of insight from it. And there are some very natural extensions that I think we should also go over and cover because, again, they have a high return in terms of investment to knowledge acquired from them.

And today, I want to extend this IS-LM model along two realistic dimensions. The first one is to make a distinction between nominal and real interest rates. Now, nominal, up to now, since we assume in the model, since we assume that prices were completely fixed, constant, there is no inflation, and then there is no distinction between nominal and real interest rates.

But needless to say, we live in an environment with inflation is positive, typically, not always, but typically. And in fact, nowadays we're having very high inflation. And that's part of one of the big macroeconomic headaches that we have at this moment is a very high inflation rate we're experiencing.

Now, we're not going to talk about the determination of inflation until later in the course. I'm going to start talking about that in the next lecture, and it will not be part of your quiz, though. Sorry, not in the next lecture, next week, but will not be part of your quiz. It will be a very important part of quiz 2, but not of quiz 1.

But we can still say a few things about what happens to the framework we have, conditional or taking as a parameter inflation. We're not going to determine inflation [INAUDIBLE], but we say, well, what happens if inflation is not really 0? And more importantly, what happens if people don't expect inflation to be really 0? And we'll see how that modifies the analysis.

The second extension is that we simplify financial markets enormously and we customize it to-- we could have simplified along many dimensions, but the simplification that we have is we look at something that is closest to what central banks do in setting monetary policy. And that's really the trade between cash deposits at the central bank and bonds. US government bonds, in the case of the US, typically have very short maturity, and that's what we had in mind, and that's the way we determine the interest rate.

Now, needless to say, there are many, many interest rates in the economy, different duration, one-year rate, two-year rate, three, ten, 30-year rates. Some countries have 100 year rates. But there is also another dimension, which is very important, is the one that I highlighted there, which is riskiness. US Treasury bonds, especially of short duration, are riskless assets. There's no risk associated to it.

Now we have a little event with the debt ceiling fight that may happen in August, September. But nobody's really concerned that something major will happen, except for a few disruptions for a few days. Let's hope that's true. Up to now, if you look at all the risk, markets are behaving as if nothing will happen there.

But corporations don't typically borrow at those rates. Corporations issue their own bonds or take loans from the banks, and those bonds often have a risk premium. That is, they're equal to the safe interest rate, the Treasury rate, if you want, plus something else. And so you can anticipate that will be important because interest rates enter into our IS-LM analysis precisely through the borrowing costs of firms in the investment function. So if there is a wedge there, if there is a spread between what the rates we've been talking about and the rate at which firms can actually borrow, then that wedge will matter.

And so that's what we want to do. So we want to introduce this. I want to explain what these things are, and then I'm going to modify our IS-LM model to take into consideration these extensions.

So what is the nominal interest rate? Well, we have been talking about the nominal interest rate, which we typically denote by little i, is the interest rate in terms of dollars. So if the interest rate is 10%, you buy a bond today, that bond will give you 10% of whatever amount of money you invest in the bond at the end of the year.

So it's a one-year bond. So that's a nominal interest rate. So if you buy 100 in bonds today and the nominal interest rate 10%, you receive $10 of interest payments one year from now, $10 of interest payment.

A real interest rate is the interest rate in terms of a basket of goods. So the CPI or something like that will be important in that. Ex-ante, that is at the moment in which you are deciding where to invest in the real bond or the nominal bond.

The difference between the two, the main difference-- there are other issues that have to do with risk [INAUDIBLE] I'm not going to talk about. But the main difference between these two is expected inflation. In other words, if you expect no inflation, then the distinction between goods, that is, if you expect p to remain constant, the distinction between an interest rate in dollars or in goods isn't existent. They're the same.

But if you expect inflation, then that's not the case because the goods are going to become more expensive over time. And if the goods become more expensive over time, that means something that pays you in dollars is paying you more per equal unit. So if the r, little r, which is the interest rate, is equal to i, and you expect inflation to be 10%, really you're expecting the real instrument to pay you 10% more than the other. That cannot happen in equilibrium, but that's what it means because one is paying you in dollars and the other one is paying you in goods, so it will be 10% more expensive next year. OK, good.

So why do we care about the distinction between nominal and real interest rate? Well, because the private sector, important decisions of the private sector, like the purchase of durable goods for consumers-- we're not modeling that in this course, but investment in the case of physical investment, not financial investment, physical investment depends on real rates, not nominal rates. So what determines whether the opportunity cost of a real investment is high or low is the real interest rate, not the nominal interest rate.

Why do you think that's the case? Why do you think it's the real, not the nominal interest rate that matters?

AUDIENCE: Because when they're borrowing, they're going to be [INAUDIBLE].

RICARDO CABALLERO: Not really. I mean, most of the borrowing in the US is done in nominal rates. So it has to come from something else.

Why do you invest? You invest to produce more goods in the future. So if those goods are going to be more expensive in the future because of inflation, then what matters to you is the difference between the cost of borrowing and what you'll get for those goods. And the goods are going to be 10% more expensive, so what really matters is the net for you.

In other words, if the real interest remains constant, and now you give me interest rates that are 10% higher, but you also tell me that the goods are going to be selling are going to be 10% more expensive, I don't change my decision. If it was a good project with zero inflation, it's also a good project with 10% inflation. That hasn't changed.

If I tell you 30%, the same thing. No, because I'm going to be investing now in order to get things that are going to be 30% more expensive a year from now. So the decision that doesn't depend on that. So that's the reason the real interest rate is what you really care about in the case of real investment.

And remember, we're talking about real investment at the aggregate level. All this can make a difference at the level of individual goods because when inflation goes up, not every goods price goes up by the same amount. Some goods go up by more and some prices go up by less. But on average, it's what I just said.

So let's try to look at this equivalence more formally, how to derive the real interest rate. Well, [INAUDIBLE] I said, not in the US, but in many places, you do borrow in real terms. For example, in Chile, we have a unit of account because we had very high inflation many years back, which is called Unidad de Fomento, and that unit of account is indexed to inflation.

So you borrow $10 million equivalent in Unidad de Fomento. And those 10 million pesos equivalent Unidad de Fomento that means the interest rate is indexed to that. But in the US, that happens very rarely.

The US government does do that. It's called TIPS. So you have nominal bonds. The great majority of the US Treasury bonds are nominal bonds, but there are also some real bonds, and those are indexed to inflation. But firms very rarely can issue bonds in the US that are in real terms. So that's that [INAUDIBLE].

Sometimes this is even a-- so the reason I made that clarification here is I'm going to derive the real interest rate, but that doesn't mean that the instrument exists. I'm saying, given a nominal rate that I see out there, how do I construct a real interest rate from that nominal interest rate? That's what I want to hear.

It doesn't mean that there is an instrument that is traded in real terms. But when I go to the bank as a firm and I borrow at 10% nominal, I need to calculate, well, what does that imply in real terms. And that's what I'm going to illustrate now. OK, good. Or maybe I shouldn't use the word good since we're going to do this.

So what we want to pin down is this real interest rate, r. So the real interest rate in terms of goods means if I borrow, say, one unit or if I buy an instrument that-- if I spend one unit of the good, the aggregate good, in a bond, then I receive 1 plus rt units of goods one year from now, then rt is the real interest rate. It's an interest rate in terms of goods.

Now, suppose that I go this route instead. So OK, that's what I want to get to, but let me do it through the only instrument I have, say, the nominal interest rate, the nominal bonds. So if I buy one unit of goods today, that means I'm really buying Pt dollars in that bond. Pt. Is the deflator we have. We have Pt dollars.

Well, Pt dollars invested in a nominal bond will give me 1 plus it, the nominal interest rate, times those dollars. So say the price index here is 2 and the nominal interest rate 10%, then next period, I get a 2 times 1.1. That's the number of dollars I get.

Now, that's still-- I cannot compare with this up here, because at this point, I have dollars. And really, I want to convert it into goods. I want to go from goods to goods. So how do I convert dollars into goods?

I divide by the price of the goods, but not here, by the price of the goods at t plus 1 because I'm going to get this amount of dollars at t plus 1 one year from now, I have to divide by the price of goods at t plus 1 in order to get the number of goods I'm getting at t plus 1. So I have to divide by plus 1. But the problem is that at time t, I don't know what Pt plus 1 will be.

The best I can do-- and here's where I'm simplifying things a lot-- is to have an expectation of what the price level will be one year from now. So the best I can do when I want to compare things today, whether I want to go this way or that way, is to use expected price here. So these two things are equivalent in the sense that they require exactly the same investment. I'm now going this way.

And then in expectation, at least, these two things are also equivalent because this is one I'm going to get in terms of goods from having invested a good. This is what I expect to get in terms of goods, but I'm ignoring all that uncertainty around that. And this is what I get if I go directly to the route, the goods route, and this is two things have to be equal by indifference. If two things give me the same, they have to be priced equally. They have to have the same price.

And so these two things have to be the same, because here I'm going from goods to goods. Here, I'm going through this channel, but also from goods to goods. These two things should give us more or less the same return. And we're going to assume strictly that they give us the same expected return. So this relationship holds.

Is this diagram clear? OK, good. Because what I'm going to do now is I'm going to take this expression here and play with it a little.

So we arrive in the previous slide to the conclusion that 1 plus the real interest rate is equal to 1 plus the nominal interest rate times Pt over Pt plus 1 expected. I'm going to denote expected inflation, the inflation we expect, the log change in the price level or the rate of change of the price level from year t to year t plus 1 as pi e t plus 1 is equal to that. So this is expected inflation at t plus 1. See that?

Well, do a little algebra, and I can rewrite this guy here as 1 plus expected inflation between t and t plus 1. I just replaced this for 1 over 1 plus pi e t plus 1. Just algebra, I got that. So now I have a relationship.

And these things, if this interest rate is not too high and this expected inflation is not too high, not too large, as it happens in most countries but a few around the world, then this implies approximately that the real interest rate is approximately equal to the nominal interest rate minus expected inflation. I'm just taking approximations here. And that is an intuitive expression. The real interest rate is equal to the nominal rate minus the expected inflation.

So if the interest rate is 6% and expected inflation is 3%, well, the real interest rate is only 3%. In terms of good, you're going to get 3% less because that's inflation rate. Good. Or if you're borrowing, in terms of your borrowing costs, well, it's going to cost you 3% less effectively because the goods you're going to be selling out of your investment are going to be 3% more expensive. OK, good.

So, look, this is what happened. I'm showing you what happened around the years of the Great Recession. Remember, the Great Recession happened end of 2008, 2009, 2010. Several things you can see in this picture.

The white line here is the nominal interest rate and the yellow is the real interest rate in the US. And since in the US you can actually trade real and nominal bonds, the difference between these two is expected inflation, as priced by financial markets. And they're called in the US are called inflation breakevens, so swaps, inflation swaps, inflation breakevens.

But anyways, so several things you can see in this picture. The first one is that typically, unless you're in Japan probably, the white line, that is, the nominal rate is above the orange line, which is the yellow line, which is the real interest rate. Why do you think that's the case? Or what does it tell you, the fact that on average sort of the nominal interest rate is above the real interest rate?

Yeah, on average, in most advanced economies and even more so in emerging markets, inflation is positive and therefore people expect inflation to be positive. Again, Japan went through this long periods of deflation, but that's a rarity. That was an anomaly, what was going on in Japan.

But you see something else here. There is an episode very clearly when the opposite was holding, when the real interest rate went much higher than the nominal interest rate. And this is despite the fact that you see even they cross in opposite direction. Here there was a sharp decline in the nominal interest rate and a sharp rise in the real interest rate.

What happened? What was happening there? First of all, forget about the picture. What was happening around 2008, 2009? The Great Recession.

So that's one observation. Typically, especially in modern recessions, certainly in recessions caused by financial crisis, as this one was, real interest rates go above nominal interest rate-- can go above nominal interest rates. What does it mean in terms of inflation?

Remember, what the Fed is setting is this one, more or less. This, I think, is a one-year rate. So it's not exactly what the Fed set, but more or less.

So why do you think the Fed cut interest rates there very aggressively? Yeah, we were in the middle of a big financial crisis, so we wanted to boost the economy, so cut the interest rate. And this is, when you map it into the very short rate, this is effectively the hit, the zero lower bound. They couldn't lower it more. They lower it as much as they could, and that was it.

So what must have happened for this real interest rate to go up like crazy? How can it be? There's the Fed bringing down the nominal interest rate, and the real rate, boom, jumps up.

Expected inflation went down a lot. So what I was saying is expected inflation is typically positive in developed economies, around 2%, 2.5%. That's the type of numbers. But in deep recessions, it can go even negative. And that's what happened.

There is the expected inflation as extracted from inflation breakevens, from the swaps. And you see, typically it's around 2% and so on, because that's more or less the Fed inflation target in the US. But during this episode here, we entered into a very deflationary episode, expected inflation close to minus 4%.

That was very deflationary. It was very scary. Deflations can be very complicated objects for [INAUDIBLE]. And we'll say more about that later. But that's what happened there. Good.

So that's nominal versus real interest rate. Now, let me talk about credit spreads, and then we're going to put everything together. So most bonds issued by corporations are risky.

They are not-- US treasuries are as safe as it gets. That's considered the safest assets in the world, together with the German bonds, government bonds, and Swiss. There are a few, but the US in terms of liquidity and everything, is the premier safe asset in the world.

But most corporations don't issue at those rates. They have to pay a premium because they're not as safe as those, as the Treasury instruments. So let me call that the real interest rate paid by this bonds by issues by firms on average be equal to the safe real interest rate plus a premium, xt.

Now, the point that is important is that this risk premium moves a lot over the business cycle, especially when you have a financial crisis. People really want to run away from risk. And so it tends to be higher in recessions, especially when recessions are caused by financial crises and things of that kind.

Now, why do we care about the risk premium? Again, because important private sector decisions depend on that real interest rate, on the risk-adjusted interest rate. If a firm has lots of credibility problems and is considered very risky, the cost of borrowing is going to be very high and therefore it's going to have to have a higher threshold for any physical investment. It's more costly for that firm to borrow. So that's a reason to worry.

So the risk premium, that x there, is determined by two things, essentially, in the case of bonds. There's also risk premiums in equity. But in the case of bonds, one thing is the probability of default. It may be that the firm doesn't honor those bonds and defaults on them, so one thing is the probability of default.

The other one is the degree of risk aversion of bond holders. There are sometimes in which you say, look, I don't want to hold any risk here or very little risk because everything looks very complicated to me. I'd rather go safe. I go to Treasury bonds. I don't want this stuff.

So those two reasons make that spread grow. The second reason, on average, to me is the most important reason. But it's easier to model all this stuff as a probability of default. So that's what I'm assuming.

What I'm going to do here is I'm going to ignore this, the degree of risk aversion of bondholders, and I'm going to just concentrate on the probability of default of a bond. But in that sense, you can model both as the same because you can think of risk aversion as somebody exaggerating the probability of default of a bond. If I get very nervous about investing in risky stuff, there is some true probability of default that some agency is calculating out there.

But if I'm very nervous about that, I may as well put a marker up, say, well, you know, these guys have messed up in the past. They may think that the probability they followed this bond is 5% during the next year. I'm going to treat it as 10% because I want to penalize for the risk I'm incurring.

So think of this p here as a probability of default, but as perceived by-- you don't know what is the true probability of default. That's an abstract concept. But it's whatever you use in your investment decisions that I'm modeling here.

So by the same principle we had before between nominal and real bonds, what we need to have is I need to be indifferent-- in equilibrium, I need to be indifferent between investing in Treasury bonds, the safe bonds that pay an interest rt, and investing in risky bonds that are paying an interest rate rf, which is greater than rt. So I have to be indifferent between these two things.

And the spread here will have to adjust so I'm indifferent between these two things indeed. It's obvious, if the probability of default is greater than zero, that this rf is going to have to be greater than r, because otherwise I don't want to invest in a bond that pays me the same as that. And on top of that, I can experience a default occasionally, not get my money back.

So what we have here, this indifference condition means, OK, during the next year, there is a probability of default p. That means with probability 1 minus p, I'm going to get this high interest rate. I'm going to get my money back. I invest one in a bond, I get my money back, plus an interest rate, which is higher than the safe interest rate, this rf. That's a good thing.

Against that is a probability that the bond there is a default, and I'm going to assume always in practice there is some recovery of a bond which is much less than the principal. I'm going to assume it's 0. So if p is positive, as I said before, then it better be the case that this rf is greater than r, otherwise I'm not going to invest anything in the risky bond.

So I'm going to replace this rf by rt plus x just to calculate xt. And you can solve this out here, and you get that this risk premium is xt is an increasing function of p. Naturally, if I perceive bonds to be more likely to default, I'm going to require a higher compensation if the bond doesn't default. And that's what you have here.

Now, what happens is that during severe recessions, actual defaults go up. So the probability of default objectively goes up and people get a lot more scared also that this will happen, and so p tends to go up a lot. So during severe recessions-- is always almost in recession, but especially in severe recessions, p can rise a lot. It can rise a lot.

r may fall or not. We shall see. But this stuff dominates, actually. This x can move up a lot during recessions.

And in fact, if I show you what happened during the Great Recession, same episode as before, there you have it. This is our x really. Look how it jumped in 2008.

So the average-- and this is for-- I think it's high yield, I think. But it's not junk. It's high yield, though. I think it's a weighted average of things.

But think of this as the median bond out there, corporate bond. It had to pay 20% more than a Treasury bond, so big difference if you are in the private sector and wanted to borrow, than if the government wanted to borrow. Big thing. This was a big issue. OK, good.

Now, it's almost always-- oh, about that level, this is high yield. So you see, typically because these high yield, these are not the prime companies. They have a probability of default. There's a risk out there.

They typically have to pay a spread, 3%, 4%, things like that. But during severe events, that can go very, very high. So if you're a corporation and you're trying to borrow here, it's going to be pretty difficult to borrow. That's the point, not a good time to invest in that sense. It pretty expensive.

So that takes me to the IS-LM model. I want to now bring in these two ingredients. So the two modifications I introduce are relevant for the IS. The LM doesn't change. The central bank keeps setting the nominal interest rate, and that's what it does. So that's not changing, and that's the target of the central bank.

The central bank may decide to react to things that happen in expected inflation and credit spreads. But the LM is the same as it used to be. In the book, at some point, the book makes a simplification and it starts setting the interest rate in terms of the real interest rate. I think that's a bad idea, so I'm not going to do that.

I'm going to keep our IS-- our LM as it was, but now with the extensions, we have to modify, well, the only place where interest rate enters for us, which is in the investment function. And so the investment function now is not a function of the nominal interest rate. It's a function of the real interest rate adjusted by credit risk, because that's the relevant opportunity cost of-- that's the real cost of borrowing, if you will, of firms when they want to invest. So that's the modification.

Now, for this part of the course, as I said, I'm going to take this as two new parameters. We're not going to look at equilibrium and the termination of that. When we get into the next part of the course, then we're never going to do much about that, but yes, about this. But for now, these are just two new parameters.

So in our equilibrium lecture, three in the goods market equilibrium, now we have two more parameters, expected inflation-- and remember the ZZ curve, where we have g, p, interest rate, all those things are constant? Well, now we have two new parameters, expected inflation and the credit spread.

So that's it. That's lecture 3. Now, so what I'm showing you here is what happened in lecture 3.

If the credit spreads comes down or expected inflation rises for any given nominal interest rate, then that shifts the ZZ curve up. Why is that? I'm sorry.

And if aggregate demand goes up, then the multiplier kicks in and we end up with an expansion in output. So I'm saying, for a given nominal interest rate, if now expected inflation goes up or the credit spreads go down, then that acts almost like an expansionary monetary policy, you see. You get an expansion in aggregate demand. Yes.

AUDIENCE: Increase the [INAUDIBLE] because for increased inflation, the firms will be expected to reduce cost more, so they would be more inclined to invest? And for a risk premium declining, they can take and borrow [INAUDIBLE].

RICARDO CABALLERO: Exactly. That's it. The cost of borrowing went up or down for firms. So that's what I'm saying. Those two things operate almost as monetary policy.

That has not been done by the Fed, by the way, by the central bank. But they have the same effect because that's the way they enter. They enter exactly the same as an interest rate. So saying that this guy is going up or that this guy is going down leads to the same analysis as when we lower i because they're identical. They enter exactly in the same place. No?

So what I showed you here, I had done diagrams like this before. That's what you get when you lower the interest rate. Well, the two strokes describe is effectively like lowering the interest rate that is the relevant interest rate for the firms because lower credit spreads, higher expected inflation means lower real interest rate.

Now, the episode I described you during the global financial crisis was exact opposite of this. In the global financial crisis, we had this x, boom, jumping. And I had shown you before that expected inflation came down a lot. Remember, expected inflation came down a lot when negative, from around 2% to minus 4. That's a big shock for the real cost of borrowing for firms.

And the x went up like crazy. That's the reason in the global financial crisis what we got is exactly the opposite of this. We got a massive shift down in the ZZ curve for the reasons we just described.

Because this is the case for x going down or pi going up. In the global financial crisis, we got exactly the opposite, and in massive amounts, massive increase in x, massive decline in expected inflation. So it's the exact opposite of this and in a much larger scale. It was a massive shock. Good.

So that's the case I was just describing. That's what happened in the global financial crisis. So the first thing is, so if x goes up, as it did in the global financial crisis and the Great Recession-- by the way, when I say the global financial crisis or the Great Recession, those are the same episode. They end up being-- it started from a financial crisis, and it turned out ended up being a recession everywhere and a financial crisis everywhere as well.

But anyway, so what I just described is this. In the IS-LM space, the IS is shifting inwards a lot. For any given nominal interest rate, if x goes up a lot, that means there is less investment and that means that the LM shift to the-- sorry, the IS shift to the left. And the same would happen if there is a fall in expected inflation. So for the Great Recession, we have two reasons why this thing move inward a lot. One, expected inflation came down, and the other one, x went up a lot, massive movement to the left.

Now, what do you think a central bank should do faced with a situation like this?

AUDIENCE: Drop interest rate.

RICARDO CABALLERO: Drop interest rate. Why do you do that? Well, because this shocks negative interest rates, like, shocks to the interest rate. Effectively, it's like if you had increased the interest rate a lot. And so the central bank will try to offset that by lowering the interest rate.

What problem may the central bank face in doing this?

AUDIENCE: Reaching low-liquidity trap.

RICARDO CABALLERO: Yeah, reaching the zero lower bound effectively lowered one liquidity trap, exactly. There's a limit of how much you can do.

And I showed you that that's what happened really here. Effectively, this is-- the reason it looks so flat, it doesn't move, is because it's against the lower bound. It cannot move.

Let me tell you a little bit about what's happening now. So this is now. Remember, the other one was for the period from 2008 to 2013, I showed you. Now I'm shifting everything by 10 years.

So still you see, on average, the white line, which is the nominal interest rate, is above the orange line-- the orange line-- the yellow line, which is the real interest rate. Why is that? Yep.

AUDIENCE: Positive inflation?

RICARDO CABALLERO: Positive inflate-- expected inflation. But they're correlated. When inflation is on average positive, then expected inflation is also, on average, positive.

There's an exception there. Why is that? When did that happen? There's one point where the real interest rate went above the nominal interest rate.

AUDIENCE: COVID recession.

RICARDO CABALLERO: Sorry.

AUDIENCE: COVID recession?

RICARDO CABALLERO: Yeah, exactly. The COVID recession. So as I said before, that was a massive shock, a scary shock. And the initial reaction of expected inflation was to come down enormously, and so that's what we saw.

And also see this big step here in the nominal interest rate, and then flat. So what do you think happened there? Yep. Again, they went all the way down to the maximum they could do. They set the short-term interest rate to 0 effectively. It's not exactly 0, but to 0, and they stay there for a very long period of time.

Now, why do you think-- and this I think helped a lot the recovery of the US economy, and it also a big reason for the rally that you saw in the equity market in 2021 you can see in this picture, which is this. Notice that the real interest rate went very, very low. You see that? The real interest rate went very, very low.

And that's the reason equity markets were flying. I mean, you had effectively very low real interest rates. So what happened there? How did that happen? What must have happened during this episode?

Yeah, the central bank was injecting everything possible to it, but even more than monetary policy, the conventional monetary policy. But what is the-- let me say this. This wedge reflects what?

What is that wedge as a matter of accounting? Expected inflation. It's expected inflation.

So this tells you-- this interest rate was at 0. The real interest rate was at minus 4 here. It means that expected inflation must have been 4%. So we had a combination in which the nominal interest rate remain at 0, but inflation was high, which is not the typical combination we get in recessions, like the previous one, demand recessions, financial crises, where inflation goes down when you are in a recession.

This was a different shock. And after the initial shock, we got lots of bottlenecks on the supply side of the economy, which we don't have a good model yet. Later, we're going to have to model here. And when you have problems on the supply side, you can get a situation in which it feels recessionary because there is low activity and so on, but inflation is high. And that's exactly what we had here. inflation was high.

Now, at some point, for a while we tolerated this high inflation, thinking that this was going to be a transitory phenomenon and so on. But then it began to last for too long. And when it began to last for too long, then the Fed reacted. And that's when you see they began to hike interest rates,

And they began to hike interest rate, and initially it didn't do much to the real rates because expected inflation kept rising. And then eventually they convinced everyone that they were serious about this, and so real interest rates began to rise a lot here. And that's when the equity market collapsed, by the way.

You don't know that yet, but I'm going to talk about the equity market later on. But believe me, that's what essentially brought down the NASDAQ, for sure, primarily, and all these memes stocks and all that. That's that.

What about today? Well, Houston, we have a problem because, you see, the Fed keeps raising interest rates and inflation is not coming down as much as we expected. In fact, expected inflation initially looked like it was going to decline, and now it's beginning to pick up again. So you have a situation here where the Fed wants to be restrictive, but the real interest rate is declining, not going up. That's a problem.

That's a problem. That's what is happening at this very moment. The Fed has a big problem because of that. They are trying to tighten interest rates, but financial conditions are relaxing in a sense because of an increase in expected inflation and even credit spreads were declining, in fact.

So here is what I just said in terms of inflation, expected inflation. And you see here the big collapse during COVID, early on in COVID, but then it recovered very strongly and went very high. And actually, in the middle of 2022, it really went up a lot. And that's when the Fed really got scared, and that's when they began to increase interest rates by 75 basis points in a hurry. OK, good.

And this is what you see recently. I told you that we have a problem now because expected inflation, they were able-- there is a famous conference happens in Jackson Hole, and it's famous mostly because most central chairs of presidents of central banks, governors of central banks around the world meet for a few days there. But there is one speech that everyone looks at, which is the speech of the Chair of the US Central Bank, the Fed.

And they were very worried-- that conference happened around here, and they were very worried because expected inflation was just exploding. I mean, 6% or so, those are unheard of numbers for the US since the '80s. And so they came up with a very tough speech, a very hawkish speech, saying, look, this is unacceptable. We are going to do whatever it takes to bring this stuff down.

And they were very successful persuading people. In fact, expected inflation began to decline a lot very quickly, which is one of the reasons you see real rates rising very fast, in fact, faster than the nominal rate, because nominal rates were rising. And on top of that, expected inflation began to plummet, and that led to a very sharp rise in real interest rates and the collapse in the stock market as a result.

What about credit spreads in this episode? Well, here you see, during the COVID shock, again we got a big spike here. It was not as large as in the other one, which was a financial crisis per se, but it was a very large spike. And then eventually of came down, and it came down a lot. That's again, when you're seeing rallying in all the markets and so on.

But then began to go up. And again, here, we began to have a problem because the Fed wanted to tighten and these credit spreads were coming down. I think I did this on Sunday or something. Today is 27? Yeah, I did it yesterday. There it is.

So this pickup here is very recent. It's last week. But credit spreads were declining, and that, again, goes against what the Fed wants to do, which is to tighten financial conditions for firms.

Now, as I said before, central banks typically intervene only-- the monetary policy. involves very short duration Treasury bonds, so their own bonds, the bonds of that government, in most places like that. But this shock was so disconcerting and so large, and it did affect corporations a lot because imagine you're in the airline industry, and then suddenly you get COVID. So it really was a major shock to corporations, and so they went beyond traditional conventional monetary policy.

They certainly-- something that had done already in the global financial crisis, they began to buy sort of very long-duration US Treasury bonds, so 10-year bonds and so on, the US Treasury. But they went beyond that and they created a facility to buy corporate bonds. That facility was meant to deal with x. You're getting a huge x shock, and they went directly to that to try to bring that x shock down.

Why do they want to do that? Well, because of the reasons we have explained here. That amounted the x shock, which came together with expected inflation coming down, amount to a big shift there. They did all they could with conventional monetary policy. They brought this down.

So you can think of their policy of intervention is called-- they're called large-scale asset purchases. That's a generic number of that. Well, what they were trying to do really is to act on those interest rates that do not show up in the LM. They show up in here, in x.

x is a parameter of here. If I go out there and I buy corporate bonds, then I'm reducing x, which is a way of shifting the IS back. Corporations can borrow more cheaply if the government is buying their bonds. That's the whole idea.

In Japan, they even bought equity, directly equity, interventions in the equity market. So happened in Hong Kong in 1997. There was a massive intervention in the equity market. Typically, central banks don't do that. But when situations get desperate and you are against the zero lower bound, so you lost your conventional monetary tool, they tend to be a little more creative, and that's what they've been doing.

OK. Any questions? That's it for today. From the-- yeah, you have a question.

AUDIENCE: Could you put x into more tangible terms? I think I'm still sort of trying to figure out what a--

RICARDO CABALLERO: Credit spread. For example, if Boeing-- I don't think Boeing is a high yield. Well, let's say Boeing. It's OK.

If Boeing borrows, they're not going to be able to borrow-- say, the 10-year rate-- I'm showing it here in 10-year rate spread. The 10-year rate for the US at this moment is close to 4%. If Boeing wants to borrow 10 years, it's not going to be able to borrow at 4%. They're going to have to borrow at 7%, so there's a 3% difference. That's x.

AUDIENCE: And that's the credit-- is that credit?

RICARDO CABALLERO: That's x. That's credit spread, which is linked to the perceived probability of default. I said, it's perceived. When you say perceived, is that, say, the actual probability of default?

Who knows who can measure that? They are, again, agencies that try to measure them, plus whatever extra risk premium you want to put on top of that.

AUDIENCE: And so this is tracking the relative, this reliability of [INAUDIBLE]?

RICARDO CABALLERO: Yeah, how unattractive it looks to lend to a corporate versus lending to the US government. And when this line is very high, it looks very unattractive to lend to corporations, and therefore you need to be compensated a lot for that. OK, good.