[SQUEAKING]

[RUSTLING]

[CLICKING]

RICHARDO CABALLERO: And so we started with something a little boring, basic definitions. And the first thing we had to do is to understand how do we measure output at the aggregate level. It's very easy to understand what output is at the level of an individual factory, but at the aggregate level, it's a little tricky.

And so we had an example of a very simple economy with two companies, one that produces steel and the other one that produces cars. And in this particular example, the steel company doesn't sell anything to the final consumers, it sells all its production to the car company. And we ask the question, what is the GDP of this economy?

The simplest answer would have been, well, 300. I summed the output of the two companies and that could be one answer. But then I show you the three different methods that that's the wrong answer.

And method 1 was-- a definition is GDP is the value of final goods only. And final goods in this simple example is, well, this company is not producing anything as a final good because all its sales are going to-- as an input into other companies' production. And so this one doesn't count at all in our simple example, this one counts, and then the answer is $200. Not 300, but $200.

Method 2 was to count only the value added in each company. And value added is the difference between the final output-- that is, the revenue from sales, minus whatever that company spends on intermediate inputs. In this simple example, this company-- the steel company is not spending anything on intermediate inputs-- it's a strange production of steel, but anyways, it is quite a decent example. And so this $100 is value-added, completely value-added. There is no expenses on intermediate inputs.

For the car company, however, the revenue from sales is 200, but the company spends 100 on intermediate inputs. Therefore, the value added of this company is 200 negative 100, so you get 100 value added from this one, 100 of value added from that one, total value added, 200. So same answer.

And the third method-- these are-- the two methods that I just described are production methods. You're measuring the production side. The alternative is to look at the income side. And the income side says just-- let's sum all the incomes in the economy. And the incomes are income to workers, wages, and income to the owners of capital, profits.

Income to workers is $80 plus 70, is 150. Income to owners of capital is 20 plus 30, that's 50. So 150 plus 50 is, again, 200. So these are three equivalent ways of measuring output. And I said-- one of the features I show you of this method is that they are immune to organizational structure within the economy.

So for example, if these two companies were to merge, clearly the sum of incomes would not change. It would still be 100-- it would be 200. This one would not change because if they were to merge, then the whole production of the revenues from sales of the car company would be value-added. Everything would be produced in-house, and still, the answer would be 200, then, because this company would disappear, it would emerge inside here, and you would get still get 200. And the same happened with method 1 because still, the sales of final goods is only 200.

The naive approach of just summing output would be terrible because once you merge it, output would collapse from 300 to 200. That tells you that's not the right way of doing things. So while the three methods we propose do work, are immune to this organization-- changes in the organization structure.

The next step was to highlight that when we say output, we're really after real output. And there is a distinction between nominal output and real output. Nominal output is simply the quantity of final goods measured at current prices, while real output is measured at some fixed set of prices of one fixed year.

And I think I gave you an example. This is an example I gave you, and then in the P-sets, you had more complicated examples with multiple goods. Here, you have an economy that produces only one good, cars, and that produces 10 cars here, 12 cars, 13 cars here. The price of the cars is rising, so the nominal GDP is rising a lot while the real GDP is rising less.

How do we measure real GDP here? We use-- in this particular example, we use the prices here, 12-- 10 times the price of the car in 2012 is 24,000, that's 240. Obviously for the base year, nominal GDP is the same as real GDP. And then for 2013 is 13-- not times 26,000, but times 24,000 and we get that.

Now in this particular example of only one good, you can pick any base year and you'll get exactly the same rate of growth of real output. If you have multiple goods, that's not true because the relative prices of goods are moving over time, but that's the basic idea. So-- I mean, again, you should know these things-- I'm not going to be tremendously important in the quiz, but they will show up in your quiz.

Then we went through some definitions. The unemployment rate being the number of unemployed over the labor force, not population, that's important. We talked about the inflation rate as well. And that's the rate of change of prices, and there are different prices in the economy. One of them is the deflator, the other one is CPI, and so on and so forth. That's it. So that was the first lecture relevant for the quiz. Any questions about that? Good. Keep moving.

OK, then we move to-- then we began to really get serious because we began to construct a foundation for the IS-LM model. And the first thing we did is we looked at the goods market. No. And what we did here is we said-- we describe the different components of aggregate demand, and we said, in this economy-- for now, at least, we're going to make this economy closed, so we remove exports and imports, and for your quiz, absolutely you're not going to see anything about exports or imports. So this is your aggregate demand.

We wanted to build a little more, so we had to have some behavioral assumptions. We made it initially very simple. We assume this was exogenous, that government expenditure was exogenous. Taxes were also exogenous. And the only behavioral equation we had was this consumption function, and we said consumption is increasing disposable income.

So we assume something linear like this. Disposable income is just income minus taxes. And remember, income-- remember from the alternative ways of measuring GDP, income is the same as output. So when I say income, because that's what is relevant for the consumption-- consumers world, but it's the same as output. So that was our consumption function. it had an upward-sloping-- it was upward-sloping because there is a marginal propensity to consume, c1.

And then a key assumption of this part of the course is that output is aggregate demand-determined. Prices were completely fixed, and we said, well, but output is whatever demand wants, that's what output is. So this is an equilibrium condition. This is the aggregate demand, this is an equilibrium condition, so we can solve out because I can say in equilibrium, z is equal to y, and I can solve for equilibrium output from that equation. And that's exactly what we did in this slide, and you got to an expression like this.

Knowing how to do that is very important for you. So you better be sure that how to find equilibrium output in this model. I mean, it's going to be very difficult to do IS-LM if you don't know these steps, so you better know this stuff.

And remember something-- we call this guy here in the simple economy the multiplier. Why the multiplier? Well, because given certain something we call exogenous expenditure, the 1 minus c1 multiplies that. If the marginal propensity to consume is very high-- say it's close to 1, then the multiplier is very, very high. If the marginal propensity to consume, say, is 0.5, then how much is the multiplier? 2. OK, good. So the multiplier is 2. Good.

And that was our equilibrium. We had the aggregate demand. The slope was less than the 45-degree line because c1 is a number less than 1, and so you have some equilibrium output there. That's the equilibrium output. At this point, aggregate demand is equal to-- well, aggregate demand is equal to aggregate supply, that's always true, but that's consistent also with aggregate demand-- with the function of aggregate demand.

And important for this equilibrium output is that the equilibrium output is a function of a lot of things that we took as parameters in this aggregate demand curve. What did we take as parameters in the aggregate demand curve? Just give me examples. Well, investment, government expenditure, and taxes at the very least. Also, parameters like autonomous consumption, that c0 we're taking as given. Anything-- if any of those things move, the position of the aggregate demand curve will shift around.

And that was one example. Suppose autonomous consumption c0 goes up. So suddenly consumers decide to spend more. Well, then what we have is that aggregate demand shift up and equilibrium output ends up changing by more than the initial change in c0. Why is that? So this is the change in c0, but the change in output-- and so the initial change c0 leads to an initial change in output, which is equal to c0. That's up to here. But then we end up with a final equilibrium output is higher than the initial response. All this happens infinitely fast in this model.

Why is this change greater than c0? There is a multiplier in front. Exactly. We change c0 by 1, but then you have to multiply it by 1 over 1 minus c1. And that's what we illustrated in this picture there. OK, good. And so you should move everything-- you can move here around. Move G up, D up, and stuff like that and see what happens.

The last thing I did in this section is I showed you an alternative way-- entirely equivalent way of illustrating equilibrium, which was saving equal to investment. Remember, I derived this, and I go to an expression like that. That's exactly the same as aggregate demand equal to aggregate supply. An investment, which, in this particular basic model, is fixed, is equal to saving by the government, which is also, in this basic model, is fixed because it's G minus T, which is fixed. Sorry, it's T minus G, which is fixed. And then private saving.

And then I show you an interesting result, which is called-- known the paradox of savings, which says the following. If, for whatever reason, consumers decide to save more, say, for example, because c0 now comes down. So now they have certain income. Out of that same income, they want to save more. Then from this very simple equation, I know that-- what happens to output? Why?

AUDIENCE: Because savings go up, consumer demand goes down. And then also, investments will also go down. And then--

RICHARDO CABALLERO: No. Investment doesn't go down here because it's fixed. In this basic example, not IS-LM.

AUDIENCE: [INAUDIBLE]

RICHARDO CABALLERO: Yes, but that's an explanation, which is the right explanation, but the explanation in the outer space, output and the income. I wanted in the space of saving and investment. So let me give it to you very quickly. But your answer is correct, but it's not what I wanted here because what I wanted to say is the following.

If, for whatever reason, for any given level of income, savings go up, then we have an imbalance. Total saving is greater than investment. The only variable that can adjust here-- so we restore equilibrium, investment equal to savings, is for the output to come down because if output comes down, savings come down, and that's the way you restore equilibrium.

I told you, this way of looking at things is entirely equivalent as we have already done. So I can also do what you wanted to do, which is represent that in the space of output and-- aggregate demand and aggregate-- and output or income. And an increase in c0-- a reduction in c0 would lead to a decline in aggregate demand and then through the multiplier larger increase in output.

So this is the way we characterize it before, this is a slightly different way of characterizing which is what gives rise to what is called the paradox of savings because suddenly you decide to save more, supposedly that should be good. Well, in the short-run it's not really good, it causes a recession. Anyways. It's cute, but it may show up in your future, so I wanted to remind you.

So that was the goods market side. Oops. Then we look at financial markets and we trivialize financial markets, really. We said let's assume the financial markets are very, very simple. Money and bonds. That's it. Nothing else. And the first behavior-- the only behavioral equation we really had here was money demand, and we said, well, money demand is increasing in nominal GDP because if nominal GDP is larger, then you need to do more transactions, you need more money, more cash. Cash of deposit, but here, we're looking only at cash.

But it's decreasing in the interest rate. Money-- the money is decreasing in-- why is it decreasing in interest rate? Interest rate is the return on the bonds. Why is money demand decreasing in the interest rate? Yes. The opportunity cost of holding cash in your pocket is higher. You didn't care about this stuff a year ago. But now, it costs you 5% to hold cash. That's what you get in 1-year certificate bond. US Treasury bond at this moment. So it's more significant.

Maybe it's not that relevant for you, but corporation, makes a big difference, I guarantee you. I'm keeping the thing in the checking account, now they're really buying short-term Treasuries and stuff like that. Good. So that's the reason this is downward-sloping. And that's the concept here.

So then what the central bank controls is money. How much money it injects in the economy, that is how much-- OK. How much money it injects into the economy, how does-- let me say just that for now. And so that's the money supply. So the equilibrium interest rate is simply the point in which money demand is equal to the money exogenous money supply.

And I said in the modern world, the central banks don't tell you M S. They tell you this is the interest rate we want, and then they provide whatever M they need in order to get the interest rate they have told you they want to have. So that's the case of an expansionary monetary policy. Suppose the Fed wants to lower the interest rate from here to here.

Well, what it needs to do is increase money. And increase money means it goes out there, an open market operation, and buys bonds from the private sector. Buys bonds, takes bonds in, and gives them cash. Money. That's an expansionary monetary policy, and an expansionary monetary policy will lower the interest rate.

That's an open market operation. So that's what we just saw, was exactly that. The Fed wants to lower the interest rate. What it does is it goes out there, it buys bonds from the private sector so it's balance sheet on the asset side has more bonds now, but it has more liabilities because it gives cash to people and that's a liability of the central banks. So that's an open market operation. That's an expansionary open market operation which is designed to lower the interest rate.

Then I talked about the relationship between the interest rate and the price of the bond. And that's the return on a bond. It's the face value of the bond, what you get when the bond matures. Say it's 100, it's a bond for 100, minus whatever you pay divided by whatever you pay. So say if you pay today $95 for a bond that will pay you $100 a year from now, that's approximately-- it's 5% interest rate. It's a little more, but that's about it.

Which also helps you understand a little bit what happens during an open market operation. In an open market operation, an expansionary monetary policy, the central bank goes out there and buys bonds. What typically happens to a price of a good or an asset that is being bought by somebody big? Goes up or down? Now we have a big buyer out there that goes and buys bond. Do you think the price of bonds will go up or down? Up. Big buyer got into the market to buy bonds, the price of bonds go up.

But if the price of bonds goes up, that means the interest rate goes down. So that's an intuitive way of understanding how monetary policy lowers interest rates. It's a big buyer buying bonds, the price of bonds will go up, but the interest rate and the price of the bond are inversely related. You can see that. Now suppose that the initial price of the bond was 95, and now the price of the bond goes to 100, the interest rate goes from a little more than 5% to 0%. Good. Then we talked about intermediaries. Forget it for now.

So then we got into two lectures about IS-LM-- about the basic IS-LM model, and then we did one more on the extended IS-LM model. And I told you that at least two-thirds of your quiz will be about this. So-- and I already know what is in the quiz and I cannot tell you, that I honor my commitment. So you better understand the IS-LM model very, very well. Now understanding the IS-LM model also means understanding the previous two lectures because we're building the IS-LM model there.

So the first thing we did here is we said, well, to make this stuff a little more interesting-- we already had a model in which we could find equilibrium output. But remember, that was in lecture 3, we had that. But we said-- but we took many things as exogenous there that are really not exogenous in practice. In particular, private investment. Private investment is certainly something that responds to aggregate activity and to the cost of borrowing and things of that nature.

So what we did-- the first thing we did here is we changed the investment function for some constant for something that was a function of output and the interest rate. That component here, the fact that it was increasing in output just increase the multiplier, but it didn't change anything qualitatively in the analysis.

But the fact that it depends on the interest rate is important because now we have as a parameter in the goods-- in the aggregate demand curve the interest rate. When you solve out the whole thing, the interest rate is one of the things that can move aggregate demand around.

And that's important because now you can begin to see the connection between what the central bank does and how it affects aggregate activity because what the central bank does is affect the interest rate. The central bank cannot go out there and buy hamburgers as I said. It can go out there and buy bonds, and with that, it affects the interest rate.

And for that to matter for the economy, not only to bondholders, it better be the case that that interest rate matters for the equilibrium level of output. And it does so by affecting real investment. So that's the mechanism through which monetary policy affects real activity. Is through the cost of borrowing.

We simply-- in reality, consumers are also affected by that, by the interest rate and so on, but let's keep things simple and have only investment as a function of the interest rate. And very importantly, it's a decreasing function of the interest rate. The higher interest rates, the lower its investment for any given level of output because it's more costly to borrow to fund that investment.

So that gives us our curve, which is a combination of output and interest rate that are consistent with equilibrium in the goods market-- that is, when output is equal to aggregate demand. So that's the IS So that point belongs to one IS for one interest rate here.

So how do we construct the IS? Well, we start moving the interest rate. So suppose we start from this one point in the IS, the point I just showed you. Supposing that now-- we increase the interest rate, we look at the new equilibrium output. Well, that also belongs to this IS. And you can keep moving the interest rate around. So you move z around only by moving the interest rate. Don't move G, T, or anything else. Only by moving the interest rate, and then you can trace an IS curve.

If you move other parameters than the interest rate, then it's a shift in the IS curve, it's not a movement along the IS curve. So if, for example, if I increase G, what happens? With this IS curve? The IS curve shift to the right because-- now for any given level of interest rate, output will be higher because aggregate demand moves up. And so that's a shift to the right of the IS curve. Good. That's an example of the opposite. An increase in taxes, well, it will shift IS to the left.

The LM relationship is already described. It is no equilibrium in financial markets, but we said the way monetary policy is conducted is the Fed sets the interest rate and the money is whatever the market needs in order for that to be the equilibrium interest rate. So the model in LM, if you will, is horizontal just like that.

So now we're set, because once the Fed decides to set this interest rate, we can find not only the equilibrium combinations of interest rate and output that are consistent with the equilibrium in the goods market, but the particular equilibrium level of output that is consistent with that interest rate. And that's exactly equilibrium output.

So given the LLM, now I looked at it intersection with my IS, and that gives me equilibrium output for that level of the interest rate, which has been set by the Fed. And then you can use this model. This is a very powerful little model because now you can do lots of things with it.

For example, that's a contractionary fiscal policy. That's what happens when you reduce G or when you increase T. What happens if you reduce G and T by the same amount? You see what I'm doing. Maybe if you-- that's often done. OK, you can increase government expenditure, but then you find a source of revenue, or reduce government expenditure, but then you don't need to generate a fiscal surplus, and so on.

So what I'm saying, this is a balanced budget fiscal policy. That's what it's called. What if I move G and T by the same amount? Does that curve move? Yeah.

AUDIENCE: It does because the multiplier next to T is c0 in the equation-- original equation.

RICHARDO CABALLERO: c0?

AUDIENCE: c1.

RICHARDO CABALLERO: Yeah, OK. Perfect. Yeah. Yeah. So, in which direction does it move? So if I reduce G and reduce T by the same amount, what happens to IS? Moves to the left or to the right? Yeah, it moves to the left. Because why is that? I can always go back to my basic goods market equilibrium model. If I reduce G by 1, that reduces aggregate demand one by 1. One for one. And then the multiplier kicks in.

If I-- but the initial change shift down is 1. If I reduce taxes, I increase aggregate demand, but by c1 times 1. And so I had a reduction in aggregate demand of 1 and I had an increase in aggregate demand of c1. 1 minus c1 is greater than 0. That's the reason you have, on net, a reduction in aggregate demand. Hint, this is not a random thought I had, so do understand it. OK, good. OK.

Thus, monetary policy. So that's an expansionary monetary policy. And in equilibrium, why it's expansionary? So cutting interest rate, because it will increase equilibrium output. That's the case in which the Fed probably is unhappy with this low level of output, maybe it's a recession. So one of the main policy tools we have to fight a recession is to lower the interest rate. And you can see here how lowering the interest rate will increase equilibrium output.

How does it happen? Why is it that this happened? Why is it that the equilibrium output rises? Exactly. Because it's increasing investment. That gives us the first kick. And once equilibrium starts rising, then consumption rises and we get the whole multiplier. But the initial impulse is exactly because this increase in investment.

And how does it implement that? Open market operation. So what the Fed will do is if it wants to cut the interest rate, it goes out there, buys bonds from the public, and gives them money in exchange, and that's what happens here.

And then I talk about different policy mixes. This is what typically when an economy is deep into recession, you're going to see both policies that work at the same time that's very powerful. That's the case in which we have a very-- we cut-- we have an expansionary monetary policy that shifts down and an expansionary fiscal policy. And that's definitely what we did during COVID, was massive. And during the Global Financial Crisis-- so typically big recessions will lead to-- any recession will lead to something like that. Obviously if it is big, you're going to have a bigger combination of this kind of stuff.

Some problems that monetary policy may face is that sometimes you hit a zero lower bound. And then when you hit a zero lower bound, you just can't lower the interest rate more, you lose monetary policy, you need to do other stuff, and typically fiscal policy then becomes very, very active. And this is not just a theoretical curiosity. I mean, we have been against the zero lower bound for a sustained amount of time during the last 20 years or so.

Oh, that's another policy mix as well that-- suppose that you need to do a fiscal adjustment, I said. So you want to reduce the deficit, reduce G, but you don't want to have a recession as a result of that. One way you can do that is by-- you have a contraction in G or increase in taxes. That's contractionary, but you can offset it with an expansionary monetary policy.

I think in the quiz somewhere you have a question-- I don't think that is specific to this, but you could you're asked to compensate for something with something and something like that. So some curve move, and then you're asked to offset that effect on output. So you should understand this kind of things.

The next step was to extend a little bit our IS-LM model. And by extension we said, well, look, at this moment we have only-- prices are completely fixed, but in reality we have inflation. And so the nominal interest rate is not really the effective cost of capital for a company. A company that wants to fund the real investment is more concerned with the real interest rate in Spain, not the nominal interest rate.

So with prices that are constant, there is no distinction, but if you have positive inflation, then the distinction makes a difference. That's the reason we want to talk about that. And the second thing is that the same firms are very unlikely to pay the same that the Treasury pays for borrowing. It's going to pay-- it's a riskier proposition to invest in bonds issued by a corporation, and therefore, they're going to have to pay a risk premium for that.

And so the importance of these two things is that a we ended up with an IS-LM model that now had something a little more complicated here because it didn't have only the nominal interest rate, but also had expected inflation. If, for any given nominal interest rate, if we expect a higher inflation, that means a lower real interest rate. So for any given nominal interest rate, if expected inflation goes up, that's expansionary, really, for firms. It's like it's cheaper, in a sense, to borrow.

Conversely, if x goes up, the credit spread goes up, that's contractionary because it's now more expensive for the firms to borrow for any given real interest rate. So we can-- this is called extended IS-LM model simply because it has been extended to incorporate these additional factors.

And now, you have two more parameters in your model, which is expected inflation and the credit spreads. So if you move either of these, you're going to move your aggregate demand curve in the goods market. And it's going to move for exactly the same reasons that that aggregate demand moved when you move the interest rate. It enters symmetrically.

In this model, these guys here enter completely symmetrically with the interest rate. So whatever was the comparative statics you had with respect to the nominal interest rate before, they applied to x minus pi. What I'm trying to say is if you know what is the change in equilibrium output as a response-- as a result of an increase in 100 basis points on the nominal interest rate, then you know what is the response of equilibrium output to an increase in credit spreads of 100 basis points, or to a reduction-- or to a reduction in expected inflation of 100 basis points. Entirely symmetric.

Because that's a channel. It's the real-- it's the cost of capital channel for the firm. That's they're all entering exactly through the same place. But the Fed doesn't control this guy, it controls only the nominal interest rate. So anyways. So these are new parameters here.

So this is an example here. That's an example in which credit spreads or expected inflation went up. Sorry. Where credit spreads went down or expected inflation went up. And that's expansionary. That will increase aggregate demand because for any given level of output, now there will be more investment. Credit spreads are lower or expected inflation is higher mean the real interest rate is lower for any given nominal interest rate.

So if the Fed doesn't react to that, that's going to lead to an expansion in output. Of course, the Fed could react to that. Suppose the Fed is OK with the level of output we have. Suppose it's a low output. And the Fed's seeing credit spreads falling, so output is expanding. But the Fed says, no, no, no, the level of output Y0 wasn't what I needed. I don't want Y1. What would the Fed do?

Increase the interest rate. Exactly. And it's very easy to see in this picture here that if you don't want this guy, the total sum to move, then if this guy moves down-- or this guy moves up, then I need to move i exactly to offset that, and that's it. It's very easy to calculate. I don't need to solve my whole model, actually.

You tell me this thing in net went down by 100 basis points, if I don't want to change output, then I need to increase the interest rate by 100 basis points so I don't change the cost of borrowing-- the effective cost of borrowing for corporations.

In fact, this is exactly what is going on right now in the US economy. Every time Marcus gets very excited, credit spreads are compressed, the stock market goes up, the Fed comes out and says, come on, guys. I mean, we have inflation problem, I'm going to need to keep hiking interest rates because I need to offset your enthusiasm. They don't use those words, but that's exactly what happened. I mean, Chairman Powell was testifying in Congress yesterday and today, and that's what he said. I'm just giving you a summary of what he said.

Now a problem that the central bank may face, suppose you have the opposite situation, is that one in which credit spreads are going up a lot and expected inflation is declining a lot. And the Fed doesn't want output to decline because that combination will lead to a reduction in output. So the Fed wants to cut interest rate. What problem may it face? The zero lower bound. It may not be able to bring interest rates as much as--

Because suppose that the interest rate today is 50 basis point. It's not the case today, but it was two years ago, 50 basis points, or 25 basis points, and credit spreads go up by 200 basis points. Well, there's no way the Fed can offset that because it has maximum 25 basis points to lower and credit spreads went up by 100 basis points. And that's when you start seeing all these more exotic policies-- quantitative easing and other things-- to offset the negative impact of the increase in the credit spreads in the economy.

And the last thing we did was to begin our transition to wear medium running shoes, and the whole thing began from the labor market. Now you're going to get a little bit in the quiz of that, but it's not going to be as important as what I just described. A little bit you're going to have.

And the basic-- well, definitions, you should know the basic definitions. Well, this was the first important equation. We had that wage-setting equation that said essentially that wages are increasing in expected prices. Obviously the nominal wage the workers are going to demand is going to be higher if they expect the price level to be higher in the future. But importantly, it's decreasing and unemployment and increasing in this variable that represents their bargaining power and so on.

Then we look at what happened on the price-setting side, meaning what firms do. And for that, we have to start with the production function. We had a very simple production function which said if you want to produce one more unit of the good, you need to hire one more worker. That means that the marginal cost of production is the wage. So it's very simple.

And then we said we're going to have a very simple model in which the firms charge their marginal cost, which is the wage times the markup 1 plus m. So m is a number like, say, 0.2. So the wage is 100, the markup is 20%, they want the price of-- they're going to charge a price of $120.

We can rearrange this in terms of wages, and you can say, well, the firm-- the maximum real wage that firms collectively are willing to pay is really 1 over 1 plus the markup. That's just from that. So then we look at a concept that is important, which is the natural rate of unemployment, and we said the natural rate of unemployment has nothing of natural. It just means that is the level of unemployment when the price is equal to expected price, or expected price equal to the price, you pick.

So all that we did was to replace the wage-setting equation the expected price for the actual price, and then we divided both sides. And now we have this real wage demand by workers, when the price is equal to expected price, and we also had a price-setting equation. We can-- and I said when we replace P e for P, then I get the right to put an n-- superscript n there. That's the natural rate of unemployment. Because that's my definition of the natural rate of unemployment. It's what happens when I can replace in the wage-setting equation the expected price for the price.

And we look at the natural rate of unemployment, which is the equilibrium here of the price-setting equation. It has an implied real wage of 1 over 1 plus m. And that's the wage-setting equation, which is obviously decreasing unemployment because the higher is unemployment, the lower the wage demand by the workers.

And that's one natural rate of unemployment. Again, nothing natural, it's a function of parameters. Which parameters? Well, it's a function of that markup parameter, it's a function of this institutional variable z, for example. So that's an equation. That's an example in which z goes up. So suppose that somehow unions go up or something like that, unionization goes up, something of that kind. Or unemployment benefits go up, something of that kind, which, in principle, is supportive of workers.

Well, in this model, that will immediately lead to an increase in wage demand-- at this level of unemployment, there are going to be a higher demand of-- a higher real wage demand by the workers because they have more bargaining power now.

In this particular model, that cannot happen because the real wage that firms are willing to pay is only this, 1, 1 plus m. So in order to restore equilibrium in the labor market, what has to happen is unemployment-- natural rate of unemployment will go up, and that will restore equilibrium here because, well, the workers-- the bargaining power workers gain through those benefits in z they end up losing by an increase in the equilibrium level of unemployment. So that's the reason here this stuff backfire in a sense-- to the workers because you end up with higher natural rate of unemployment.

So Europe, for example, has much higher labor protection than the US. Well, they typically have a much higher unemployment rate than the US. So that trade-offs, all these things. That's the case of increasing the markup, and increasing the markup means effectively that the firms are going offering a lower real wage.

Well, at this level of unemployment, workers are not going to take that lower real wage. So what will have to happen for workers to take that lower real wage is for unemployment to rise. So those are the two canonical experiments you can have here. It's what happens when markups go up. And that can go-- they can go up for the wrong reasons. It could be for oil shocks and stuff like that. It could be because the market becomes less competitive or it will be used to [INAUDIBLE] and so on.

But the final outcome here is that we end up with a higher natural rate of unemployment, which, again, highlights the idea that this is not a God-given unemployment rate, so it's not-- it's not good in any sense, it's just whatever it is the equilibrium.

OK. Anyway. So you should understand well what these two type of shocks do to the natural rate of unemployment. And I think that's-- because lecture 9 is not for this quiz. That's all I want to say. Any questions? No? So-- oh, yeah.

AUDIENCE: [INAUDIBLE]

RICHARDO CABALLERO: Yeah. This?

AUDIENCE: I think so. I think-- is that the same x as next to the--

RICHARDO CABALLERO: Yeah. This is the credit spread.

AUDIENCE: All right.

RICHARDO CABALLERO: You want me to explain this--

AUDIENCE: I just want to make sure it's credit spread.

RICHARDO CABALLERO: Yeah, this is the credit spread. I said-- that's the way you calculate this credit spread here. It's-- remember, there are two reasons why-- you really want to know? In any event, let me say.

So there are two reasons why the credit spreads really happened. One is the actual probability of default of a bond, which the Treasury has a very low probability to default. Corporations, depending on the ratings, they may have a high or low. And the other one, which is very significant, is how risk-averse investors are. And that risk aversion changes a lot over the business cycle.

We capture everything through just that x spread, which we capture through this probability of default. But you can think of that probability of default as being the perceived probability of default. When you're very scared, you perceive that terrible things can happen. So it's a subjective probability of default. So when that probability of default is different from 0, then you start getting a positive spread.

AUDIENCE: How impactful is the actual default? I know there were some recent defaults in at least the European real estate markets.

RICHARDO CABALLERO: Yeah.

AUDIENCE: Like how-- I guess, is there a difference between a fear of a default and like an actual default, like the implications--

RICHARDO CABALLERO: Oh. This is all about perceived risk. So because this determines the borrowing that firms can do-- the cost for firms of borrowing. If you already defaulted, you cannot borrow, so that's over. That has other consequences. It may have impact on the balance sheets of the banks, it's destruction of wealth, it may lead to other problems. But the problem we're highlighting here in this model is the cost of borrowing, and that is something that happens only before you default.

Yeah. I mean, actual defaults, especially typically in developers and stuff like that, can-- and that's what happened in the Great Recession, it can have consequences, especially for the banks that typically lend to these developers and so on. But I may do something about financial crisis, but much later in the course at the end. OK. Well, good luck. Enjoy it. If you understood what I said today, you're in good shape.