[SQUEAKING] [RUSTLING] [CLICKING]

RICARDO CABALLERO: So today I'm going to talk about the Phillips curve and inflation. Now as I said in the previous lecture, the material that is specific to this lecture will not enter this quiz. It's the beginning of what is perhaps the most important model you'll see in this class, but it will take us three or four lectures to develop.

So I'm going to say things that certainly will-- may help you understand a little better the previous lecture, so if you're only concerned about the next quiz, there will be a sort of small review of the previous lecture here. But again, anything that is specific to this lecture and was not in the previous one won't be part of this quiz.

So what is this Phillips curve? Well, in 1958, an economist at LSE, London School of Economics, came out with just an empirical relationship. This is AW Phillips found that using historical data for the US, I think he did, there was a negative relation up to the '50s, I think. There was a negative relationship between the unemployment rate and the rate of inflation.

And then our very own Paul Samuelson and Robert Solow labeled this relationship the Phillips curve in honor of AW Phillips. And nowadays, it is a central concept in macroeconomics, and it's certainly very, very relevant to understand what is going on right now, not only in the US economy, but in most economies around the world.

So let me show you this is not the one that Phillips plotted. I think this is the one that Samuelson and Solow plotted. For data from between 1900 and 1960 for the US, you find this negative correlation. I think it's reasonable, this negative correlation between the unemployment rate and inflation rate, no?

At very low levels of unemployment, you typically see very high levels of inflation. Conversely, very high levels of unemployment, you tend to see low levels of inflation or even deflation. In fact, this period includes the Great Depression, for example.

So that's the data. And again, this was just an empirical regularity. But we can build some theory about this relationship using the ingredients-- most of the ingredients that-- I mean, essentially we can build a relationship that is downward sloping from the ingredients we already have. And this is the part that is a little bit of a review of the previous lecture.

Remember that we had a-- actually, the previous two lectures. We had a wage setting equation, W equal expected prices, and then a decreasing function of unemployment and an increasing function of this labor market supporting institutions, or workers supporting institutions. Institutional variables, I should say.

And then we had a price setting equation, which was simply the wage marked up. m is a positive constant. So let me start from these two. So what I'm trying to do is derive a Phillips curve. Again, this was only an empirical relationship.

But it turns out that even with theory, we knew by the time of Samuelson and Solow we could come up with a theory of that relationship. And that theory builds on the ingredients we have been looking at. So these are the wage setting equation, the price setting equation.

I'm going to just simplify things and assume that this relationship here, this function, F of u z, is some linear function, at least locally linear function, which is decreasing in unemployment and increasing in z. Why is it decreasing in unemployment?

This says no, that if unemployment goes up for any given expected price, wage demand is lower. And that's essentially because for the worker, it's sort of-- becoming unemployed is a scary situation. Conversely for firms, it's easier to find a worker and-- so we say a worker is scared for two reasons.

One is that it's more likely that he gets fired when unemployment is high. Typically, that's a recession. It's also like-- that worker knows that if she were to fall into the unemployment pool, it will take a longer time to get out of it.

And the firms are seeing the opposite side. It's pretty easy for them to replace a worker if they were to dismiss a worker, because there's lots of available workers in unemployment. So that's the reason that's negative.

So I'm going to stick this function back in here. And then I'm going to replace this W with this function in there in the price setting equation, and I end up with an equation for P. So this says that the price, given the expected price, is decreasing unemployment, and increasing in z, and increasing in the markup.

So again, why is this price decreasing in unemployment? This is the part that is review of the previous lecture. Previous two lectures.

STUDENT: Because when wages go down, and then factors of production are achieved.

RICARDO CABALLERO: OK, perfect. Because wages go down, since our firm needs one worker to produce one unit of a good, then the cost of production of one unit goes down with the wage and therefore the price goes down. Because the firm is asking for a constant markup over that wage, the wage declines, and the price drops.

Good. So that's all review. So this equation, you have seen just without an explicit functional form here. What I want to do is to go from here-- this is still not the Phillips curve. Remember, the Phillips curve was a relationship between inflation and unemployment.

Here, we have a relationship between the price level and unemployment. So we want to take one derivative higher. We want to go to relationship between inflation and unemployment. Inflation is the rate of change of P, no? It's not the level of P.

So to do that, all that we'll do is-- so this, when I don't have a subscript here, I mean the price at time t, And this is the expected price for next period. That's what you have. But today, for the next period.

What I'm going to do, I'm going to divide both sides by P minus 1. By that, I mean the price in the previous period So both sides. I'm going to divide this side by P minus 1 and this one by P minus 1.

So I get that expression. That's exactly the same equation we had before. All that I did is I divided by P minus 1. Remember what this means.

So if this is the price for January 2023, this is the price for-- say, what, we're using annual data for January 2022? So I'm dividing by the price of January 2022 both sides.

Now notice that-- remember that P over P minus 1 is equal to 1 plus the inflation rate. Remember where inflation rate is just P minus P minus 1 over P minus 1. So this is just straightforward algebra, no? Remember our definition of inflation.

That's P minus-- that's inflation. So 1 plus pi is just P minus-- over P minus 1. And that's what you have there. I can do the same for expected inflation.

Notice that sometimes, people get confused. But expected inflation is equal to P expected, not minus P expected minus 1. It's P minus 1. P minus 1.

And the reason I'm not subtracting the expectation here is because at time t, which is when you're forming that expectation, you already know what happened at t minus 1. So that's the reason this is expected inflation. I don't need to put expectations in here.

So that's pi e. And so what we get is I can replace this guy here for 1 plus pi, this guy here for 1 plus pi e, and I get the following relationship. All that I've done is substituting this for that, that for that.

So that's our price setting equation now expressed in terms of inflation rates and expected inflation rate. And now, we're not in Argentina, we're in the US, expected inflation are small numbers. And the log of 1 plus a small number is approximately that number.

So I'm going to use this approximation, which, again, is valid for x small. And so I can replace this 1 plus pi for pi and this 1 plus pi e for pi e, this 1 plus m for m plus, and this term here, if these numbers are not too large, again, plus minus alpha u plus z. And I do all that and I end up with this expression.

All I've done is I took logs of these. So I get log of 1 plus pi equal to log of 1 plus pi e plus log of 1 plus m plus log of 1 minus alpha u plus alpha z. I'm saying if pi, pi e, m, alpha u, plus z are not very large numbers, which we will assume, then this is approximately right. So I can rewrite that expression as that, approximately. I should have put in approximately.

So now we have something that looks a lot more like the empirical relationship we were talking about. We have a relationship between inflation and unemployment. So this says that for any given expected inflation, and markups, and labor market institutions, higher unemployment means lower inflation.

And why is that? So that curve tells you, that's the negative relationship we wanted, no? It says, higher unemployment, lower inflation. Why is that?

Look, you heard it very clear when we talk about this, no? You understood very clearly why an increase in unemployment lowered the wage. You understood very clearly why, therefore, an increase in unemployment lowered the price.

I haven't done anything but algebra in the two steps. So the same economics behind the explanations that you had before apply to this curve here. So the reason inflation will be lower when unemployment is higher, given all the rest, is because it will be less wage pressure. Workers will demand lower wages.

That means lower prices, and therefore inflation will be lower. The economics doesn't change at all. I only divided both sides by P minus 1 and I took the logs and I approximated it. So the economics has not changed. I just did a little bit of basic math.

So all-- what I'm trying to say is all the intuitions that you can already-- you already had from the wage setting, price setting equation and so on, you can apply to the Phillips curve as well. Good. So now we have something that, in principle, could explain the type of relationship that Phillips found and then Samuelson-Solow corroborated with extended data.

Let's see. How do we get to something that looks like what these people run as a regression? Remember, they ran a regression essentially, or they correlated inflation with unemployment. And they found a downward sloping relationship.

Well, look at what happens here. Suppose that we assume that the expected inflation is equal to some constant. In economics, we say when that's the case, and especially if pi is a low number, inflation expectations are well anchored, meaning any single year, there can be a price of oil is high, or something happens and inflation will deviate from that. But people are all the time expecting for inflation to go back to what is a normal level.

Nowadays, or at least a few years ago, in the US, the normal level was around 2%, say. So people say, well, this year inflation was 1.8%, but we expect next year 2%. The next year, we got surprises on the upside. Price of food went up, or something like that, we got inflation of 2.3%. But you ask people how much you expect for next year and say, well, 2%.

So that's what a model of expectation like this means. It's that you're always expecting something which is some historical value and that we have agreed is a reasonable level for our economy or something like that. So you see that if I replace expected inflation for a constant here by bar, then I have-- then my Phillips curve is really this. It's inflation, then I have a constant minus alpha u. That's the simplest of the downward sloping relationship I can have. That case is a downward sloping line. That's it.

Of course, it could be nonlinear and so on. But this captures the essence. So that's a theory for why Phillips was finding what he was finding.

Our theory of the wage of the labor market, if you will, and the price setting behavior of firms gives us a Phillips curve of the kind that he had in mind. And if you look in the '60s in the US, then you see this negative relationship that eventually became steeper.

So it wasn't linear like this. It was a little convex, but it's downward sloping. And in fact, to some extent, our very own Bob Solow and Paul Samuelson were advising the US government at the time and they said, well, let's exploit this stuff a little.

We like to have lower unemployment. We can live with a little more inflation, but we know that it's a negative trade off. It's a negative trade off between these two things. So if we'd like to lower unemployment, it's fine. We get a little more of inflation.

And initially the deal was very good because this curve was very flat, you see? So you could cut unemployment a lot-- you can see the dates here. You're cutting unemployment a lot and you're not getting a lot of inflation.

Eventually, the deal turned into a much rotten deal-- much more rotten deal, because then to lower a little bit more unemployment, we start getting a lot more inflation. So people, for a while, were OK with this model, assuming that inflation was low. But when they realized that this thing was being exploited, then they began to change the expectations they made.

I think that's what we had here. But the region held pretty well during this time. And again, it became steeper and steeper as we pushed it more and more towards very low levels of unemployment.

So that's the story. But again, there is your model of the Phillips curve. And that is a very good model for the times where Phillips also estimated his Phillips. Now if you turn the page and look at the same data in the '70s, look how it looks.

So from 1970 to 1995, that's the data you have there, there is no negative relationship. I think it's all over the place. So had Mr Phillips been born a few years-- a few decades later and had he estimated his regression, he would have found nothing.

There would be no curve in his honor, at least he had run that same regression. Maybe he would have run a different regression. But nothing.

OK, so what happened? Well, our theory can explain as well what happened there. Remember the theory is not that inflation is equal to a constant minus alpha u. The theory says this is a constant only if the mode of expectation is this constant.

But if the expectation is moving around, or if anything in this constant is moving around, then there is another source of variation. For example, what happens-- suppose you are here in 1965 and all of a sudden, you get-- the price of oil goes up a lot. And I'm telling you, capture the price of oil with an increase in m. Firms need to mark up things more in order to cover higher energy costs.

Well, look at what m does. m says that for any given level of unemployment, now I get higher inflation. That's what an oil shock does, no? You get an oil shock, then for any given level of unemployment now, you find yourself with more inflation.

So that moves you in the opposite direction. It moves you up there. And that's one of the reasons for these points around here. We got lots of inflation because we got massive oil shocks during the '70s and early '80s.

We had wars in the Middle East and so on that led to those shocks. So that was one of the reasons we got shots here, to this term here. And that sort of muddied the relationship. But the other reason, which is more interesting, I think, and that you already began to see that something was happening here is that as inflation went up, people stopped believing in this model. So the expectation formation mechanism changed.

So this guy began to react to endogenous variables. And I'm going to explain more precisely why. So that's what we mean by expecting inflation became deanchored. It was no longer anchored around this constant of 2%, but it became deanchored. It began to follow the data.

So if the data came with more inflation, then people believed that next year, we would have more inflation as well. Not back to 2%, but if we got 5% inflation today, people began to say, well, OK. I don't think that next year-- my best estimate is 2%.

It's probably closer to 5%. So that's what it means, deanchoring. That's what has the fed and most central banks around the world terrified today. Inflation is much higher than 2% and they're very worried about this guy becoming deanchored, or unanchored.

I'll get back to that in a second. Anyway, but let me explain how this expected inflation term works. So let me replace the model of expected inflation for something which is some weighted average of a constant and the most recent inflation.

So this model says, what is my expected inflation for next year? Well, it's an average of this long run target that we have, say, 2%, and whatever was the most recent inflation. If theta-- in the model I showed you before, the one that applied to the '60s and so on-- up to the '60s had essentially theta equal to 0. So this guy didn't show up there and expected inflation was very well anchored.

What, what began to happen as we began to move that way and then we got hit by oil shocks, so people began to see much higher inflation numbers than they were used to, then this theta began to increase. So people began to change the model of expectation and began to think that the inflation was going to be more persistent than they used to think in the past. So high inflation today means high inflation tomorrow.

That's what it means more persistent. In the past, it was high inflation today. That was a backdraw. We'll go back to the normal long run average.

Now that's no longer the case. And so if I replace this more general model of expected inflation here in the Phillips curve, I get this expression, which now has this extra term. So we used to have theta equal to 0. But during the '70s and '80s, and even early '90s, actually that theta got to be very close to 1. You estimate these models, you get that theta was very close to 1.

And look at what happens when theta gets very close to 1. So when theta is 1, literally, then the best forecast for inflation is the previous inflation. So this year is 5%, and I think next year is 5%. Not 2%, 5%. If this year is 7%, I think next year is 7% again.

And so if you do that, then my expected inflation becomes lag inflation by t minus 1. So if I replace the expected inflation for pi t minus 1, I get to this Phillips curve, which I can rewrite as the change in inflation-- as a relationship between the change in inflation and the level of unemployment.

So now what you have is that if unemployment is very low, then inflation is picking up. It's going-- so if inflation-- if unemployment is very low, not only the inflation is high, but it's also growing over time.

That's the reason sometimes people refer to this formulation of the Phillips curve as the accelerationist Phillips curve, because now it's the relation between unemployment and the change in inflation. And if you estimate this Phillips curve, this accelerationist Phillips curve on the data I just showed you of the '70s and '80s, you get a much better relationship.

You still have the oil shocks that mess things up, but you start recovering this negative relationship. But again, it's between the change in inflation and the level of unemployment. And that's a very scary situation for the central bank to find itself in, because it's very easy for things to escalate.

So by the mid-90s, we had reanchored expectations. There were very aggressive policies to control inflation by Paul Volcker in the US and it was imitated around the world with some lag. But inflation became reanchored. So we went back to this theta equal to 0 type model. The expected inflation in the US-- the target inflation of the central bank was around 2%. That became what people expected for the next year and that reanchored-- so we went back, in other words, to that Phillips curve.

And that's what central banks want to be at. They want to have inflation expectations very well anchored. And they were very successful after the '90s. And so we got into again-- now look. And now I'm not running the accelerationist-- I'm again running inflation against unemployment and you again see this downward sloping relationship.

So that was very good news. It was a great success of monetary policy during the '90s and later was the reanchoring of expected inflation again all around the developed world, and many of the-- even Latin America. Many economists in Latin America reanchored their expectations, Asia, and so on. So it was a good time for central banks.

So the next thing I want to do, this will connect more with the previous lecture, and it's the last thing I want to say for this lecture, and I may start the review afterwards, is that I want to connect now this Phillips curve with something we discussed in the previous lecture, which is a natural rate of unemployment. Because that's the way you typically see the Phillips curve written and that's also the way that when Chairman Powell is talking about the labor market tightness and so on, he's not talking relative to m, and z, and things like that. He's talking relative to what is called the natural rate of unemployment. So I want to go from a Phillips curve that looks like that the one that has the natural rate of unemployment in there. And so that's the last step in this lecture.

So remember the definition of the natural rate of unemployment? What was the definition of the natural rate of unemployment? Was it the unemployment rate that God gave us, any God? No. It had a very precise meaning for us.

And remember, we used exactly that model to figure it out. Remember? We saw-- actually, we saw the natural rate of unemployment from something like this. I think we had-- the function is still generic function F of u z, but we solved from an expression like this.

And we said, under one assumption, we can call this u, un, the natural rate of unemployment. What was that assumption? And that's the only thing--

STUDENT: The price is equal to the expected price.

RICARDO CABALLERO: Expected price is equal to the actual price. So we said, if this is equal to that, then you solve out the natural rate of unemployment. And that's the only thing that natural rate of unemployment means, simply that when the price is equal to the expected price.

But if the price is equal to expected price, what else is equal? And I pointed at the right expressions.

STUDENT: [INAUDIBLE].

RICARDO CABALLERO: Inflation is equal to expected inflation. So I can use the same logic I used here for the natural rate of unemployment using the Phillips curve. I can say, OK, I can solve out for the natural rate of unemployment here simply by setting the expected inflation equal to actual inflation.

And if I do this, I can solve for the natural rate of unemployment from here, un. I mean, I'm going to give-- I'm going to put the superscript n here when you let me replace pi for pi. The fact that I replaced this pi e for pi is what allows me to put the superscript n there. Call it the natural rate of unemployment.

And now I can solve it. Well, obviously that cancels with that and I can solve the natural rate of unemployment, and it's equal to this function here. So why is the natural rate of unemployment increasing m? A question like that can come up in the quiz.

I'm not going to use the Phillips curve to ask you, if I ask you about that. But I can ask you that. What happens to a natural rate of unemployment if m goes up? You know that un will go up, but what is the mechanism?

So why does the natural rate of unemployment go up when the markup goes up? Yep.

STUDENT: [INAUDIBLE] our main cause and we just have to go down, right?

RICARDO CABALLERO: I mean, another way of saying it is that the firms are not willing to pay-- they want to pay a lower real wage. At the original level of unemployment before the change in m, workers would not take that lower real wage.

It's not an equilibrium real wage, because workers say, no, no. At this level of unemployment, we need a higher real wage. So the only way to restore equilibrium in that model we had was to increase unemployment, because that will lower the bargaining power of workers, and they will end up accepting the lower real wage that firms are willing to offer now. So that's the reason and we get this markup effect.

z is same logic. It's a little easier to see it there, but z means, well, at any given level of unemployment, an increase in z means workers want a higher real wage. Firms are not willing to pay a higher real wage. So you have to bring down the real wage and workers' demand, and the only way that can happen is with a higher unemployment. That's the reason the natural rate of unemployment is also increasing in z.

And now the last step. The last step is to-- you see, I can go back to my Philips curve, say that. And I'm going to replace m plus z for alpha un. I can do that, you see? I can replace this m plus z for alpha times un.

How do I know that? Well, m plus z, z is equal to un times alpha. We can replace in the Phillips curve m plus c by alpha un and I can therefore rewrite the Phillips curve in the following form. Inflation is equal to expected inflation minus alpha times the gap between the unemployment rate and the natural rate of unemployment.

So when Chairman Powell is worried about labor market very tight, what he's saying is, well, unemployment is likely to be below the natural rate of unemployment. Because if unemployment is below the natural rate of unemployment, that's putting upward pressure on inflation.

So that's a-- so that's what he means. This gap is very important for macroeconomists, and certainly for central bankers that are very worried about inflation, that gap here. Problem is, is this is a difficult object to estimate. So you have to have estimates.

The truth is that it's very difficult to know what it is, although there are estimates out there, and I'm going to show you one. You notice that something is wrong when this guy starts speaking up. It's a little bit the other way around.

The US, in fact, had the opposite problem before COVID. It's that somehow, unemployment was very low, relative to historical levels, but inflation was not picking up. So that was implicitly telling us that for some reason not fully understood, the natural rate of unemployment was declining.

So here is one picture that looks-- is one estimate. Again, I don't trust any particular estimate, but it tells a story. That's one particular estimate of the natural rate of unemployment in the US, that blue line. And what you see in red, the red is the actual rate of unemployment in the US.

So what happens in situations like this? So what do you think was happening to inflation in this episode, which is right after the global financial crisis, or the Great Recession? So what do you need to read here?

Well, the unemployment rate was a lot higher than the natural rate of unemployment. Does that put upward or downward pressure on inflation? Downward pressure on inflation. Unemployment is very high relative to natural rate of unemployment. It's minus alpha times u minus un.

And that's what happened. We had lots of problems with inflation. Inflation was going very low. We even had negative inflation there, a little deflation for a while. So that was the problem.

Here is the period that I described before. It's a little mysterious, because we went-- unemployment went below what we thought was a natural rate of unemployment and inflation wasn't really picking up a lot. At the end, it began to pick up a little. But it wasn't picking up a lot, and that was a little bit of a mystery.

Now we're in this situation here, which we have extremely low unemployment and very high inflation. So I think this captures well the situation right now. We have a negative gap between unemployment and the natural rate of unemployment. And that's the reason that's putting a lot of pressure on inflation.

We also have other things that are putting pressure on inflation that come from the supply side of the economy and so on. So that combination is pretty bad for the inflation outcomes and outlook as well. So that's where we're at.

We're going to talk a lot more about this, because this is what is going on right now. Any questions about that? Otherwise, I want to start sort of reviewing things. Although, I don't know-- any question about this? Yeah?

STUDENT: Is the only way to fix it this direction to increase unemployment?

RICARDO CABALLERO: Sorry?

STUDENT: Is the only way to fix, I guess, the inflationary--

RICARDO CABALLERO: Well, that's a very good question. That's a very good question. I'm trying to decide what to answer it with what we have.

There are two views at this moment. There's one view that says there's no way around that. Just look at this curve.

It says, look, there is no way around that. That's the reason we need a recession. Because otherwise, we're not going to control inflation. A recession means high unemployment. That's one view.

At this moment, it's becoming the dominant view. It has gone in cycles. But at this moment, it's the dominant view.

There is another view, which is the one that the central bank, the fed adopted for a while that said, well, this is not the only indicator of tightness of the labor market. There is other things as well. And those indicators are moving in the right direction.

And so we may be able not to create a big mess here because these other factors are moving in the right direction. Some of those factors are, as I said, other measures of labor market tightness and hiring, the flows. Remember I showed you flows between employment and unemployment, out of employment, and so on? Those flows look extremely tight and now they're improving. So the gaps in those dimensions are better.

And the other one is there was a big cost push component, which is what I said before. The supply chains and so on created extra inflation, abnormal inflation, like increasing markups. m was very high. And some of that is subsiding as well.

So there are dynamics that suggest that inflation is declining even without unemployment. But I would say the median voter in this space of forecasts, of inflation and so on thinks that we will need some adjustment through this part as well. My main concern-- I think that the path the fed is forecasting is feasible, but a very narrow path. I mean, it may happen.

And to me, whether they're successful at not creating a big mess here, I mean bringing unemployment very high in order to bring inflation down, has a lot to do with whether somehow we manage to keep expected inflation anchored. And there was some evidence-- I think I said that a few lectures ago. There was some evidence that in the summer of 2022. I'm from the Southern hemisphere, so I get always confused with summers and so on.

So in the summer of 2022, US summer of 2022, inflation was becoming very unanchored. This guy, one year expected inflation was creeping up to 6%, and that was very scary. Because think what happened. If you get expected inflation at 6%, then it's not enough to bring an employment to the natural rate of unemployment to get inflation back to the 2% we like, because you need to bring expected inflation down now. And that means you need to bring the unemployment rate very, very high in order to re-anchor expectation. So that's a very scary situation.

They were very persuasive, though, at the end of the summer with very hawkish speeches and so on. And they managed to re-anchor expected inflation. Expected inflation very quickly came down to 2%, 2.5% one year out even. But now it has been picking up again and now we're around 3% again. So it's a little scary where we are.

So to me, this is going to be very important in that. So if inflation keeps lingering around 6% and so on, and eventually, expected inflation becomes unanchored, then there's almost no way around but to have a recession to get out of that. If that doesn't happen, if they succeed convincing people that they're very serious about this stuff and they re-anchor expected inflation, then we don't need to create a large recession.

Still, they may create causes because accidents happen, but they don't need to. But they will need to if this guy gets unanchored. Actually, maybe I can use even this expression here to explain what I'm trying to say.

And I realize that again, this is material really for the next lecture. What I'm trying to say is that if they manage to keep this theta very close to 0, then in order to bring inflation back to their target of pi bar, 2% or so, all that they really need to do is to bring unemployment to the natural rate of unemployment. So they only need to really fix this gap.

They need to raise unemployment so it closes that gap. But it's a small change. That is, they succeed keeping expected inflation at around 2%. If they don't, suppose that theta becomes very far from 0. Then we have a problem. Because then expected inflation is above the target, no? Because we have 6%.

So suppose that is equal to 1. We have 6%, then expected inflation is 6%. That means that if your expected inflation is 6%, then in order to bring the inflation-- if you bring unemployment just to the natural rate of unemployment, so the red line to the blue line, you haven't made a lot of progress. All that you have done is you have brought down inflation to 6%, which is expected inflation.

So if you have expected inflation of 6%, you need to bring unemployment much higher than the natural rate of unemployment in order to bring inflation back to the target of 2%. That's the reason I say to me, the fight will be-- the battle will be won or lost on that term there. Yep?

STUDENT: How much of this current inflationary pressure is caused by unemployment and how much of it caused on the supply side? Because it feels like a lot of the stuff, like CPI going up, energy prices going up, how much can the fed control something like that.

RICARDO CABALLERO: Well, it varies at different places around the world. But in the US, for a while, a big component of the inflation was all that stuff, bottlenecks in the ports and stuff like that. That's almost all gone. There's very little of that left.

So now it's aggregate demand. People feel very rich for a variety of reasons. They're spending a lot, and that's the reason unemployment is very low. It's not unemployment per se, it's just that aggregate demand is very high. And that translates into very low unemployment and that feeds into inflation this way, through wages and so on.

But in the US, the component of aggregate demand is much larger than in Europe. In Europe, those supply side factors are much more important. So around yeah, the summer of 2022, you could say both Europe and the US are about the same amount of excess inflation. We're hold with around 10% inflation. But in the US was 2/3 excess aggregate demand, while in Europe was 2/3 problems on the supply side, especially because of the war and stuff like that.

But for the US today, it's mostly an aggregate demand problem. We're not going to get a lot of-- obviously, if the war stops, that's going to help. But it's not going to be enough. We need to-- just the economy is too hot. It's too much aggregate demand out there. That's the fundamental problem.

STUDENT: Can you explain again why an increase in z would increase the natural rate of unemployment?

RICARDO CABALLERO: An increase in z? Yeah. So for that, the base is the previous slide diagram, but remember what z does. Actually, let me go to this equation here.

So we can figure it out in these two equations here. If z goes up, that means for any given level of unemployment, unexpected inflation, wages go up. Workers demand a higher wage. But remember that the firms-- sorry.

We're talking about the natural rate of unemployment, so let me replace this Pe for P, first of all. So I'm going to divide W by P on both sides. So I get-- if z goes up, the workers want a higher real wage, because if z goes up, then W over P, I'm dividing by P both sides, goes up. Workers demand a higher wage.

But the firms, from here, you can see that I can divide by P both sides, W over P that the firms offer is equal to 1 over 1 plus m. So the firms are not going to offer a higher real wage. The workers want a higher real wage. The only thing that can restore equilibrium that the workers end up demanding the same real wage as the firms are willing to pay is that somehow, the hands of the worker gets weakened. And the only variable here that can weaken their hand is higher unemployment.

So let me put it all in. So at the natural rate, I know that P is equal to P. So that means the wage setting equation implies W over P equals F u, z. From the price setting equation, I have that W over P is equal to 1 over 1 plus m.

So in this very simple model, this is given. If this guy goes up, these guys want a higher real wage. But that cannot happen because that would be inconsistent with the price setting. So you need to bring down this guy. The only thing that can bring it down is for unemployment to go up. And that's-- at P, we call that a natural rate of unemployment.

STUDENT: Last lecture, we talked about the labor force participation rate. Is there any reason to try and increase that to increase--

RICARDO CABALLERO: Oh, that would be fantastic. Yes.

STUDENT: Is there a policy that [INAUDIBLE]?

RICARDO CABALLERO: Well, I mean there are negative policies as well. z reduction, in a sense, does that, because there was emergency unemployment benefits, an emergency income supplement and so on as a result of the pandemic that are disappearing slowly. And that's very natural, so it's going to bring participation back up.

And it is beginning to pick up. So yeah, you need to incentivize return to work. And now there are some people that there is nothing, that they retire, essentially, or they have health problems and they just cannot return. We lost that.

And the other margin, which is very important, is immigration. So that's a big issue, because immigration, obviously-- we lost, I think in the US-- I'm not a labor economist, but we lost, I think, a flow of the order of 500,000 people a year during COVID. And that's a big chunk of the decline in the labor.

No, what you need is more employment. That's going to-- that puts downward pressure on wages for the same amount of aggregate demand. And that's what you need. But yeah, that's a very good point. We're taking all that as given here.

Remember, we're fixing all that. But if you don't, then other terms start appearing in this expression and so on. Good.

Obviously, I'm not going to start the review. We have only one minute. So in the next lecture, I'll just review the material for the quiz.