Second Thomas Laubach Research Conference
Transcript of Session 5: Financial Market Expectations:
Implications for Policy and Communications
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TREVOR REEVE. Thank you, and welcome back to day 2 of the Thomas Laubach Research Conference. It's great to see all of you back here in the room. Today's focus is on monetary policy communications, and I'm sure it'll be a very engaging discussion. I'm very much looking forward to the conversation. We will try to be mindful of the time. We know people have flights to catch later this afternoon, and so we do intend to end promptly at 12:15. And with that in mind, I will turn it over to my colleague from the Federal Reserve Bank of New York, Roberto Perli. Thank you.

ROBERTO PERLI. Thank you, Trevor, and good morning, everybody. Welcome. So today's topic, you know, is—obviously all the topics at this conference have been extremely interesting. This one is certainly not any less interesting: market expectations, implications for policy and communication. Obviously, the interaction between the two is fundamental to the transmission and implementation of monetary policy. So I very much look forward to what the presenter and the discussant will have to say.

So without wasting too much time, I'm tasked with introducing the presenter and the discussant. Of course, they don't need any introduction, but just so I earn my invitation here. So Ricardo Caballero will present the paper "FCI-plot: Central Bank Communication Through Financial Conditions." So Ricardo, of course, is Ford International Professor of Economics at MIT and MBR research associate. Of course, one of the most prominent researchers in macroeconomics and finance. Many awards. I'll just mention the Frisch Medal of the Econometric Society, the Smith Breeden Prize from the American Finance Association, the Brattle Group Prize for distinguished papers, and the Banque de France Senior Prize in monetary

economics and finance. Fellow of the Econometric Society and fellow of the American Academy of Arts and Sciences. And the discussant—sorry, I should also say at a personal level, I remember my first class in graduate school studying his papers just a few short years ago. [Laughter]

Markus Brunnermeier will be the discussant, and sadly I cannot claim to have studied his paper in grad school. Sorry about that—sorry for me, especially. [Laughter] Sanford Professor at Princeton and director of the Princeton Bendheim Center for Finance. Research, of course, focuses on international financial markets, monetary theory, and macroeconomics. He's president of the America Finance Association, nonresident fellow, the Peterson Institute, research associate at the NBER and several other organizations. He's a long research fellow, fellow of the Econometric Society like Ricardo, Guggenheim fellow, and he is a recipient of the Bernacer Prize granted for outstanding contribution in the fields of macroeconomics and finance. So without much further ado, Ricardo, why don't you come up here? [Applause]

RICARDO CABALLERO. Thank you, Roberto, for the kind introduction. And good morning, everyone. I hope you're well rested. I'm about to hit you with a model. [Laughter] So thank you also to the organizers for having pushed us into thinking about the communication implications of our work and the interactions between risk markets, financial markets, and monetary policy. This is a joint work with Alp, who is sitting somewhere there, and we have a sort of long agenda and long history of collaboration.

So let me get to the question immediately and do so by quoting Chair Powell saying in Jackson Hole, 2018, "Our communications with financial markets are a critical component of monetary policy transmission—markets take our words as signals for future moves, so ambiguity is the enemy of stability." So communication very clearly with markets in particular is a very

key pillar of monetary policy. Now, that raises a few—there are a few questions we want to address here. In particular, there are three questions we want to address here. The first one is, what specific advantages does enhanced communication with markets provide for monetary policy effectiveness? The second question is, which communication strategies best deliver these benefits? The third question, how should central banks manage frequent disagreements with market participants?

We answered these questions with our comparative advantage, which is a model. And the answers of the models are as follows. For question 1—what are the advantages of enhanced communication?—it's two advantages. One, it reduces market misunderstandings of policy, what we call tantrums for obvious reasons. And then, second, it recruits sophisticated market participants to insulate financial conditions from the prevalent noise that we see in financial markets.

The answer to question 2—what are the best communication strategies?; and here is a proposal—is FCI-plot. So it's a plot of financial conditions—that is, central banks should communicate the expected desired path of financial conditions rather, or in addition to—but it could also be rather—than the expected policy rate. Second piece of component is something very dear to Ben is scenario-based FCI-plot—that is, communicate how the central bank would adjust financial conditions across different economic states. What about how to manage disagreements with markets? Well, you can't manage them. They're informed and opinionated. You're not going to change their views. So the goal is not persuasion. It's to achieve and agree—what we call in theory agree-to-disagree equilibrium, where markets understand policymakers' views and help to implement them despite different views.

So I'm going to follow the presentation more or less the roadmap of the paper. And we start with a few motivating facts that inform the assumptions, the key—the pillars of our model. And we are—the facts are eight facts. I'm not going to have time to discuss all of them here, but let me mention them at least. First, monetary policy transmits through financial conditions. Second, financial conditions are primarily driven by risky asset prices. Third, financial conditions are noisy and cause macroeconomic fluctuations. Fourth, monetary policy affects financial conditions beyond interest rates—through channels beyond interest rates. Fifth, lags and unobservables make monetary policy belief dependent. Sixth, central banks already have views about desirable financial conditions. Seventh, markets disagree with central banks and therefore perceive policy "errors" where the codes are there to represent, that is, the perception of the market—it does not really need to be an error, but it's a fact of life for central banks. And, eighth, markets are uncertain about financial conditions, even conditional on the economic outlooks they may have.

So for the first fact, let's use some quotes. So monetary policy transmits through financial conditions, quoting, again, Chair Powell, who says, "Our policy decisions affect financial conditions immediately. . . . Then, changes in financial conditions begin to affect economic activity . . . within a few months." Okay? So it's all in the transmissions through financial conditions. Keynes had a very similar view many years earlier: "There are not many people who will alter their way of living because the rate of interest has fallen from 5 percent to 4 percent . . . Perhaps the most important influence depends on the effect of these changes on the appreciation or depreciation in the prices of securities."

Now, when you construct an index of financial conditions, what you're trying to do from the point of view of monetary policy is, all these indices are weighted average of different asset

price returns, recent returns. And the question is, how to weight them? And the typical weighting mechanisms, the desired weighting mechanisms, is by the impact they have on economic growth over the next year or so. And of particular interest to us is one index that is constructed in-house, okay, that essentially uses the Fed's models to assign this weight. So it uses input responses, the different MPCs that you have in respect to stocks, housing and so on and so forth, the different dynamics—they weighted them and they construct this index. All these indices are measuring yield space. So going up means tightening, going down means loosening. And you see there two things that we want to highlight. The first one is that the bulk of the volatility of this financial conditions index—again, because it's consistent with the Fed's model—comes from equity market fluctuations and exchange rate fluctuations. Then housing, together with mortgage trade, play a role, but rate-type things play a much more secondary role. And this is—this index in particular is constructed with a three-year backlog. So it's not really the intraday volatility that is playing in this, it's really the accumulated effect of fluctuations in this risky asset prices.

Now, once you think that risky asset prices are going to play a very important role in financial conditions, which is what ultimately determines aggregate demand, then the first question you have to ask is, well, does this noise matter for things that the Fed cares about? And we addressed that question in a previous paper together with—Alp and I, together with a fantastic student at MIT, Tomas Caravello. And there, what we do is the following. We use a typical sort of large VAR or the kind that is used for monetary policy analysis, we expand it to include financial conditions, and then we instrument shocks to financial conditions by a noise measure indicator that comes from flow of funds. So that tries to isolate macro fundamental reasons, isolate sort of the quantity movements, supply and demand effects that come from

idiosyncratic reasons, and it studies how that VAR behaves once instrumented by that particular instrument. And what you see there is simple response to a financial condition shock so instrumented, and it looks very much like a canonical aggregate demand shock. You see output gaps rising, you see inflation going up, financial conditions as a shock—so, obviously, it's loosening—and you see monetary policy responding to it with a delay, okay? But also in that paper, we document—and we're trying to bring that number down, to tell you the truth—we document that about between 30 and 50 percent of the forecast variance of output gaps one year out is accounted by this kind of shocks, okay? So it's a large contributor to this.

In the second study, which is more recent, and that's what you see in the right panel, you see two things. You see in the dash in the top panel, the dotted line is the FCI-G index that I just showed you. And the second one is an index we construct, what we call FCI-star, which is the equivalent of *r*-star, but in the FCI space, okay? And what you see there is two things. One, you cannot see it there really, but this index is moved primarily by macro factors, not financial factors. Unlike realized financial conditions, which is really driven a lot by financial market–type activity. And that's what you see that—sometimes you see very big gaps between these two measures. And these very big gaps within these two measures, realized financial conditions and FCI-star, is sort of very closely linked to output gaps. So it's very closely linked, and that's what you see in the bottom panel. The blue line at the bottom is the output gaps we extract from the model we have. And what you see at the top is this gap—the difference between these two curves is the gap between the two of them.

So, third point that I want to highlight is something that we know at least since Bernanke and Kuttner is that monetary policy affects financial conditions through many other channels distinct from interest rate itself, from applications of interest rate. There's a very nice recent

survey by Bauer et al. in which there is a very long literature that follows Ben's paper that essentially summarizes that it's very clear that monetary policy affects risk appetite in a very significant way. There is a very nice recent paper by Boehm and Kroner—the figure comes from that paper—which construct this fake non-yield shock. It says, whenever there is a monetary—high-frequency monetary policy surprise and we observe sort of a big fluctuation in S&P and on currency or the dollar, how much of that can you explain with the interest rate response to this monetary policy surprise? And the answer is "very little." So a lot of the impact of monetary policy on financial conditions comes from effects that monetary policy has on factors other than the interest rate itself.

Next fact is that markets routinely disagree with central banks. What you have there is, you know, the path of the federal funds rate, and what you have in the left panel is the difference between the forecast for the federal fund rates in the Greenbook/Tealbook and the forwards, okay? And you see that sometimes you open pretty wide gaps that you cannot account with risk premium and stuff like that. And the right hand is just a median dot rather than the Greenbook/Tealbook forecast, but you also see this big widening. And on the right panel, you see the difference between Greenbook, and we plot those gaps, the path over time, against the gap that is between Greenbook and Blue Chip forecast for inflation one year out. And what you can see that it's very clear that this disagreement have a lot to do with difference in the outlook that markets sometimes have relative to the Fed.

Now, naturally, once you have disagreements, the markets begin to perceive errors. So this terminology, "you're behind the curve," and all this stuff, is really things that comes from these disagreements. And, again, we use the quotes because it does not need to be a true error,

but it's a perception that errors are there, and that's something that can add volatility to financial markets.

And the last fact that I want to highlight that also uses Julia's data—but don't worry, I like Julia, I'm not going to insult you here. So what you have there in red is the FCI-G plot that I already showed you. And then in blue is sort of the consensus. The average—what they do is they survey market participants, and they ask them, what is your forecast of financial conditions one year out? And what you see there is that sort of the consensus is—has predictive power. You can see that they predict what financial conditions will do ahead.

More interesting for us, though, is the big dispersion that there is among respondents. And that's what you see in the two standard deviation bands there. There's a big difference of opinions in markets about what financial conditions will be one year out. Now, the table, the first column of the table shows you that that big difference has very little to do with macroeconomic forecasts, because the same participants also give you forecasts about unemployment, about inflation, and so on. And you can explain very little of the divergence with those factors. Unlike the second column, which shows you interest rate and the forecast of interest rate, the path of the forward, and there there's a lot of explanatory power. You can explain a lot of what the difference that people—opinions that people have about future interest rate has to do with the different opinions they have about the path of unemployment and the path of inflation. So that means markets don't understand very well when the Fed talks about monetary policy. Where do you want to steal? What is your scenario analysis? What will you do—try to do with financial conditions? Try at least, whether you will be able to do with financial conditions if conditions were to change.

So armed with those facts, we try to build a model that is consistent with those facts and try to study the communication implications of that model. So let me try to sketch the model. First, it's very—the top is very New Keynesian, very traditional. It has, you know, aggregate supply, aggregate demand, and aggregate demand is driven by financial conditions. That's the driver of aggregate demand. Financial conditions are determined in markets, and markets have arbitrageurs—rational agents, if you will—and noise traders. There's a lot of reasons why markets experience volatility. And this Fed, unlike fiscal policy, doesn't have direct access to households. It has to go to households through financial conditions. And for that, it has tools of monetary policy and communication. Now, importantly, arbitrageurs, or the rational face of the market, may have different views from the central banks. They maybe believe disagreements. And that's when communications plays a big role.

Now, let me add a few equations because it will be easier to explain what comes next. Don't worry, there won't be a lot of equations. So just to give you the structure of the model, aggregate supply will make—we're going to make it as simple as possible. Constant y-star, that's potential outcome. Aggregate demand, everything is in logs here. It's driven by lots of demand factors and financial conditions. Now, this financial condition—so for us, p is financial conditions, but it's expressing price level, not yield level. So p going up is more wealth that relaxes financial conditions rather than the normal yield expression, okay? Then financial conditions are determined in markets which are forward looking, but there's risk and therefore arbitrageurs are handling these noise traders. And then there's monetary policy, and monetary policy takes into account—it wants to smooth interest rates, so it doesn't really want to shock the market too much, but it also wants to close output gaps. So it has sort of a standard tradeoff. And then somebody talked yesterday about the difference between the science and the art of

monetary policy. Well, the science is those first two terms, the art is the last term. I mean, their conditions change, and you may need to, you know, do different things from what you've done normally with your Taylor rule because conditions are different. The role that that extra term, the *v* term, plays in the model simply makes the inference problem of the markets a little harder.

Now, this model is consistent with three features that motivate our analysis. The first one is that noise affects financial conditions, okay? That's very important. We know there's enormous excess volatility in asset prices. Well, here noise will affect financial conditions. Noise is μ—the variable is noise. Importantly, the impact of noise on financial conditions is a function of how risky are financial conditions, how volatile financial conditions themselves are. And that object, how volatile financial conditions are, are endogenous to the communication strategy the Fed may have, okay? And this is very important for us. And the reason this enters there is because arbitrageurs face risk. It's a risky arbitrage, and therefore they will be reluctant to act against noise, to lean against noise, if it's a very risky business, okay? So markets become very inelastic when financial conditions are very volatile.

The second ingredient which I highlight is disagreement, okay? And here the entire disagreement—so *y*-star's potential output is constant, but one's beliefs do matter. One way to do it is, we relax. We have done that in previous models. Another way to do it—both are realistic—is that things like *u*-star or *y*-star are not observable. You don't really know in real time what they are. So disagreements—we're going to capture them by disagreements about potential output. The Fed will think *y*-star-F, the arbitrageurs are going to think *y*-star-A, okay?

Now, how do these disagreements matter? It's because, well, the Fed, you know, the Fed will set its policy according to its own beliefs. It will take into account what the market is thinking. That's the reason you see this subscript *a* in expectation in the smoothing term. But

what you see in the output gap is what matters to the Fed is to close the output gap relative to what its own beliefs are about what the current output gap is. And that affects interest rates. If the Fed thinks that the output gap is very positive, then the Fed will raise interest rates. So for the market, it has become very important to understand what the Fed believes because it needs to understand, figure out what interest rates will do, and interest rates in turn impact financial conditions. Okay, so that's the reason disagreement matters. The Fed needs—the markets need to understand what the Fed thinks because that's very important for the path of financial conditions.

The third ingredient of them all—it's the last ingredient that I'm going to highlight—is that the Fed sets policy gradually. The Fed doesn't want to be in the business of chasing financial conditions every single day. So it does so smoothly, but it does so smoothly, that also means that financial conditions leak into—the noise shocks leak into financial conditions. A lot of the volatility we saw in financial conditions is not the Fed doing things, it's the markets doing their thing, okay? But since the Fed therefore has decided not to have an instrument against all these daily-type fluctuations, it needs collaboration from someone. And the communication problem is exactly about that. It's about convincing, persuading in some way—in the ways that markets understand—the arbitrageurs to go along with the interest of the Fed. That's the game here.

So let me start with a benchmark to explain how disagreements matter. So the benchmark is going to be no disagreements. Suppose that markets and arbitrageurs have the same—markets and the Fed have exactly the same view of this. In that case, there is no issue with communication because there's nothing to communicate. We know exactly what each other thinks. We get three key insights from that very simple model. The first model is that you see

there's a term there we call *p*-star like the FCI-star. Well, your *p*-star depends only on macroeconomic factors, supply and demand. It doesn't—it's not a function. Unlike *r*-star, it's not a function of things that happen in financial markets. So you need to be an expert not on financial markets for this purpose—you need to be an expert on aggregate demand and aggregate supply. That's what *p*-star is done. Then actual financial conditions move around, you know, move around this *p*-star. And they're driven largely by this noise that happens in there. And the third point is that they stabilize, but sort of moves around, but moves around *p*-star. There is noise happening in the market, but if people understand what the Fed thinks, this movement will be around that *p*-star.

Now, the third point is that there is destabilizing feedback between volatility and the impact of noise in financial conditions. You see there, the term σ^2 is a solution of fixed points. That's the volatility of financial conditions. And if for whatever reason volatility goes up, then that makes markets more inelastic, that means financial conditions start responding more to noise, which means financial conditions become more volatile and so on and so forth. So you get this very stabilizing force that comes from this feedback between noise and the volatility of financial conditions.

Now, to that model, we add disagreements. And so disagreements, as I explained before, is going to be simply taking the model we had before and said, look, we're going to have two very stubborn agents. The Fed would believe potential output is *y*-star-F, arbitrageurs are going to think that *y*-star is *y*-star-A. The immediate implication of that is that they have different views about *p*-star, because *p*-star is potential output minus demand, okay? So *p*-star of the Fed is *p*-star-F, and *p*-star of the market is *p*-star-A. We do this to potential output. It could have been different outlooks about *m*, aggregate demand—it would've been exactly the same result.

Now, once you're in a war with disagreements—we have a disagreement here—once we are in a war with disagreements, then introspection is not enough. If I want to figure out what the other one knows, it's not enough that I analyze myself and say, "Well, that's what these guys think." I need to figure out what the other agents thinks. So we want to make it very simple here and say, well, suppose that the Fed can extract with the great stuff they have from the market what the market is thinking. But the market doesn't really fully know what the Fed is thinking. It will have a prior, they will see monetary policy in action, and that will give you a posterior. That posterior will create some mean—we're going to call that *p*-star-FA; it's the *p*-star that the market thinks the Fed has—but there's going to be residual uncertainties. There's no way of completely figuring out that. So there will be some residual uncertainty.

That generates two results in the model. The first one is arbitrageurs may misunderstand the policy intention—that's what we call tantrum shocks. So it may happen that after you announce your policy action, your monetary policy action, the market thinks that you want financial conditions that are tighter than what you actually want, and that's going to lead to contractionary effect.

The second effect is that arbitrageurs are going to perceive greater future volatility because they don't know what your preferences are and there is extra risk that comes from the σ^2-FA. You know, there is residual uncertainty floating around. Now, remember that volatility is a bad thing here because the more volatility you have, the more impactful noise is on financial conditions and then the more volatility you get and so on and so forth. So another source of volatility is a bad thing to have. And also the two results—what you get out of adding this extra element.

Now, what is the solution to the staff in this model? There's a very clear solution—it's FCI-plot communication. So what you tell them is what you expect the path, what you expect—what you like as current financial conditions, which is going to be different when it's actually happening, and what you expect—what are your desirable financial conditions for the next period. It happens that in this model, this completely eliminates both effects. There is no confusion about what your beliefs are. It doesn't mean that they agree with you, but they know what your beliefs are. And that's enough to reduce both the tantrum—there's no confusion about what is your intention—and it also eliminates the additional volatility that comes from learning about the beliefs of the Fed over time.

Unlike in our model, it's very stark—interest rate forward guidance does nothing here. It leaves the model—it leaves us back in beliefs disagreement. In the model it's very stylized—that's what models are for—very stylized, but the insight is far more general. And it comes from one of the pictures I showed you. Really, interest rates have very little—the announcement of future interest rates have very little explanatory power for financial conditions movement today and in the future, so that you leave a lot of unresolved uncertainty in that case.

The last point I want to make—well, two points—but the last one is going to link probably to Ben's point is scenario-based FCI-plot communication. When does it arise in our context? Well, when—in the previous context they were very stubborn, the Fed and the markets were very stubborn, they had very stubborn beliefs. But in reality, both markets and the Fed learn from data. There is data dependency, okay? And when you have disagreement and there is data dependency, it's very interesting because the agent that disagrees with you expects the data to punch you in the face and for your beliefs to move in your direction. So in this case, what really happens is—we're going to make it very simple. We're going to assume that, again, that

the Fed understands what the market believes, but the market doesn't know what the Fed—so the markets—actually, let me step back. We're going to simply it further for this slide.

We're going to assume here with a simple example that the Fed believes that the state of nature of day 1 is *f*—*f* for aligned with the Fed's view. And the Fed is going to believe with probability 1 that's what's going to happen, okay? It's completely convinced of that. The markets are on the other side. They think that state *a* will realize, and they think that will happen with probability 1, okay? So at date 1, if state *f* realizes, the Fed will continue with its beliefs *p*-star-F. But if state *a* realizes, the Fed gets punched in the face, then the Fed is going to have to change those beliefs because the data—the areas have changed, you know, changed here. The areas have changed, but the market doesn't know necessarily. What does that mean for your desired financial conditions, okay? So the market has uncertainty about what your desired financial conditions will be in that *a* scenario, which was not your central scenario. And that's the reason FCI-plot itself doesn't work in this case because the market—in this particular case, the market, the only thing it wants to know is what will you do with financial conditions, what will be your target if you get surprised by the data. But you're not revealing that with the plot alone.

So what solves that? What solves that is a scenario-based analysis. That means you tell them—the Fed tells them what you'll do in the central scenario. That reveals *p*-star-F. But it also tells the market what it will do if there's an alternative scenario, preferably very aligned with what the market believes will happen, okay? And that's exactly the same as we did before with FCI-plot, but here in this contingent environment we get the same type of benefits—you eliminate tantrums, and you reduce endogenous volatility.

[0:30:15]

I want to conclude with—the last part of the paper, you know, has lots of things, but I want to highlight only one point, which is with a little proof of concept in this paper. So what you have there is, on the left panel you have first two lines that you already saw, which is, you know, the dashed black line is the financial conditions index I showed you, the orange line is the FCI-star line that I showed you before, and the new lines are the two in the middle, those are the FCI-plot, okay? The blue line is the FCI you announced for the current conditions. The red line is the FCI you expect to have four quarters ahead. How did we generate this? We use a large VAR model with financial conditions in it and then we minimize this loss function, which is very standard in central banking, no? Given current economic conditions and given current financial conditions, what would you announce in that scenario to minimize that loss function? And that's what you get sort of from the blue and the red line, which is very much what you do with monetary policy. I mean, financial conditions are way tighter than actual what you want, FCI-star, you're not going to go all the way immediately to FCI-star. You're going to go in steps there, and that shows you those steps.

The scenario analysis part is the second chart. It shows you the same sort of lines without the FCI-star part but as a function of the output gaps that you face. And what you see on the left, the three bars on the left, you see the actual FCI, the current quarter desired FCI, and the four-quarters-ahead FCI for a situation where there's a negative output gap. In that case, you're going to expect financial conditions to loosen over time, and that gives you sort of the path that you should have. If you fall somewhere in the middle, there's no reason to do anything with financial conditions. If you're on the other side, obviously you expect to tighten financial conditions over time, okay? So that's, again, very simple, but it's a proof of concept of how this could work.

So let me—I think I used more than my assigned time, so let me just summarize for you what I had, since a lot has happened. So markets' uncertainty, what do we try to say? So markets' uncertainty about central bank's desired financial conditions creates misunderstandings and tantrums. Higher uncertainty raises the impact of noise on financial conditions, and financial markets are very noisy. FCI-plot communication eliminates tantrums and recruits arbitrageurs despite disagreement. The purpose of communication is not agreement—it's really to manage the expectations of the markets. And FCI-plot is scenario-based guidance particularly useful when there are severe disagreements about the likelihood of the near trajectory of the economy. Thank you very much. [Applause]

ROBERTO PERLI. Thank you. Thank you, Ricardo.

MARKUS BRUNNERMEIER. So thanks a lot for the organizers for inviting me and for honoring Thomas Laubach. It's a great honor to be here also in memory of him. So what I want to do is, I want to go to this FCI-plot proposal, outline it a little bit, and put it in a bigger context and stepping back a little bit. So, essentially, what the FCI-plot proposal is, what Ricardo and Alp put forward, is to communicate a financial condition index to enlist or encourage arbitrageurs to be more strong and more forceful, because, you know, they have to lean against these noise traders, and that helps—by communicating, that helps essentially these arbitrageurs to push against these noise traders and take essentially noise out of the system. And this proposal says not only the current financial condition index, but also a path forward, so there's a like a contingent, scenario-contingent path forward. So it's—I would—you can also call it an FCI forward guidance in a sense. And what's the difference to an interest rate rule, which is also—is a reaction function. Of course, there's no instrument attached to that. It's purely

communication. So it's not that you say, "okay, I forecast what interest rate tool I will use," but it's pure communication similar to the S&P projections.

And, of course, as we have seen yesterday already from Sylvain's presentation, there are two different ways to see it. One is a pure communication aspect. There's a Delphian approach. That's the focus of this particular paper—the authors have an earlier paper where it's not only communication, but it also has an element of commitment to it, an Odyssean approach, so in order to overcome some time and consistency problem. And I will touch on this other paper a little bit as well and put it in a bigger context.

But before I go into this, I would like to say, what are the challenges you face when you want to communicate financial conditions? And the first challenge you might face is what Ben Bernanke called earlier the "halls of mirror effect." So you have, you know, as a central bank, you try to extract a lot of information from financial statistics and numbers. And, of course, if you communicate a lot of financial conditions to the financial markets, you might change the statistics, and then you just look in the mirror and you see what—essentially what you told them. And you might lose some informational content by doing this. So that's one of the challenges you face. And it might also lead to some unintended consequences when you communicate that, because you change the market's behavior. In the author's paper, the takeout, you know, the arbitrageurs will be more forceful and actually it'll be more informative, but it can also lead to other situations, and essentially you give something to the markets and you just look in your mirror subsequently.

The second challenge, which also came up yesterday in Sam's discussion—he called it "the gradualism trap"; I call it Jeremy Stein's "whispering effect"—essentially, the central banks don't really want to scare financial markets, and they don't want to erupt and create volatility in

the financial markets. So central banks speak more softly, so they try to communicate in a very soft voice. But, of course, the reaction of the financial markets is, if you communicate this very softly, they'll listen even more carefully to you and interpret any micro announcements. [Laughter] So then it means this creates more volatility in the markets as well, so central banks speak even more softly. And then the financial markets interpret every nano announcement, and that's another challenge you might face. So these are different challenges how you should, you know, think about—I should say, in general, they're sympathetic. I think we should do communications along the author's lines, but one should also be aware of the challenges one faces.

So if you think about the financial condition index, you might say, okay, which one should I take? You know, the Fed Board's one, should I take the Chicago Fed, the Goldman Sachs, or [inaudible] index? So there are a lot of indices. So which one should we take? Should it be a one-dimensional thing? Should it be a multidimensional index? And the big decision in my view is, should it reflect the price of risk, or should it reflect the market capitalization—so the level, the price level? Because then, you know, higher prices, higher stock prices creates a wealth effect that translates into higher consumption. And that's the emphasis that the authors take. I think it's also very important to take the price of risk into account. And then the question is, you know, which market? And that depends, you know, how segmented you think the markets are. If the market is very segmented, then you have to take different price of risk into account. And also whether you want to focus more on the price of risk or some certain Taylor risks, they can also take this into account. So one is, you do focus on the p level—that's what Ricardo's notation is in market capitalization—or the variance of the p itself and the price of risk.

Now, if I go a little bit more specifically to their models, essentially what they do is, they say, okay, I take essentially the stock value or some financial condition reflects the wealth in the economy. Because in their model, they have log utility, the agents have log utility. The consumption is just, rho, the time reference rate times the net worth or the wealth. And so what happens in—if I take the model very literally, communicating the financial condition index is essentially communicating total consumption in the economy. And given that there's no investment, it also communicates the output.

So the question then is, you know, should I communicate essentially financial condition index or should I communicate essentially GDP forecast or GDP growth rates? And so for this one, it's a rich model where, you know, to break this one-to-one link between financial condition index, even though Ricardo has shown there's some correlation about this too, and also communicating just future output.

Now, of course in the earlier paper, in the CS24 paper, they have a noise term de-linking this one-to-one relationship. And in that paper, there's a case, there's an actual objective function for the central bank, which is like output gap, and you can think of inflation gap. But then what you really want to do is essentially you commit to a rule for following an operational objective function. And the operational objective function, in addition to the output gap and inflation gap, has a weight on the FCI gap, on the financial condition index. And you can see that's essentially where the commitment power comes in, because the assumption is you can commit to a rule, and by committing to a particular rule, which puts weight on the FCI gap, you actually have a commitment power as a central bank, and this way you commit, and this can improve then the total outcome in this economy.

So I think it's very—I mean, it's hard to argue, you know, if you provide more information to the marketplace it's actually bad. It's always a good thing—better communication should be a good thing. But if you add it with a commitment power, it becomes more subtle, the reasoning. But the thing I would like to emphasize is, is this pure communication or is this more than pure communication? So if you have a single instrument—and what's the only policy instrument is let's say the interest rate—then you have a Taylor rule plus communication. And what happens in this particular model is that, you know, you have the inflation gap and then you have an output gap. And the output gap is just the one-to-one function between the FCI and the FCI-star. And what you can do is you can generalize that, think about a multiple instrument. You do also balance sheet measures—so you also have QE, QT, or you do other measures—and you can have a generalized multidimensional Taylor rule in a sense. So rather than setting only the interest rate, you also set the QE policy as a function of things, or you want to affect the price of risk through QE policy or through balance sheet measures. You affect the price of risk. It might just be an extreme state of the world. And then you have a richer function, where the left-hand side of the function is not only one variable, there's a whole vector of variables. So it can be the interest rate on required reserves and excess reserves and all the balance sheet measures. And then you have the inflation gap, the output gap, and also the financial conditions, but now the financial conditions is more than purely a communication. It actually feeds into this generalized Taylor rule. And I think that would be something, you know, worthwhile, and I analyze that—the optimal way of doing things. Thanks.

Now, the authors, they also think about tantrum—so tantrum theory. In a sense, tantrums occur when there's an abrupt change in beliefs in the market. So you make an announcement and, well, you make—there's disagreement, and you make this disagreement public, and then

you actually can reduce the tantrum and their thing. So typically tantrums occur when they hit the tipping point, you have a jump in equilibrium, and it can also involve higher-order beliefs where things jump around.

So in their paper, it's the financial market arbitrageurs' beliefs about some *p*-star is different from the Fed's *p*-star and, you know, they can't agree if there's no communication. Once you introduce this communication, then, you know, then you can actually fine-tune this, and then they might still disagree, these arbitrageurs, but they might still help you to implement the policy you want to achieve. The question here is, to some extent to me, this, you know, in a richer model, how would it work? Do I—when I make the FCI announcement, I might also trigger a jump, okay? There might be some jump occurring for that. How to get rid of this discontinuity and how gradual I want to release the information over time. So in a rich dynamic model, can I make it more gradual and make it sufficiently subtle essentially that it doesn't come in one shot—it's not discontinuous. And how, you know, you smooth out the communication—I think that's also an interesting problem that one can go beyond that. So it's also about the optimal frequency of revisions, how often I want to reveal than the FCI.

Finally, I would like to say a few things about financial dominance. Of course, financial dominance is a situation where there's a lot of volatility in the market, and you are concerned if you do certain monetary policy measures for monetary policy reasons, you might actually destabilize the financial markets. So there's a constraining factor with this. And I think we should also think to what extent good communication of the financial condition index can actually mitigate a financial dominance problem. So you can say, okay, I have a good communication way, so this way I don't create havoc in the financial markets if I do certain monetary policy measures because I have already well communicated this in advance.

Finally, I have some political economy thing. So if you take the financial condition index very seriously and say, okay I announced what the market cap should be. And let's suppose you focus on a particular market, a very big market. It can be misinterpreted as investment advice, and say, okay, I think the S&P 500 should be, you know, end of the year, should be a number X, and you [inaudible] S&P projections that, you know, there can be mistakes in these projections. You might, you know—the Fed might be responsible for losses from this advice. So some investors might follow this advice and might make losses, and then this falls back on you, and they might complain about you, and there might be political pressure against you. Of course, we have seen occasionally central banks make statements about the level of the stock market, like Greenspan made this famous speech on irrational exuberance. But this might also then—one has to be careful how to design the FCI that you can't interpret this as a clear investment advice because if things go wrong and things don't realize as they are, people might come back to the Fed and then complain about the Fed, and this might undermine the Fed's independence and will be costly for independence reasons.

So let me sum up. So I think it—I'm very sympathetic to have some communication tool in this dimension. It's difficult to say whether it should be, you know, a one-dimensional, a multidimensional thing. But, in general, there are some challenges to it, to this communication, particularly this halls of mirrors effect, the whispering effect or gradualism trap and so forth. How you want to communicate? Is it communication—a Delphian signal device only, or is it also an Odyssean commitment device only to a certain extent? I think it's probably more likely to have more bite if it's the latter, just at least there's some commitment element to that. And then the question is, what is a good FCI index? How can I reduce it to a one-dimensional index? That will be challenging. Of course, we could also say reducing inflation to a one-dimensional

inflation number is also challenging, but that's particularly challenging. What should I focus on—on the market cap, including the bond stock, including the bonds and house prices, or should I just have more focus on the price of risk, should there be a price of risk to that? And, of course, then there's this taper tantrum and then there's also, you know, if you give—if it can be interpreted as investment advice, it can threaten ultimately Fed independence to some extent. Let me leave it at that. Thanks again. [Applause]

ROBERTO PERLI. All right. Thank you. Thank you, Ricardo. And thank you, Markus. I think very, very interesting presentation and discussion. So let's start by taking questions from the audience first. Let's see. Let's start with how about President Musalem and then let's see who else. Any other policymakers? Otherwise, we have Brian and Lewis back there. So let's start with these three. Alberto?

PRESIDENT MUSALEM. Thank you. Thank you, Ricardo, for a great paper. I had a couple of thoughts and questions. In your model, you chose *y*-star, meaning potential output, as the variable over which there are expectations disagreements, and you probably did that because it's an exogenous variable and doesn't depend on financial conditions itself. Market participants spend—I'm a former market participant—about 80 percent of their time thinking about *y* and not *y*-star, meaning aggregate demand and not potential output. In your model, aggregate demand is a function of financial conditions, so it's endogenous. And I wonder when the disagreement or agreement is about an endogenous variable, does that add to the instability of the result and that fixed point equation that you had? So that may be related to the halls of mirrors point.

And the other question I had is, it's already pretty challenging to communicate a future path of interest rates—the variable the central bank controls—because that depends on future variables, expectations of future variables. What do you think it would do to central bank

credibility to then have to communicate about oil prices, exchange rates, equity prices, credit spreads? It seems like a pretty daunting task when oil prices have more to do with decisions made in Saudi Arabia than anything else. So those are my two questions. Thank you.

ROBERTO PERLI. All right, thank you. Thank you, Brian. Please introduce yourself also when you ask a question. Thanks.

BRIAN SACK. Hi, Brian Sack from Balyasny. I have a general comment that's probably not that useful and then a specific question. So I've played a lot with FCIs, trying to estimate FCI policy rules, trying to understand the dynamics of FCIs and all their components. And the general comment is, the econometrics involved are super complicated because all these variables are forward looking, they're all endogenous, they're all reacting to each other. So I guess I wanted to say—I mean, I think the modeling effort is great, but I think there's a whole other space of research that's required here, which is like trying to identify these relationships better and understand all these pieces. You really need to use some sort of creative identification approaches in your econometrics. And I think we have a great deal more to learn about FCIs, and this is the primary challenge.

I guess my specific question is, you can sort of think of every asset price as reflecting the expected path of the risk-free rate, which is the Fed's policy instrument basically, and then a risk premium on top of that, right? You know, the expected path is what you could earn sort of in risk-free investments and then you get more return or less return based on taking the risk. And so I guess the question is, if the idea is there's a desirable path of FCI, is that equivalent to just saying we're going to put risk premia in the policy reaction function, then we're going to adjust the expected path of short rates always in response to risk premia? And have you thought about that and like whether that works if you actually measure risk premia on asset prices? Or is that

right? Is it risk premia that should enter the policy reaction function? And then have you actually seen if that works? Thank you.

LEWIS ALEXANDER. Hi, I'm Lew Alexander with Rokos. Just a small addition to what Brian said in terms of the difficulty of doing this. I've been trying to do this for many years, both in public- and private-sector context. And in addition to the problems that Brian raised, I would note, financial markets just evolve at a very rapid rate. And as many issues as there are in estimating a macro model and assuming stability, the degree to which financial markets are evolving and financial markets' participants are responding to new opportunities in ways that question the stability of these relationships, I, as somebody who's tried to do this, it's really hard, and I have a certain degree of skepticism about your ability to define a stable system that you can use. That's a comment.

My question for the author and for Markus is, if you could comment on different types of disagreements between the private sector and the policymakers, and I'm thinking of two particular examples. Markus mentioned the equity market in the late '90s. To a certain extent, there can be disagreements about what do you think about the opportunities available in the future. To a certain extent, the disagreement at that time was, how do you think about the potential returns of the internet and all of that? And that was a very particular kind of source of disagreement. And I would argue we're facing another one of those right now. And so if the source of disagreement in some sense is different judgments about fundamental long-run things, how does that relate to this?

The other one is disagreements over the prospects of nonmonetary policy. I would argue that to a certain extent, what we're dealing with now is an environment where there's a lot of uncertainty about nonmonetary policy. And in many ways, I think financial markets are

responding in ways that I would argue are too optimistic about the implications of some nonmonetary policies. But that creates, it seems to me, a special challenge in your context. I wonder if you could just comment on how you think about that. Thanks.

ROBERTO PERLI. All right, thank you. Let's start with these three questions first, and then we'll go to the second round in a few minutes.

RICARDO CABALLERO. Let me start in reverse order. I'm not jet-lagged—I don't have your excuse. I'm flying to Greece tomorrow. Does that count? Forward jet lag.

So I think on the type of disagreements, I think the first statement, the AI revolution, for example, you don't need disagreement there to trigger monetary policy reaction. It's just that potential output will grow dramatically five years from now. That creates wealth today. That creates an excess aggregate demand problem today. That's a conventional monetary policy issue. It doesn't depend on disagreements. In other words, it doesn't depend on whether you think it's bubbly or you think it's real. It's still a headache for the current prospects, right? That's, I think, the first issue with respect to that.

The second kind of disagreement you have in mind is the kind of disagreement we have in the paper because the disagreements are not about monetary policy. What is the optimal monetary policy response? Disagreements are precisely about the underlying fundamentals of the economy: potential output, aggregate demand. And you may think that aggregate demand will be depressed because Democrats will be depressed, whatever you want. But how do you react to that? So as long as there's difference in perception, then this applies. It's not really about disagreement on how monetary policy should be run. That's not where the big disagreement occurs, in our model at least.

The question on endogenous variables. I mean, if they're really endogenous, then they're a function of exogenous things, you know? So I can always go back and map it to some disagreement about something exogenous. So I don't think that that's the issue. But you're touching on something that is actually very important, and it's subtle, and it's at the core of the reason for us to propose this. And I think it's sort of a criticism, a veiled criticism, that appears in many places, in many questions, which is that one of the things we want to avoid, in a sense, is a lost-in-translation-type problem, okay? It's lost in translation. So we feel that interest rate communication, yes, it may be very credible and so on, which may be a nuisance, by the way, because then it feels a lot like commitment and so on because you can indeed control it. But the mapping that the market needs to do between that interest rate policy and what the assets you end up trading, unless you're a bond trader, sort of requires lots of understanding of macroeconomics, and traders are not Ph.D.'s in economics. They have other skills, but they're not Ph.D.'s in economics, so it is very likely that they get lost in translation. So in a sense, the general principle of what we're having here is that do you want to communicate on something that first, traders understand, okay, or portfolio managers, if you will. They understand. And, second, more important for you, is that it matters for aggregate demand. And so those are the two channels. Or in some scenarios it could be that matters for the left tail of the distribution, and that's the reason I wouldn't want to commit to any index forever because conditions change, and there's a lot of art in this kind of thing. But I think that's the general principle—reduce the lost-in-translation problem. Interest rate policy has a lot of lost-in-translation problems. So all the residual uncertainties left there is because markets don't really know how to map from what economists talk about.

This also relates to a point that Markus said. It's true that in our model, in this very stylized version, you could do all the communication in terms of output gaps and output growth and so on. And that's what you typically do. But markets don't know how to map output gaps and so on into equity markets and stuff. They have some sense, I hear all sort of stories that made very little sense, most of them, okay? You're right—I can tell you about growth, and you'll figure it out fully and tell me the caveats and the challenges, but you tell markets about output gaps, their mapping output gaps and interest rate is a very insufficient statistic for the things that they really do.

And challenges of communication—I mean, it's a huge issue. It's a huge issue. Well, in a sense, you're going to do that. I mean, in the reports you do have estimates of the term premium and all sort of things there. And I'm sure that Ben's report will include even more things in there that are all very valid. But they're all, again, things that Ph.D.'s understand very well. Putting them together for markets, I think you need to do both maybe, because you need to have different audiences. But they should be something simple, and something simple I think is worth investing in this financial condition indices. Many questions about, well, is this the right financial index, blah, blah, blah. Yes, true. It's a measurement error problem, okay? There's going to be measurement error problem. We're going to have to try to minimize the thing. But now we have an omitted variable problem, because interest rate is such a small thing of aggregate demand that you're leaving a big chunk out. So let's go for measurement error and then improve on that. But I think it's better than omitted variables.

There's no doubt that political economy is a huge issue and so on, but there are lots of experts in this room that are much more diplomatic than I am, as you can appreciate. And the whispering effects, I think that especially if you are thinking about a broad index and so on,

there's going to be so much uncertainty still left in the system—the hall of mirrors and so on. I think it's much more problematic in interest rate space, for example, because that's very narrow, very narrow communication and so on. But when you study an analysis of an aggregate of lots of asset prices, there's a lot of residual uncertainty that will reduce the effect of this. They are there, but I think they will reduce them. Let me stop there.

ROBERTO PERLI. All right, thank you. Markus do you want to—

MARKUS BRUNNERMEIER. One quick reaction. So what I find always puzzling, essentially the risk-free rate is just one price. We put a lot of emphasis in monetary policy on this one price, and we have a lot of risk premia or price of risk as well. The question is, why should there be so much emphasis on the risk-free rate and not on the other risk premia?

And I agree with what Kim, Brian, and Lew essentially did. The challenge essentially, if you want to do this, you have this 100-dimensional space and through communication reports it can be very sophisticated, and you want to reduce it to a 1-dimensional number or 1-dimensional path. And that's actually very, very challenging. And then, in particular, when everything is shifting over time, the weights are shifting and that makes it a very challenging proposition. But perhaps you should give it a try, but that requires a lot of research first. Similarly, when we do measure inflation, as I mentioned before, we also have different inflations and different sub-sectors and we aggregate it too, but it seems more challenging for the financial condition index.

ROBERTO PERLI. Thank you. All right. So we have time for another couple of very quick questions. Let's make it three. Lorenzo then here and then—actually, why don't we start with Governor Waller?

GOVERNOR WALLER. I guess some of the points I was going to make are related to what has been said. So, first of all, the financial conditions index, you pointed out, most of it's

equity prices moving around. And I do recall a long time ago people arguing, should you put stock prices in a Taylor rule? I didn't do this work, but I remember a lot of people, particularly in the '90s after all this. And the general result, I believe, was it didn't really matter. Pretty much anything you were going to get out of that, you already got through consumption, wealth effects, and output. So it's kind of to Markus's point earlier. It just didn't really add much.

The second point was just, a lot of this is observed market prices, and one of the things we're seeing a lot of growth in is private credit, private equity. We're not seeing public prices and things to determine what those financial conditions look like. So it's back to your mismeasurement, but it makes me a little more concerned that you're missing big important parts of financial conditions.

The last part is exactly Markus's point on political economy. When you think about doing something like this, you are signaling you care about all these rich people. I'm dead serious. You look at what we did when we did keeping interest rates low, continuing with asset purchases in 2021, that was a common thing. You are just pushing up asset prices and making all these rich people richer and that's your job. You're not protecting "us" in some sense. So the beauty of just looking at a standard Taylor rule with inflation and output or inflation and employment, it maps directly into our mandate. This is what we're looking at to drive our policy choices. We are not sitting here trying to manipulate or control asset prices to benefit a particular segment of the population.

ROBERTO PERLI. Thank you. Then Lorenzo, quickly please.

LORENZO GIORGIANNI. Lorenzo with Tudor. One question on the assumption underlying the FCI construction that then will need to be communicated is the assumption that the correlation across asset prices or risk premia is constant over time. And if that is the

assumption, then shouldn't the communication also provide information about that correlation structure? I can envisage cases where, for example, in the current circumstances because of news other than monetary policy news, fiscal policy or about central bank independence, tariffs, the correlation structure changes and turns more into an EM-type of correlation structure where rates and FX have a different correlation than we would normally have in a developed market economy. And quick question for Markus on the multidimensional Taylor rule. If we are targeting FCI, shouldn't we also have macroprudential tools in the Taylor rule?

ROBERTO PERLI. Thank you. And final question, please.

SAM HANSON. Sam Hanson, Harvard. So I'm a Cambridge-trained financial economist with a strong interest in macro. So I'm almost genetically programmed to love this work. And the Ricardo and Alps model very much captures kind of the spirit of how I think that monetary policy actually works. And I'm very sympathetic both to it as a positive view and to kind of many of the normative points they make. Essentially, my big question is, do you want us to kind of take this idea seriously, or do you want us to take it literally? [Laughter] Which is to say that it seems like the broader worldview suggests a world and a view of markets where the Fed is kind of engaged in a very complicated dance with markets. And it's almost a view—I'm probably a little bit more behavioral than you guys—but it's almost a view where monetary policy is a little bit like parenting, okay? And it suggests a view where parenting is really kind of like an art. And it feels like literally taking literally FCI plot is like trying to reduce parenting to a science where I'm going to announce a scalar, you know, expected path of a scalar to my three daughters and that will then make them into the human beings that I'm hoping them to be.

So the question is—so I love the idea of this as a parable that policymakers should have in their head as they're going about their jobs, but I'm less comfortable with the idea that we

should actually try to codify this into a regime where there's blue dots, you know? Yeah. Do you want us to take it seriously or do you want us to take it literally?

ROBERTO PERLI. Thank you. And so very, very quickly—we're already over.

RICARDO CABALLERO. Okay. I'm surprised that being a theorist trained in Cambridge, you take models literally. [Laughter] They're meant to be parables. So that's my answer.

So on Governor Waller's points, when you say we add the stock prices and didn't add much, that's two models, but it makes a difference for the markets. And so, yeah, I'm sure that if you put it in a DSGE model, you put in some prices, it's not going to do much because you have an equation that relates consumption to—but this is about how markets will react to that. So that's a component that this adds.

On the political economy, for sure. I talk about that this matters, but this is not about changing the mandate. The mandate is exactly the same. This is about recognizing that financial conditions are a big driver of one of the key components of your mandate. So still you can keep the mandate as is and you put the other one not in the Taylor rule, you put it in an equation down there, which drives demand and so on. So I think, yeah, definitely the mandate and the communication requires for the obvious reasons you stated, so I fully agree with that.

On private markets, yeah, it's an issue. I think, for example, this approach is much better here than in Europe, because in Europe a lot happens in banks and so on. And so they talk about financing conditions rather than financial conditions for that reason. So, yeah, you actually have to adapt it, which takes me to another point. I wouldn't want to commit to one single index that everyone looks and so on. I want to think about what is the current episode and then what are the main drivers of the current episode, and that's the sort of basket we look at. So more than

having 25 different indexes out there, I'd rather look at what needs to be addressed at the moment but just have some sort of comprehensive thing that is appropriate for the moment. So I'm very much into the art part.

On correlations, well, these indices are constructed backwards, so the correlation is whatever happened in the data. There's no assumption about anything there.

ROBERTO PERLI. Markus?

MARKUS BRUNNERMEIER. Yeah. Very quickly to the macroprudential question. So if you look at this multidimensional Talyor rule, I think, of course everything the central bank is doing, like QE, QT, and balance sheet measures, should be part of it, because it's explicitly doing it. So it's good to have a communication and a particular rule in that. It's very much along these lines. We talked about this in the Valentin Haddad work. And then, of course, macroprudential, which is beyond the realm of central banking. That probably should be outside, but there should be an understanding what the interaction is in a sense, the marketplace. But it's not part of an explicit rule, but at least there should be some understanding how it interacts.

ROBERTO PERLI. Perfect. Thank you. So thank you for this discussion. Thank you for the questions. [Applause] Very important announcement—it's a coffee break. But we'll reconvene here promptly at 9:50—five zero. Thank you.