# 2025 Financial Stability Conference, Financial Stability in a Time of Rapid Economic and Technological Change

Keynote: Itay Goldstein, Wharton School, University of Pennsylvania

**Host: Joe Haubrich, Federal Reserve Bank of Cleveland**

Joe Haubrich:

Welcome back everyone. We're ready to get started with the afternoon program, and we're going to start with a keynote today, Professor Itay Goldstein. Itay is the Joel S. Ehrenkranz family professor and professor of finance at the Wharton School at the University of Pennsylvania. He's been on the faculty since 2004 and currently serves as chair of the finance department. Itay has been recognized with the Provost's Award for Distinguished PhD Teaching and Mentoring in 2022. He earned his PhD in economics from Tel Aviv University in 2001. His research focuses on corporate finance, financial institutions, and financial markets, with a special emphasis on financial fragility and crises, and the feedback between firms and financial markets. So you can understand why we are very excited to have him presenting the keynote today.

His work has been published in top academic journals and featured in media outlets such as The Economist, the Wall Street Journal, Financial Times, Bloomberg Forms, and even NPR. Goldstein was also executive editor of the review of financial studies and has served as academic advisor for various policy institutions, including Federal Reserve Banks of New York, Philadelphia, in Richmond, the Bank of Canada, and the International Monetary Fund. Please join me in welcoming Itay Goldstein.

Itay Goldstein:

Okay. Thank you, Joe, for the introduction. It's great to be here. So the title of the conference is Financial Stability, and that has been a topic that I've been working on over the years quite a lot. I'm calling it here financial fragility, but of course financial fragility is the other side of financial stability. So we need to understand the underlying sources for financial fragility if we care about policies that promote financial stability. And that's basically what I'm going to talk about here today. Kind of give an overview of different things that I've done related to that over the years, of course related to a much broader literature. And then towards the end also give you a flavor of a couple of recent papers that I have on this.

So this is the outline that I have in mind. I'm going to start by talking about basic concepts. What is financial fragility? And in particular the way that it has been discussed in much of the literature as a distinction between fundamentals and panic. And I will explain what this is about. As you will see, what I will argue is a lot of what we see in terms of amplification of crisis and fragility is coming from what I would call panic. And I will then spend time talking about some evidence, how you can tease it out from the data when it comes to banks and then mutual funds, and how those two are related. And I will talk a little bit about current research that I have in the context of banks and then in the context of mutual funds. And I will conclude with some general thoughts of what this means for policy and given the current things that we see around us, current developments such as financial technology and so on. Okay?

So I'm going to start with the basic concepts, financial fragility and kind of thinking about fundamentals versus panic. When you think about financial fragility, there are a bunch of classic episodes/pictures that come to mind. And here are two. One is a run about a hundred years ago. Back then you had many

episodes like this where people just gather outside a bank and they all just want to take their money out as quickly as possible. And the other one from a classic movie, where there is a bank run in the character of the movie, the main character is trying to convince everyone to be patient and to think about the collective benefit of keeping their money in. Okay? So these are kind of things that come to mind when you think about financial fragility.

So to think about it in terms of the economic forces and economic theory, the idea of fragility and panic is coming from a basic role that banks have, which is liquidity transformation. Okay? Liquidity transformation, I would say, is at the core of banking. And the way that this looks is banks provide liquidity to their depositors and invest in illiquid assets. Okay? By doing that, they create liquidity, but they also end up with a liquidity mismatch, whereby they have liquid liabilities, but illiquid assets.

You see a couple of pictures here on the right. This is from the Nobel Committee press release, when they gave the Nobel Prize to Diamond, Dybvig, and Bernanke, partly or mostly on the theory of bank runs and bank fragility. And you can see at the top how banks effectively work, by collecting deposits and then putting this money to work in the economy, and being ready for people to take the money out whenever they want. And then in the bottom, you see what happens when this gets out of control, which is basically everyone realizes that the bank does not have enough money to serve everyone if everyone wants to take their money out, and so they all panic and they go to the bank and take their money out. Okay?

So the liquidity mismatch is essentially making banks vulnerable to panic-based bank runs. Depositors rush to withdraw their deposits because they expect that others will do so. And in the language of game theory, sort of thinking about it formally, we talk about it as strategic complementarity. And I'm going to come back to this term over and over again, so it's important to remember that strategic complementarity. Basically, strategic complementarity in game theory is describing a situation where people want to do the same thing as other people, okay? And strategic complementarity is generating fragility, because if everyone wants to do the same thing, you can have big movements from one equilibrium to another equilibrium. So keep that in mind, because this will come back as we are trying to identify how to look for this in the data.

So the big question over the years in the literature on bank runs has been is it really panic or maybe it's fundamentals. Okay? And there have been these separate approaches going back to some of the classic papers in the literature, where the fundamental-based approach says, "Well, it's not really panic. People are just responding to fundamentals. When they see that the bank made some bad investments, then they want to take their money out. So this is all fundamental-based." Or is it panic-based, which suggests that people are responding to the fear that other investors are going to take their money out? So thinking about it along these separate lines. And as I will show you, they're not so separate. They, in fact, interact. And what I will argue is that we have a little bit of both, and we can see how the panic is kind of aggravating the response to fundamentals. But I will say that you may wonder why do we care about all this? Is it just academic curiosity or is there something practical in it?

I would say this is super practical, because at the end of the day, when you are thinking about policy and what governments, central banks, what they should do when it comes to financial crisis and regulating banks and so on, most of the approach that has been taken over the years where banks are providing liquidity, where banks are regulating... sorry, where central banks are providing liquidity, regulating, and sort of trying to prevent a crisis, I would say most of it is coming from this idea that there is some underlying panic, right? So many policies, such as deposit insurance or lender of last resort, are basically based on the premise that runs are not driven only by fundamentals, but there is an element of panic in it. And then people who criticize those policies would say that they sometimes go too far and they might cause more damage than solving any problem. And so I think it is important, very important for

policymaking to identify the extent to which panic indeed plays a role in those real-world episodes versus just fundamentals. Okay?

So how do you look at it empirically? And this is mostly what I'm going to talk about today. Based on some underlying theory, I will describe how you can look for these forces in the data. I will say there is longstanding evidence that crisis and runs are connected to fundamentals, and that should not come with a lot of surprise. At the end of the day, it is the banks that are weaker that are more likely to suffer a crisis and a run. There has been some confusion in the literature for some time, where people would say, "Well, they're connected to fundamentals, so maybe there isn't really any panic." But as I will argue here today and based on some theoretical work that I've done and others have done, I will say that this is not the right way to look at it. And I will describe to you some conceptual framework that is based on what we know in game theory as global games. I'm not going to go into the technical details of it, of course, but just kind of show you the gist of it.

And basically, what it says is that the association between runs and bad fundamentals does not rule out the existence of panic-based behavior. In fact, as I mentioned before, panic can basically manifest itself as amplification of the effect of fundamentals. And then you need alternative tests that can be designed to identify panic. And I will basically show you how this is done, how we've done it across different papers in the data.

So let me show you some evidence from banks, and this is based on a recent paper that we did that was published last year in the Journal of Finance. So I will start by showing you the main idea of the conceptual framework. Underlying this, there is a model with a lot of details, but I'm not going to go into it. And then I will show you how this is taken to the data and what we can conclude from that on the underlying forces behind fragility. Okay?

So what you see here is kind of a graph that demonstrates the key theoretical force or prediction that is coming from the theory. If you look at the top, then you can think about the horizontal axis here as, you see the letter P, you can think about P as capturing the performance of the bank or the fundamental of the bank. Okay? In general, what we say is when P is very high, then there will be no bank run. When P is very low, there will clearly be a bank run. And when P is in between, it's kind of undetermined. It's depending on panic, there could be a run or not.

The global game framework that I described, that I mentioned, is basically helping us to pin down what will happen in this intermediate region. And then there is this threshold that you see here as P star, and we say below P star, people will coordinate to run, and above P star, they will coordinate not to run.

Moving to the lower panel. And this is where the power of the theory is coming from, to go into the empirical evidence. What you see there are two different thresholds characterizing two different banks. So the bank with the higher threshold is the bank that has more liquidity mismatch or more strategic complementarity. And the bank with the lower threshold is the bank has a lower liquidity mismatch or lower strategic complementarity. And the basic idea is that if you are a bank that provides more liquidity transformation, you have more liquidity mismatch, you are going to generate more strategic complementarity, and as a result you're going to be more prone to run or panic. Okay? So people are going to start running on the bank that has more liquidity mismatch at higher fundamentals than they will run on the bank that has lower liquidity mismatch. And that's the kind of thing that you can then generate predictions from and look at it, at the data, and see how this fragility is leading to panic and how panic essentially amplifies the effect that fundamentals will have on the bank.

So there are two key predictions that come out of it, and I will show you how we look at them in the data. One prediction is conditional on low fundamentals. Banks that have a higher degree of liquidity mismatch will have more outflows. Okay? So you can take two banks, they have the same fundamentals,

the same performance, the same ROA, whatever you want to think about it. The bank that has more liquidity transformation, more liquidity mismatch is going to suffer more outflows.

And the second one that is a little more continuous and in some sense easier to see in the data is basically saying that banks that have a higher degree of liquidity mismatch will have stronger sensitivity of outflow to bad performance. So that's just a more continuous version of the first prediction. And it basically says as fundamentals start to deteriorate, the bank that has more liquidity mismatch is going to see outflows more quickly, more forcefully, whatever you want to call it. Okay? And these are the things that we try to take to the data to kind of give support to the idea that panic indeed plays a role.

So how do we do that? Well, the key question is how do you measure liquidity mismatch? Okay? What is liquidity mismatch? It's basically the extent to which your assets are more illiquid than your liabilities. So a higher liquidity mismatch will show up as more illiquid assets or more liquid liabilities, and we measure it with both. And then we also do interactions and so on. So I'm not going to go into all the details here. What I will say is the way we look at it from the side of the liabilities is through the reliance on uninsured deposits. So banks that have more uninsured deposits, they will have more liquidity mismatch according to our measure. And then from the asset side, this is measured by the illiquidity of the assets. Banks that have more illiquid assets will have a higher degree of liquidity mismatch. And again, you can interact the two and do all sorts of things like that. But these are the two building blocks essentially.

And again, the idea is that both these measures, they strengthen depositors' incentive to run even when the bank is solvent and just because of the fear that others will run. Okay? So when you are invested in a bank and you know that other investors around you are uninsured, depositors, you worry what they will do and then you're more likely to run. When you are investing in a bank and you know that the bank has more illiquid assets, again, you worry about what other people around you are going to do and then you're more likely to run.

Here is a quick balance sheet example that I think helps to see how these work. So look at the balance sheet at the top. You see a bank that has on the asset side, $50 in cash and $50 in loans. And then on the liability side, $75 of uninsured deposits, $15 of insured deposits, $10 of equity. There is an assumption here that in case of early liquidation, the loans can be liquidated with a haircut of 40%. So if you want to sell the $50 of loans, you are only going to get 30. Okay? If you do the math quickly, you will realize that the bank that I show you here at the top is not prone to runs. Why? Because the liquidation value of the assets is going to be 80 and there are only $75 of uninsured deposits. So basically, the uninsured depositors say, "Whatever happens, we are okay."

However, if you move to either one of the balance sheets in the bottom, we are changing one dimension and we see how a bank that has the same degree of solvency can all of a sudden become prone to run. So looking at the left of the slide, what we did was to now make the assets a bit more illiquid. So instead of $50 in loans, you have $80 in loans and only 20 in cash. If you do the math, you realize that now this bank can come up with only $68 of quick cash. And so the uninsured depositors will start to worry because they have 75, there is only 68 that can be liquidated immediately. And so they realize if others run, I will be out of money. And this is what creates the incentive to run.

You look at the balance sheet on the bottom right, what we did here was to change the liabilities and basically say that instead of having 75 of uninsured and 15 of insured, now everyone is uninsured. And again, if you do the math, you realize that there are more uninsured deposits than the amount that can be liquidated immediately. And so this bank is now going to be prone to run, depositors are going to be nervous. Okay?

So that's the gist of the story and that's what we look for in the data. The paper does a lot of regressions and sensitivity analysis and robustness with all sorts of specifications of the kind that you would expect

from a refereeing process. And I'm not going to get into all that. I will just show you three pictures that I think capture the main finding of the paper and related to what I said before.

So what you see in the top, basically the top panel, so the horizontal axis is the performance of the bank, and we are measuring performance by ROA, return on asset, but you can do it in various ways. And what you see in the red line is the flows of uninsured deposits, the blue line is the flows of insured deposits. And what you see here very clearly is uninsured depositors are responding to fundamentals. When they see that the performance of the bank deteriorates, they start to take their money out. Insured deposits, as you would expect, they're not doing it. They don't care so much what's going on with the bank. And, by the way, I didn't say that, but this is a study that is done on effectively all US banks in the last 30 years, so roughly from the mid-'90s to 2022.

So one thing to take from the top panel is uninsured depositors are sensitive. When they see that there is a fundamental problem, they are more likely to take their money out. The other two panels are going deeper to try to understand this additional force of panic. And what you see in the middle panel, we have two terciles. So here we basically look at it based on the illiquidity of the assets. And the red one is the banks that have more illiquid assets and the blue one are the banks that have less illiquid assets. And you can see that the uninsured depositors are much more sensitive to the bad performance when the bank holds more illiquid assets. Okay? So that goes back to the story I said before, it's not just about the fundamental of the bank, the performance of the bank. When they realize that there is bad performance and there is liquidity mismatch, they get nervous and they're more likely to take their money out.

The bottom panel is doing the cut based on the percent of uninsured deposits. And again, the red one are those that have more uninsured deposits and the blue one are those that have less uninsured deposits. And what you see here is when uninsured depositors are surrounded by other uninsured depositors, they are more likely to take their money out. Okay? So again, banks are worried not just about the fundamentals, but also what others are going to do. When they think that others are likely to start taking their money out, they want to do the same thing. And that means that when we are monitoring banks, we have to look at how they do in terms of performance, but we also need to think about the structure of the balance sheet and the extent to which they have liquidity mismatch. When you have a higher degree of liquidity mismatch, depositors are more likely to respond to bad performance and start taking their money out. And this is really the core of fragility.

Okay. So that's all about banks. I'll come back to banks a little bit at the end, when I briefly mention a couple of recent papers or working papers. This one was also recent, but work-in-progress. But let me now pivot and talk a little bit about mutual funds, because what I will tell you is that similar forces also happen with mutual funds, and that's also something that I've been working on quite a lot over the years. And I will show you the story of it through three papers that kind of evolved over time as I think this phenomenon became more and more central. Okay?

So think about open-end mutual funds. Some people will say, well, it's very different from banks, because with a mutual fund, you put your money in, but you are not guaranteed any fixed amount, right? The mutual fund tells you when you take your money out, you will basically get whatever is the net asset value at that point. Okay?

But what I argued over time and others as well, is that even though we have a floating-NAV environment, there is still liquidity transformation when the mutual fund invests in illiquid assets. Why does that happen? Because if a mutual fund invests in illiquid assets and investors want to take their money out, investors basically come in and can take their money out at the end of the day. Now, the mutual fund is not going to take whatever assets they have and just liquidate everything at the end of the day and pay investors. The way they manage it is they hold a bunch of cash and then they pay

investors with cash, and then they deal with the consequences later on, right? So they will rebalance the portfolio and liquidate assets in future days.

So basically, what happens, which is very similar to banks, is that when investors take their money out of a mutual fund, they impose this negative externality on others, we get the same strategic complementarity, right? If I think that other investors are going to take their money out, I want to take the money out as well, because I don't want to be the one paying the liquidation costs for all those who took their money out before me. Okay? And with this insight, I'll show you three different papers with different settings on how this liquidity mismatch is amplifying flows in mutual funds just the way it does in banks.

So this is an early paper that was published in 2010. Back then, most of the mutual funds were equity mutual funds. And what we showed, looking at the red line versus the blue line, the red line are the funds that are holding more illiquid stocks, the blue line are the funds that are holding more liquid stocks. And you can see that as the performance gets more and more negative, there is a wedge that opens up between the illiquid funds and the liquid funds, in which the outflows from the illiquid funds are amplified relative to the outflows from the liquid funds. Okay? That's kind of a lab to look at the underlying forces. The magnitude here is still moderate, I would say, given that we are looking at equity funds, and in general they tend to be liquid. Okay?

But the thing became, I think, much more noticeable and also of much more policy interest when corporate-bond mutual funds came into the picture and started growing in prominence. And corporate bonds, of course, can be much more illiquid, given that they are not traded in centralized exchanges. And there's a lot of evidence on the big transaction costs that you have to pay in order to liquidate corporate bonds. So now you basically have a structure where the fund is holding very illiquid assets, but they are still allowing their investors to take their money out whenever they want. And all of a sudden this run problem becomes much more prominent.

So what you see here is a comparison between corporate-bond funds on the left and stock funds on the right. The main line to look at is the blue line, which is the main estimate, and you can see how the sensitivity of outflow to bad performance is very significantly amplified in corporate-bond funds and not in stock funds. In fact, I think the main thing that people may remember from this paper is the fact that in stock funds you have a convex relationship between flow and performance, which is something that has been discussed a lot over the years, but in bond funds, this convex relationship changes into a concave relationship, and there is a much greater sensitivity on the downside than on the upside. And there's a lot more, of course, to show that this is coming from this liquidity mismatch, but this is kind of the headline result to take from that.

And then paper number three here is the COVID-19 episode, where I think it all came to some peak and we saw a major almost crisis, I would say. It could have been a crisis, except that there was policy intervention that prevented the full-blown crisis. But for a few weeks there were major outflows from corporate-bond funds that were unprecedented. Okay? So what you see in the top panel, this is kind of a decade-long overview of flows into and out of corporate-bond funds. You see that the outflows in March of 2020 were clearly unprecedented. Nothing like that happened before. And then what you see in the bottom panel is how this evolved over the window of the crisis. And again, what the paper does is to go in a lot more detail and show that even among corporate-bond funds, you can show that these forces were much stronger for funds that held more illiquid assets as the theory would predict. Okay?

So again, the connecting theme is that liquidity mismatch creates strategic complementarities. Strategic complementarities can generate panic. The way that this operates, it's not that people out of the blue just decide that they want to take their money out of a bank or a mutual fund, but rather as fundamentals are deteriorating, they become more worried when they know that there is this strategic

complementarity. So the panic is essentially amplifying the response of investors to fundamentals. And you see that both in banks and in open-end mutual funds.

So I will now talk a little bit about current research. So this is ongoing work. I will spend just a few minutes on each one of two papers, and then I will conclude and leave time for questions. So current research on banks, and I will try to be quick on that. So in a follow-up paper to the paper that I showed you before on banks, we're now looking at how these shocks are transferred across banks. Okay? So this is basically thinking about spillovers and contagion.

And of course, I don't think I need to motivate here why we care about contagion. You see two pictures here, one from the 2008 crisis. Lehman Brothers I think was a very good illustration of how the failure of one financial institution can generate many other failures. And since then, there is a lot of reflection and attempts to prevent contagion and spillovers. What you see in the bottom panel is just evidence of how the fear of contagion was central in the Silicon Valley Bank crisis. And this is Bill Ackman basically saying in a few days there will be no banks left, because after people see one bank failing, they will start taking their money out of other banks as well.

So in this paper, basically what we are trying to see is try to dig into that and see whether using the same kind of framework and logic that I showed you in the previous paper, whether there is evidence that these shocks are also transmitted across banks, and that you have these spillovers and contagion. And I will say when you are thinking about contagion, you are basically thinking about three interacting layers.

I would say the first and most basic is banks are correlated. And so when you see that there is a problem in one bank, you start worrying about other banks. This is kind of the pure fundamental effect.

But the second layer is that panic aggravates that. And when you see that there are problems in one bank and you say, "People will start worrying about my bank," now you worry if there is liquidity mismatch that is generating panic, right? So in some sense, following what I said before, the fact that there is liquidity mismatch is going to aggravate the extent to which we respond to shocks in other banks.

And the third layer is that banks are also interconnected. And when people start taking money out of one banks, this is putting other banks in a more problematic situation, because we have file sales and banks are interconnected. So these are really two interacting layers, and that's what we are trying to bring out of the data.

So basically, the idea here is to take the same framework that we had in the other paper but now apply to a cross-bank setting. And this is an opportunity to show that panic works in a richer setting. It also gives you the opportunity to explore multidimensional liquidity mismatch because, think about it, now you worry not only about the liquidity mismatch of your own bank, you also worry about the liquidity mismatch of other banks, right? Because if I invest in bank A and I see that there is a problem in bank B, I'm basically saying, well, if bank B has a liquidity mismatch, this is more likely to get out of control and then affect bank A. So I worry about my own liquidity mismatch, the other bank liquidity mismatch, the interaction of the two. There are a lot of things, interesting things that come out of the data in a framework like this.

So I'm not going to go too much into the details at all, because I should probably finish in a few minutes and leave time for questions. I will say the way that we are looking at it is basically for every bank create a measure of the performance of peer banks, where peer banks are banks that are operating in the same counties. And what you see here is how this is created by having a proxy for the performance in a given county and then having a proxy for the performance of peer banks for any individual banks based on the counties that they're working in.

And then basically what we do is, looking at the same measures of liquidity mismatch, which are the reliance on uninsured deposits and the illiquidity of the assets, we can then basically run the same tests and see whether these shocks are transmitted across banks and whether they are amplified by contagion across banks. Okay?

This is the way that the regression works, where on the left-hand side we will look at the deposit flow and then on the right-hand side we will have the peer ROA, which is a measure of the performance of the peers. And then the key thing is the peer ROA interacted with the liquidity mismatch. And the idea will be that this beta one should be positive and significant because liquidity mismatch is going to aggravate the response in the focal bank to the performance of the peer banks.

And again, without going into details, I will just say that the regression analysis confirms this and the magnitudes are pretty large.

So here we look at focal bank fragility. So basically looking at bank A, how depositors in bank A are responding to performance in bank B, and how this is affected by the liquidity mismatch of bank A. And you can see the table on the right of the slide kind of gives you a sense of the magnitudes. The magnitudes could be quite large. So for example, if you look at the percent of uninsured as a measure of liquidity mismatch, and you are thinking about what happens to the flow performance sensitivity, then it amplifies it by 62%. So one standard deviation increase in the percentage of uninsured is going to make the flow 62% more sensitive to performance of peer banks. And you can play around with this. And in general, the results are pretty strong.

And here, we look at the effect of peer bank fragility. Again, the idea is, so you have bank A and bank B, there is a shock in bank B, how depositors are going to react in bank A and how this depends on the liquidity mismatch of bank B. And again, the general message that comes out of it is that those liquidity mismatch proxies are amplifying the response of depositors to fundamental shocks, not only within a bank, but also across banks. And so this is the sense in which we can detect the presence of panic or strategic complementarities in the data.

So last thing I will talk about before concluding is another working paper on mutual funds. So in general, it's kind of two parallel tracks that I've done over the years, thinking about the fragility of banks and thinking about the fragility of mutual funds. And I think they are related, but of course the institutional details and the episodes that you have are pretty different. So you get different opportunities to look at it from different angles.

So what we're doing now, sort of the current research on mutual fund, which came as a surprise to me, is the role that target allocation funds have in the fragility of mutual funds and the fragility of corporate-bond markets more generally. So I talked about the COVID episode before. What you see here is looking at bond fund flows that are done by target allocation funds versus other investors. And the red line is the target allocation funds, the black line is the other investors. And you can see that a lot of the outflows in March of 2020 came from target allocation funds.

Now, why does it happen? It's pretty interesting. There's a very basic mechanical details about how they work that make them take their money out in an episode like COVID, which is target allocation funds are supposed to maintain the same proportion of holdings across bond markets and equity markets. In March of 2020, the equity market dropped a lot, so what they had to do is take money out of bonds and put them in equity in order to keep the allocation proportional to what it was before. So they took a lot of money out of bond funds as a response to that.

Now, how is this related to everything I told you so far? In some sense, this is kind of the ideal setting to look at strategic complementarities, because here you have an episode where you know that a bunch of investors are kind of forced to sell, and the question is what do other investors, holding money in the

same funds, what are they going to do? And this is the setting where you can look at that. And this is a regression setting. And again, I will spare most of the detail and just focus on the key thing.

What we are looking here on the left-hand side are flows out of corporate-bond funds by investors that are not target allocation funds. And what we're looking at the right is the amount of outflows from the same corporate-bond funds that is driven by the reallocation, rebalancing-induced trading, this is how we call it, of the target allocation funds. And then we are also interacting this with illiquidity.

So the idea is if you have an investor in a corporate-bond fund and you know that other investors in this fund are heavily represented by target allocation funds, you know that they are going to take their money out because of this mechanical rule that they have to follow. So if there are strategic complementarities, you are more likely to take your money out as well. But this is even stronger when you know that the fund is illiquid, because then, as I mentioned before, you worry much more about what they are going to do.

So that's what we look at. And the results that you see here in the table confirm that this is going on. So there is the shock, then the target allocation funds are taking their money out. But what is even more surprising is that the other investors that are matched with the target allocation funds are more likely to take their money out. And I think this is pretty direct evidence that this kind of strategic thinking, strategic complementarity is in play.

What you see here is kind of decomposing the flows into target allocation fund trading, strategic complementarity and others, and the strategic complementarity is in red. And if you focus on the first quarter of 2020, you see that the strategic complementarity is amplifying the direct withdrawals of the target allocation funds to a large extent. And when you take together the outflows of the target allocation funds plus the strategic complementarity that they were generating, you get about 50% of the outflows from the bond funds.

So again, there is something institutional, very curious here, that target allocation funds are bringing this new source of fragility to corporate-bond markets. But I will go beyond that and say it's not just the fact that they are withdrawing, but it's also the fact that there are other investors around them who know that they are going to take their money out, and so they are more likely to follow because they're nervous about the implications. Okay?

I will maybe skip that. I will just say this is also generating a correlation between stock markets and bond markets because, as I mentioned, when stock markets are going down, target allocation funds will start taking money out of bond markets, and that is generating this correlation. And you can measure how much of this correlation is generated by this channel.

Okay, so let me conclude and then take some questions. So the general thesis that I was pushing here that is supported by research over the years, is that liquidity transformation, which I think is a key function of the financial system, is generating strategic complementarities, and these strategic complementarities cause fragility in the financial system. You can find evidence for that, as I argued, using insights from theory. Strategic complementarities cause panic that amplifies the direct effect of fundamentals. And it's important to remember this is how it works, panic is amplifying the effect of fundamentals.

I think for a long time, when people are thinking about panic, they have in mind this sunspot that all of a sudden appears and everyone out of the blue start panicking and taking their money out. I don't think that's how it works. I don't think we're likely to find these episodes of sunspots and crisis that happened completely out of the blue. I think the way it works is there is some deterioration of fundamentals and then the panic is building on top of that and amplifying the response to the fundamentals. And this phenomenon is present both in banks and non-banks, and I showed you evidence from banks and from

open-end mutual funds, and then also the extent to which this is related to interconnectedness of institutions in the financial system.

When you think about the implications for regulation and policy, this is the kind of fragility that calls for regulation or intervention to limit the negative externalities. So when we are thinking why do we need a lender of last resort? Why do we need liquidity injection? Why do we need deposit insurance? It's always because we think that there is this element of panic, and this evidence helps to support that. But it also, I think, supports taking measures in advance to reduce the extent of risk that is coming from these institutions. In general, we have a lot of these policies when it comes to banks, we don't have them as much when it comes to non-banks and in particular open-end mutual funds that I looked at.

So over the last decade or so, this issue was in discussion across different forums and there are many ideas that came up, but the implementation has been pretty slow, such as improving the liquidity of underlying corporate-bond assets, requiring funds to hold more liquid securities and cash, or even something like swing pricing, that is meant to reduce the extent of strategic complementarities. Those have been very slow to be implemented.

And finally, I'll finish with that, thinking about new dimensions of risk. So the environment around us is changing fast, and I think it has implications also for the sources of fragility and runs. One thing we saw in the Silicon Valley Bank crisis is that recent technology might have amplified the effect of strategic complementarities. So the fact that we had digital banking and people could withdraw their money very quickly, essentially made deposits much more flighty. The fact that there was social media that facilitated the transmission of information, again, probably helped the fragility. So there is the level of strategic complementarities that we are used to, but all these technological advances could make it faster and stronger. And those could maybe even strengthen in the future with all the innovations that we are currently discussing, such as stable coins and tokenized deposits. So I think in general, policymakers should keep that in mind alongside with all the evidence that I mentioned on panic and fragility to think about how to design a more stable financial system. So I'll stop here.

Joe Haubrich:

We have time for a few questions. I'll start with one that was from online. Maybe following up on one of your final points, would you like to expand on the idea that social media may have changed the propensity of depositors to run or panic?

Itay Goldstein:

Yeah, absolutely. So I think there is still a lot more to do on this dimension. But if you are looking at the anecdotal evidence coming from the Silicon Valley Bank episode, certainly there was a lot of information that was transmitted on social media, including depositors saying, "I'm going to take my money out, you better do the same." We need better models and maybe more careful empirical analysis to see what role this played in amplifying the crisis. But I think the anecdotal evidence that we see suggests that this was quite a potent force in that episode. And I did see a couple of papers that started to look at it more, including showing that banks that were more exposed to social media were less stable around that time, which I find quite interesting.

Joe Haubrich:

Thanks. Anyone in the room?

Speaker 3:

Thank you. I'm thinking about that Bill Ackman quote, the Tweet that you put in saying he was concerned about deposits flowing from the likes of Silicon Valley Bank to the likes of JP Morgan, because they were perceived as being too big to fail. So I wonder whether you, first of all, whether you've extended your results to what we might consider as systemically important banks, but also thinking about that almost as a potential policy outcome, where would a system like you get in Canada or Australia, with a relatively small number of large, more protected banks, be better? Because the money's got to go somewhere, right? It's going to go from one bank or fund, into somewhere else.

Itay Goldstein:

Right. Yes. Yeah, I agree with you. I think this is a very important thing to look at. So I will say in the paper that I showed you that we are currently still working on, we haven't looked at this dimension. And I should also say, I mean, it doesn't include the SVB episode, so it's until 2022. But the way that we are defining a peer bank there is to say that this is another bank that works in the same area as you. We're putting them into buckets of size, but we are not necessarily looking at how a shock in one type of bank will cause flows into another type of bank or, more directly, how deposits are potentially flowing from the small banks to the large banks. I think we need more evidence and more research to look into that.

I will say in general, when we are looking at flows in these papers, we are looking at a particular bank, so we see when depositors are taking money from a particular bank, but we don't really know where this money is going to. You need more detailed data and information to look into that. But in general, I agree with you, it is certainly a source of fragility, the fact... I think what you're saying is it's not enough that they worry about the current bank they're at, it's also whether they have an alternative. So maybe making them all more homogeneous is going to reduce the extent of fragility along these lines. I think that's an interesting point, yes.

Speaker 4:

Regarding mutual funds, do ETFs solve the problem or do they have something in their structure that creates a similar issue?

Itay Goldstein:

Right, yes. Yeah, this is a very good question. In general, I tend to think that ETFs are resolving this strategic complementarity that you have in open-end mutual funds. Because the way that it works in ETFs, when you want to take your money out of the ETF, you need to sell your share in the market. So in some sense, you are immediately faced with the consequences of what you did. Unlike a mutual fund, when you take your money out of a mutual fund, the mutual fund will pay you cash and will deal with the liquidation later on. So I think the structure of the ETF really helps in that dimension.

But, and the ETF structure is pretty complicated, at the end of the day, it does rely on this segment of the market that is called authorized participants, because the authorized participants are those that are kind of intermediating between the investors and the funds. And basically, what the authorized participants are supposed to do is they're supposed to then exchange shares with the fund and potentially they are generating the redemptions or creation of new shares. And without the authorized participants, basically what will happen is that this will just be a closed-end fund. And the closed-end fund, we basically know from history, they tend to have a big discount between the price of the asset in the market and the value of the underlying assets. And investors get very upset about that, and then a lot of the closed-end funds turn into open-end funds.

So I think whether ETFs can really solve the problem at the end of the day will depend on the extent to which we can rely on the authorized participants. What we showed, according to this COVID paper, is that it seemed like ETFs were more resilient than open-end funds in the COVID paper, but I think we need to see more over time to what extent this authorized participants are really resilient and the extent to which they can support this mechanism.

Speaker 5:

I have a conceptual question, how to marry your results from the empirical work to the theory, right? In some sense, the way the games are often set up is the strategic complementarity ends up leading to an equilibrium that is sort of at the far end of the spectrum, right? You can have a stable equilibrium, where everyone stays in their bank, or you can have a run equilibrium, where everyone runs, because it's self-reinforcing.

Now a lot of your empirical work shows that there's a correlation between... that there is evidence for strategic complementarity in the sense that the fact that some people move, be it in a bank or a mutual fund, encourages others to move as well. Yet a lot of the evidence you've shown did not result into the full switch, where the mutual fund failed, where the bank failed, right? So how do you think about those forces that have complementarity but yet constrain those dynamics and sort of find a new equilibrium at which we don't have a complete run?

Itay Goldstein:

Right. Yeah, that's a good point. I would say the version of the theory that I showed you is pretty simplified. And one dimension of simplification is to say that people get noisy signals about the fundamentals, but the noise is very small. So even though they don't get exactly the same signal, their signals are very close. And then, at the end of the day, a small shift in fundamental will lead to a shift in all their signals, and then they either all run or none of them runs. If you look at a version of the model where people have noisy signals and the noise is larger than that, then it'll not be such a bang-bang solution, it will be much more continuous and there will be a meaningful region where a few people run, a few people don't run.

The other thing I think that is missing in the theory that I showed you is that there could be also heterogeneity across people. So they have different liquidity needs, they pay different amount of attention, all sorts of things like that, and that will make it smoother. So you're right, I mean, the version of the theory I showed you is pretty stark. Reality is obviously more complicated than that.

Joe Haubrich:

Thank you, Itay. We will now take a 15-minute break and come back at 2:15 for our next paper session.

Itay Goldstein:

Thank you.