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Multiple Scenarios in Stress Testing

Remarks by

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at the

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Thank you for the opportunity to speak today. I'm here to offer my thoughts on the next steps for stress testing, and in particular why using multiple exploratory scenarios will help improve our understanding of risk in the banking system.[1]

The stress test as we know it today grew out of the 2009 Supervisory Capital Assessment Program, or SCAP, conducted in the heat of the global financial crisis. In the winter of 2008–09, markets had lost confidence in banks amid wide uncertainty about the future path of the economy and the losses banks could face. This prompted the Federal Reserve and Treasury to conduct a stress test to determine the health of the 19 largest banks under a severely adverse economic scenario and to publish the findings. The release of the results provided transparency about the status of the largest banks, made it easier for firms to re-capitalize themselves, and restarted the provision of credit to the economy that began the process of recovery.

Following the success of this stress test, Congress mandated in the Dodd-Frank Act that the Federal Reserve conduct an annual stress test of large banks to determine whether those banks have sufficient capital to absorb losses under adverse economic conditions.[2] And today this test—as well as the data collection that supports it—is one of our primary tools to assess and to help ensure banks' resilience, in good times and bad. During periods of economic or financial uncertainty, stress tests can provide critical assessments of bank resilience to supervisors, the

[1] These remarks represent my own views, which do not necessarily represent those of the Federal Reserve Board or the Federal Open Market Committee.

[2] Specifically, the Dodd-Frank Act directs the Board to conduct annual evaluations of firms to determine whether "such companies have the capital, on a total consolidated basis, necessary to absorb losses as a result of adverse economic conditions." 12 U.S.C. § 5365(i)(1)(A).

market, and policymakers. This transparency helps enable markets to function better in times of stress.[3]

Outside of stressful periods, stress tests can help to assess sufficient capitalization and improve supervisory insight into risks. The stress test also can provide transparency into the build-up of risks across banks. In our experience, the test results have given supervisors valuable information to provide feedback to individual firms and helped the Board assess the stability of the financial system. A recent study confirms this experience, finding that banks subject to the stress test were less exposed to common systemic risks.[4] In addition, the stress test helps to make capital requirements less susceptible to gaming by firms and therefore more likely to be set at adequate levels.[5] This is so because the design of the scenario can change based on our observations of growing risks in the system. The scenario framework, by using parameters that become stricter when the economy is stronger, also helps to avoid exacerbating the natural tendency for banks to take larger risks during good times and become highly risk averse during bad times.[6] Furthermore, stress tests change in response to improved modeling and evolving risks, so that the tests better estimate potential losses in a downturn.

Over the past 14 years, we have learned from our experiences and continued to evolve the stress testing program. We have taken steps to increase the transparency of the stress testing

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[3] See D. P. Morgan, S. Peristiani, and V. Savino, "The Information Value of the Stress Test," *Journal of Money, Credit and Banking* 46, no. 7, September 23, 2014: 1479–1500, https://onlinelibrary.wiley.com/doi/abs/10.1111/jmcb.12146.

[4] See C. Sahin, J. de Hann, and E. Neretina, "Banking Stress Test Effects on Returns and Risks," *Journal of Banking and Finance* 117, August 2020, https://www.sciencedirect.com/science/article/pii/S0378426620301096.

[5] See R. Greenwood, J. Stein, S. Hanson, and A. Sunderam, "Strengthening and Streamlining Bank Capital Regulation," Brookings Papers on Economic Activity (Washington: Brookings Institution, Fall 2017), https://www.brookings.edu/wp-content/uploads/2018/02/greenwoodtextfa17bpea.pdf.

[6] See 12 C.F.R. § 252 appendix A.

program, including to publish an extensive description of our approach to model development, implementation, and validation, as well as our approach to scenario design.[7] In connection with each stress test, we disclose a detailed summary of the stress test methodology, and for several key portfolios, disclose our approach to modeling loss rates, summary statistics, and modeled loss rates.[8] In 2020, we adopted the stress capital buffer, which uses the results of the stress test to inform a firm's capital buffer requirements.[9] The program also provides banks with the opportunity to request reconsideration of their stress capital buffer.

While our stress test is an important measure of the strength and resilience of the banking system, we must recognize that it does have limitations, as does any exercise. I'll walk through three limitations and explain how they can be at least partially mitigated by incorporating multiple exploratory scenarios into our stress test program. What I mean by an exploratory scenario is a scenario that is not used to set a firm's stress capital buffer requirement. I'll then describe how the Federal Reserve could use the results of exploratory scenarios to help ensure the banking system remains strong and resilient, by allowing us to better understand potential risks and improve our supervision of those banks.

As we move forward, we must remain cognizant that none of us can predict future stressful events and their consequences with confidence.

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[7] See 12 C.F.R. § 252 appendixes A and B; Board of Governors of the Federal Reserve System, *2023 Stress Test Methodology* (Washington: Federal Reserve Board, June 2023), https://www.federalreserve.gov/publications/files/2023-june-supervisory-stress-test-methodology.pdf.

[8] See *2023 Stress Test Methodology*, https://www.federalreserve.gov/publications/files/2023-june-supervisory-stress-test-methodology.pdf.

[9] See Board of Governors of the Federal Reserve System, "Federal Reserve Board Approves Rule to Simplify Its Capital Rules for Large Banks, Preserving the Strong Capital Requirements Already in Place," news release, March 4, 2020, https://www.federalreserve.gov/newsevents/pressreleases/bcreg20200304a.htm.

Limitations of Stress Testing

First, the current stress test uses a single scenario that is focused on a credit-driven recession and single global market shock to test the financial condition of firms.[10] A single scenario cannot cover the range of plausible risks faced by all large banks. This has been confirmed time and time again, including in recent experience.

The failures of three large banks last spring showed that acute banking strains can emerge even without a severe recession. Yet, conditions such as those recently experienced presented challenges for the design of the supervisory stress scenario. Most notably, the Federal Reserve's stress testing policy statement—which governs how the hypothetical scenarios are determined—requires that the severely adverse scenario include a rapid increase in the unemployment rate to at least 10 percent, as well as steep declines in house prices. Such conditions are historically associated with subdued inflation and a fall in interest rates. The fact that significant banking stress emerged in very different conditions underscores the limitations of our current stress testing processes.

We also do not take into account second-order effects of stress within the financial system, which are channels that amplify the effects of the shocks hitting bank's balance sheets, leading to losses spreading throughout the financial system. A good example of this is the reaction of funding markets to stress at an individual firm or many firms. These network effects may result in losses across the system not fully captured by our stress tests. While the severely

[10] Banks with large trading operations are tested against a global market shock component that stresses their trading, private equity, and certain other fair-valued positions. Furthermore, banks with substantial trading or custodial operations are tested against the default of their largest counterparty.

adverse scenario is calibrated to historical recessions that have included contagion, our stress tests may not fully capture the evolving interconnections in today's financial system.

The second limitation involves our models. In developing supervisory models, Federal Reserve staff draw on economic research and industry practice; the models are also independently validated by a group of experts outside of the stress testing program. However, all models have limitations—they are generally trained on historical data and therefore may not be robust to structural breaks, such as a once-in-a-lifetime pandemic, or important changes in technology.[11] Expanding the range of risks captured in the stress test makes models more robust to these limitations but will not address them completely.[12]

The third limitation is how the stress test affects bank behavior. Using scenarios that test for the same underlying risks year after year could disincentivize firms from investing in their own risk management as the test becomes predictable, and may encourage concentration across the system in assets that receive comparably lighter treatment in the test. Additional exploratory stress test scenarios could allow supervisors to better probe the internal risk management of firms and assess whether they are holding sufficient capital for their risks.[13] We find that firms often use a large number of scenarios and shocks when running their own internal stress testing processes, and our regulatory counterparts use a number of scenarios as well.

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[11] Each year, the Federal Reserve refines the supervisory stress test, including its development and enhancement of independent supervisory models. The supervisory stress test models may be enhanced to reflect advances in modeling techniques; enhancements in response to model validation findings; incorporation of richer and more detailed data; and identification of more stable models or models with improved performance, particularly under stressful economic conditions.

[12] See Richard J. Herring and Til Schuermann, "Objectives and Challenges for Stress Testing," (December 16, 2019), forthcoming in J. Doyne Farmer, Alissa Kleinnijenhuis, Til Schuermann, and Thom Wetzer (eds.), *Handbook of Financial Stress Testing* (Cambridge: Cambridge University Press), https://ssrn.com/abstract=3504347 or http://dx.doi.org/10.2139/ssrn.3504347.

[13] See Herring and Schuermann, 2019, https://ssrn.com/abstract=3504347.

Expanding the Risks Captured in the Stress Test

Exploratory stress test scenarios could mitigate these and other risks. The goal of stress testing should be to provide sufficient coverage of the types of severe but plausible scenarios that could adversely impact a bank's operations, and the combination of scenarios and shocks should be curated to achieve this goal. This doesn't imply a large number of scenarios. Given the limited number of unique bank business models and variables that drive losses, a relatively small number of scenarios may be all that is required to capture a wide range of outcomes for the banking system.[14]

On the macroeconomic side, additional scenarios could be used to explore the effects of qualitatively different macroeconomic and financial environments. For example, instead of the usual demand-driven recession, a scenario could explore the impact of an inflationary shock to supply. Potentially, an exploratory scenario could probe the interplay between capital and liquidity, to help ensure firms understand their capital exposure to rapid changes in the composition or pricing of their liabilities.[15]

With respect to market risk, the current single market shock used in the test is a one-time shock to several thousand variables in bank trading books. This is just one realization of a large set of risk factors that determine changes in market values.[16] Using additional market shocks

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[14] See Bora Durdu, Rochelle Edge, and Daniel Schwindt, "Measuring the Severity of Stress-Test Scenarios," FEDS Notes (Washington: Board of Governors of the Federal Reserve System, May 5, 2017), https://doi.org/10.17016/2380-7172.1970 and R. Roengpitya, N. Tarasherv, K. Tsatsaronis, and A. Villegas, "Bank Business Models: Popularity and Performance," Bank for International Settlements Working Paper no. 682 (Basel: BIS, December 2017), https://www.bis.org/publ/work682.pdf .

[15] See William F. Bassett and David E. Rappoport, "Enhancing Stress Tests by Adding Macroprudential Elements," Finance and Economics Discussion Series 2022-022 (Washington: Board of Governors of the Federal Reserve System, May 2022), https://doi.org/10.17016/FEDS.2022.022.

[16] The global market shock is specified by a large set of risk factors that include, but are not limited to: equity prices, foreign exchange rates, selected-maturity government yields, selected maturities and

would help us understand how the trading books and counterparty concentrations of firms would change under a range of financial conditions. This could include testing the exposure of firms to different directional risks, such as a sudden rise or fall in certain asset values, or to an unexpected divergence in values of correlated assets.[17] It is particularly important for us to consider a range of market shocks because some concentrated counterparty exposures may be revealed only under certain scenarios.

To advance the goal of improved testing of market risk, last year, for the first time, we introduced an additional, exploratory market shock component. As compared to the global market shock, the exploratory market shock was characterized by a less severe recession with greater inflationary pressures. As we explained in our results disclosure, banks generally looked better under the exploratory market shock, experiencing smaller trading and counterparty losses in the exploratory market shock than under the global market shock. This is valuable information to us and the public, since it suggests that these banks' trading and counterparty exposures may not be an unexpected source of vulnerability during a rising inflation scenario (although that test did not explore the effects of unrealized losses from interest rate risk). The exercise also provided important insight into banks' counterparty exposures in varying conditions, since banks' largest counterparties differed between the exploratory market shock and the global market shock.

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expiries of implied volatilities that are key inputs to the pricing of interest rate derivatives, selected expiries of futures prices for energy products, selected expiries of futures prices for metals and agricultural commodities, and credit spreads or prices for selected credit-sensitive products.

[17] As market makers, the banks subject to the stress test often take either long or short positions depending on the demands of their clients. As such, it is possible that at a given time, the firm is exposed to either rising or falling prices.

Building on these experiences, the Federal Reserve is developing both exploratory macroeconomic scenarios and exploratory market shocks for next year's stress test. As I noted above, an exploratory scenario would not be used to set a firm's stress capital buffer requirement. Instead, the exploratory scenarios will be used to inform the Board's supervisory assessments of firms' risk management and our understanding of different risks in the banking system.

Using the Additional Stress Test Results

Let me speak to how we currently use the stress test, and how we could use exploratory scenarios going forward. A current use of the stress test is to help set capital requirements for large banks to help prepare firms to withstand a severe economic recession and continue to lend and operate. The key features of the scenario used to calculate the capital requirements are generally similar from year to year. Since the stress test is used to set each firm's stress capital buffer requirement, there is a benefit to predictability so that firms are better able to conduct capital and business planning. To the extent we were to adjust key features of the scenario used to set the capital requirements, we would do so through a transparent, public process.

However, a tradeoff with producing predictable scenarios is stifling creativity in scenario design and less bank resilience to a range of potential scenarios, and this is where exploratory scenarios can help. The use of stress scenarios and shocks that do not set a firm's stress capital buffer requirement can provide room to explore a wider range of vulnerabilities to inform risk-based supervision. For example, if the purpose of the exploratory scenario is to inform the Board or the public about new or underappreciated risks, the Board could explore the impact of a scenario using a different set of variables than the ones it has currently defined in its policy statement.

Additional exploratory stress test scenarios could allow supervisors to better probe the internal risk management of firms and assess whether they are holding sufficient capital for their risks. For example, the 2018 stress test revealed that one firm had highly concentrated counterparty exposures that would materialize under the hypothetical stress scenario. This led to supervisory feedback to that firm and its prompt mitigation of the concern. We should continue to enhance the feedback loop between supervision and stress testing.

We can also learn from our international counterparts, who have effectively employed exploratory stress tests. Since 2017, the Bank of England has run a biennial exploratory scenario designed to explore risks not covered by their annual capital stress test. The results of their exploratory tests are used to improve supervisory feedback related to the risk management of firms.

While the results of our stress test are informative and provide a rigorous measure of resilience, the supervisory stress test is not a replacement for a firm's own risk management or its own stress testing processes. Large banking organizations should maintain a solid line of sight into their own risks and focus their efforts to capture those risks and determine capital needs. Our stress test is designed to provide a consistent measure of risk across firms, and is not a replacement for comprehensive modeling, risk management, and capital planning by the largest banks that enable them to measure and manage their own unique risks.

The Future Evolution of Stress Testing

Exploratory scenarios would also allow the Board to have more flexibility in its modeling approaches. For example, the Board could explicitly model the behavioral response of depositors to losses, allowing for contagion of the type we saw earlier this year, the interaction of

the broader economy and the banking system under stress, or the transmission of stress through nonbank parts of the financial system.[18] The Bank of England's recent stress tests included a set of models to better understand how feedback and amplification channels during a stress event could drive contagion losses and exacerbate the impact of an initial shock. These feedback loops included a contagion model testing how deteriorating capital positions might impact the market for interbank lending.[19] Expanding the use of exploratory scenarios in the stress test would allow for more experimentation in the modeling of risks by the Board's supervisory stress test program.

Conclusion

In conclusion, forums such as this research conference are excellent sources of ideas and hypothesis testing. In thinking about the future evolution of stress tests, we would benefit from wide ranging input—from academics, other policymakers, public interest groups, bankers and other market participants.

The stress test needs to continue to evolve. Introducing multiple exploratory scenarios—both for the broader macroeconomic scenario and the global market shock for trading banks—would be beneficial for supervising potential risks on bank balance sheets. These continued adjustments will help to ensure, consistent with the original intent of the Dodd-Frank Act, that

[18] See e.g., D. Aikman, et. al, *Macroprudential Stress Test Models: A Survey*, Bank of England, Staff Working Paper No. 1,037 (London: Bank of England, August 2023), https://www.bankofengland.co.uk/-/media/boe/files/working-paper/2023/macroprudential-stress-test-models-a-survey.pdf.

[19] See Bank of England, "Stress Testing the UK Banking System: 2017 Results," (London: BOE, November 2017), https://www.bankofengland.co.uk/-/media/boe/files/stress-testing/2017/stress-testing-the-uk-banking-system-2017-results.pdf.

the stress test remains a powerful and relevant tool for assessing whether large banks are resilient and our financial system is robust.[20]

Thank you.

[20] See 12 U.S.C. § 5365(i)(1)(A).