Exploratory Analysis of Risks to the Banking System

Summary of Results

June 2024

BOARD OF GOVERNORS OF THE FEDERAL RESERVE SYSTEM

The Federal Reserve System is the central bank of the United States. It performs five key functions to promote the effective operation of the U.S. economy and, more generally, the public interest.

The Federal Reserve

- **conducts the nation's monetary policy** to promote maximum employment and stable prices in the U.S. economy;
- **promotes the stability of the financial system** and seeks to minimize and contain systemic risks through active monitoring and engagement in the U.S. and abroad;
- **promotes the safety and soundness of individual financial institutions** and monitors their impact on the financial system as a whole;
- **fosters payment and settlement system safety and efficiency** through services to the banking industry and U.S. government that facilitate U.S.-dollar transactions and payments; and
- **promotes consumer protection and community development** through consumer-focused supervision and examination, research and analysis of emerging consumer issues and trends, community economic development activities, and administration of consumer laws and regulations.

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Purpose of an Exploratory Analysis

The Federal Reserve promotes a safe, sound, and efficient banking system that supports the U.S. economy through its supervision and regulation of domestic and foreign banks.

As a companion to the 2024 supervisory stress test, the Federal Reserve conducted an exploratory analysis.

The purpose of exploratory analysis is to deepen the Federal Reserve's understanding of the resilience of the overall banking system and help shed light on the health of the financial system for the Federal Reserve, the banking industry, and the public. The Board's exploratory analysis is distinct from the stress test and explores additional hypothetical risks to the broader banking system. This year's exploratory analysis disclosure does not focus on or include bank-specific results, and the analysis does not affect bank capital requirements.

Exploratory analysis offers further insight into the resilience of the U.S. banking system by providing information about vulnerabilities of the financial system under a wider range of stresses than the supervisory stress tests. Different types of exploratory analysis, such as those focused on macroeconomic elements and those focused on market shocks, can offer different insights. Additional macroeconomic analysis allows for exploration of the resilience of banks to alternative economic and financial conditions. For example, this year's exploratory analysis includes funding stresses under different sets of interest rate and economic conditions. The use of additional market shocks offers insight into how the trading books and counterparty concentrations of the largest and most complex banks would change under a range of different market conditions.

Executive Summary

As a companion to the 2024 supervisory stress test, the Federal Reserve conducted an exploratory analysis. This analysis complements the stress test by providing aggregate banking system results against different economic and financial conditions. The exploratory analysis is distinct from the stress test and does not affect large bank capital requirements.

The exploratory analysis consists of four elements.[1] The first two elements examine funding stress under differing macroeconomic conditions:

- funding stress that causes a rapid repricing of a large proportion of deposits at large banks, under a severe global recession, combined with high and persistent inflation and rising interest rates
- the same funding stress under a moderate global recession, combined with increasing inflationary pressures and rising interest rates

These two elements apply to all 31 banks subject to the supervisory stress test.[2] The results of the funding stress analysis suggest that the banking system is able to withstand a funding stress under the moderate and severe economic conditions included in the exploratory analysis.

The other two elements are aimed at understanding the vulnerability of the largest banks to two exploratory market shocks:

- a market shock featuring a sudden dislocation to financial markets stemming from expectations of reduced global economic activity and a negative outlook on inflation
- a market shock featuring a sudden dislocation to financial markets stemming from expectations of severe recessions in the United States and other countries

These two elements apply only to the eight U.S. globally systemically important banks (G-SIBs).[3]

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[1] For more information on the parameters for the exploratory analysis, see Board of Governors of the Federal Reserve System, *Exploratory Analysis of Risks to the Banking System* (Washington: Board of Governors, February 2024), https://www.federalreserve.gov/publications/files/exploratory-analysis-of-risks-to-the-banking-system-20240215.pdf.

[2] For more information on which banks participated in the 2024 stress test, see Table 3 of Board of Governors of the Federal Reserve System, *2024 Federal Reserve Stress Test Results* (Washington: Board of Governors, June 2024), https://www.federalreserve.gov/publications/files/2024-dfast-results-20240626.pdf.

[3] The U.S. G-SIBs are Bank of America Corporation; The Bank of New York Mellon Corporation; Citigroup Inc.; The Goldman Sachs Group, Inc.; JPMorgan Chase & Co.; Morgan Stanley; State Street Corporation; and Wells Fargo & Company. The Bank of New York Mellon Corporation and State Street Corporation were only subject to the hedge fund counterparty default components of the exploratory market shocks; the results do not include mark-to-market losses on their trading or credit valuation adjustments exposures. The exploratory market shocks are applied to positions held by the banks on October 13, 2023.

In both elements, market volatility is assumed to lead to the default of the five hedge funds with the largest counterparty exposures for each firm subject to the exploratory market shocks.

The results of the market shock elements suggest that, in aggregate, the largest banks' losses under these shocks would total between 1.0 and 1.2 percent of their risk-weighted assets. Trading losses across these two elements are similar despite significant variation in the direction and magnitude of the shocks, indicating that the U.S. G-SIBs have similar trading exposures against the tested market shocks. However, the way in which the risks manifest in the underlying exposures varies. For example, the hedge fund counterparties associated with the largest post-stress losses vary across the two exploratory market shocks, providing insight into banks' counterparty risk management. Additionally, results from the hedge fund default component demonstrate that U.S. G-SIBs have material exposure to hedge funds.

This report includes

- risks probed in 2024 exploratory analysis,
- funding stress results, and
- exploratory market shock results.

Risks Probed in 2024 Exploratory Analysis

This section describes the motivation for the four elements tested in the exploratory analysis, including the two funding stresses and the two market shocks.

Exploratory Funding Stresses

The 2024 exploratory analysis sheds light on risks to the banking system from funding stress, coupled with a hypothetical reacceleration of inflation and an increase in interest rates. Over the past couple of years, interest rates have risen at a more rapid pace relative to the prior 20 years.

Typically, banks benefit from a rising rate environment as older, maturing loans are replaced with newer assets that have higher yields. Additionally, interest rates on deposits tend to rise at a slower pace than rates earned on bank assets, resulting in higher net interest income. However, as rates rise further, they begin to increase bank funding costs. Deposit-holders seek higher-yield investments, and banks are pressured to raise rates paid on deposits to maintain deposit levels. At the same time, higher rates reduce loan originations and refinancing activities as borrowers are less likely to take on new credit, reducing the benefits of higher rates to banks' interest income. Additionally, rate increases generally reduce the value of fixed-rate securities held by banks, further lowering banks' equity. These conditions may place pressure on bank capital, especially if they occur concurrently with other forms of stress, such as credit losses.

For these reasons, it is important to understand how funding stress may play out in different economic environments. To that end, the exploratory funding stress elements include two different sets of macroeconomic conditions.

Exploratory Market Shocks

Exposures to market risks at the largest banks are dynamic in terms of direction and can vary across firms. The exploratory market shocks help us understand the implications of a wider range of vulnerabilities.

One of the market shock elements includes a sharp increase in long-term Treasury rates due to an adverse outlook for inflation over time. The other market shock element is characterized by expectations of a severe recession in the United States and other countries, leading to lower inflation expectations and thus a decline in interest rates.

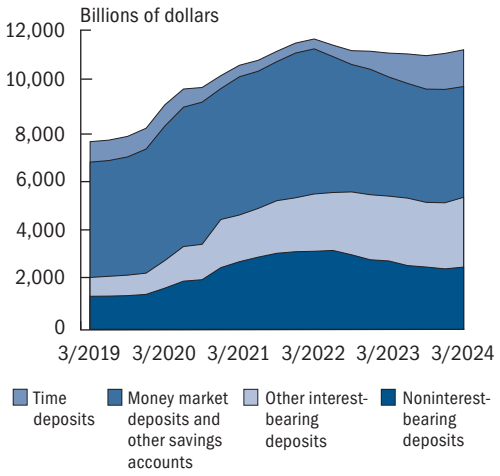
Under both market shocks, the increase in market volatility leads to higher margin requirements. Hedge funds unable to meet the higher margin requirements are forced to unwind their positions at a loss; as a result, the five hedge funds with the largest counterparty exposures for each firm subject to the exploratory market shocks fail.

Only U.S. G-SIBs are subject to the exploratory market shocks because these banks have the bulk of the trading and counterparty exposure among stress tested banks.

Exploratory Funding Stress Results

The funding stress assumptions are motivated by recent funding pressures experienced by banks. At stress tested banks in aggregate, noninterest-bearing deposits fell by 22 percent over the past two years. Over the same period, time deposits more than doubled, as shown in figure 1. This trend indicates a shift of deposit concentration as banks face pressure to pay market rates on a larger share of their deposit liabilities.

Figure 1. Aggregate domestic deposits at stress tested banks



Note: The key identifies shaded areas in order from top to bottom.

Source: FR Y-9C.

The funding stress analysis contains the assumption that banks must convert 20 percent of their noninterest-bearing deposits into time deposits. The deposit shift is assumed to occur all at once at the beginning of the projection horizon.

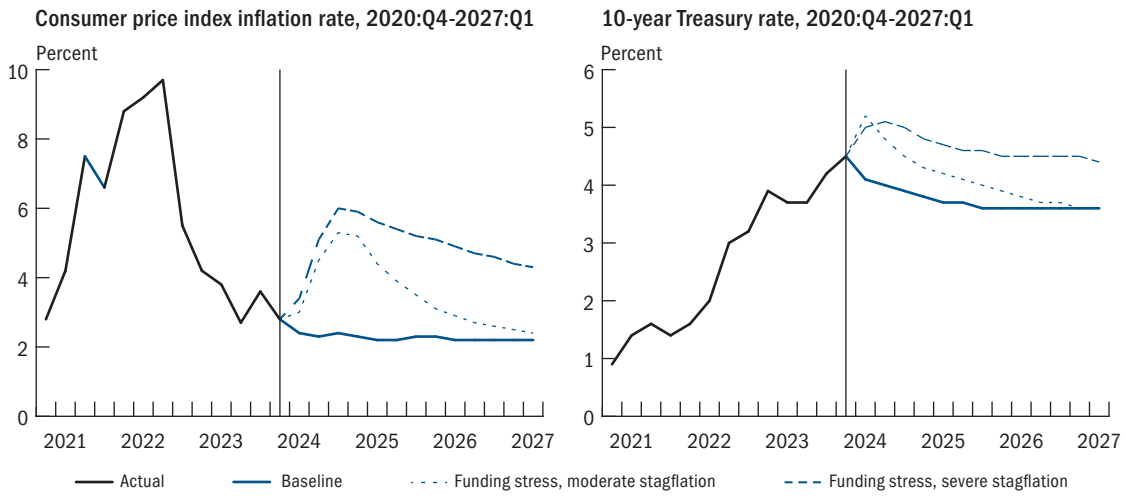
It is assumed that interest income earned on mortgage-backed securities and mortgage loans remained unchanged from the levels observed in the fourth quarter of 2023 to reflect a sharp decline in mortgage origination and prepayment activities in a rising rate environment.

The analysis explores how this sort of funding stress would play out in different sets of hypothetical economic conditions. In both sets of conditions, the 10-year Treasury rate increases in the short term before gradually declining over the stress horizon (see figure 2).

Inflation also rises in both sets of conditions for several quarters before beginning to fall, declining gradually under severe stagflation and more quickly under moderate stagflation.[4] As measured by the Consumer Price Index, inflation peaks at 6 percent in the severe element and 5.3 percent in the moderate element.

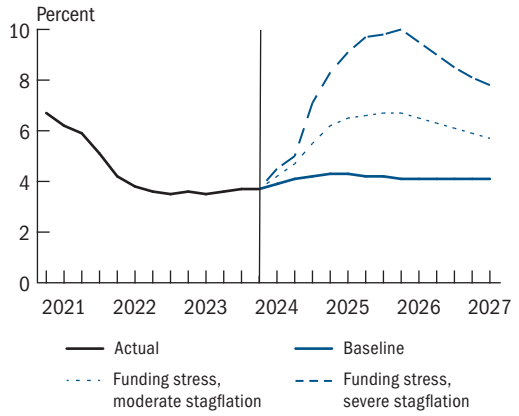
[4] Stagflation is a set of economic conditions characterized by high inflation combined with slow economic growth and high unemployment.

Figure 2. Treasury rates and inflation under different stress test elements



Source: Bureau of Labor Statistics and Federal Reserve for historical data and Federal Reserve assumptions for the baseline and funding stress elements.

Figure 3. Unemployment rate under different stress test elements



Source: Bureau of Labor Statistics for historical data and Federal Reserve assumptions for the baseline and funding stress elements.

The primary ways the funding stress elements differ is in the severity of economic stagnation. One assumes the funding stress occurs in a severe global recession in which the unemployment rate rises to 10 percent (figure 3) and asset prices decline sharply. In the other, the unemployment rate rises more gradually to a peak of 6.7 percent, and asset price declines are less pronounced.

Results

The results of the funding stress analysis suggest that the banking system is able to withstand a funding stress under the moderate and severe economic conditions included in the exploratory analysis. In the case in which the funding stress occurs during a severe global recession, the aggregate common equity tier 1 (CET1) ratio falls by 2.7 percentage points to a minimum of 10.0 percent. Under funding stress

with moderate stagflation, the aggregate CET1 ratio falls by 1.1 percentage points to a minimum of 11.6 percent (see figure 4).[5]

The differences in capital declines are mainly driven by differences in projections of pre-provision net revenue (PPNR) and provisions for loan and lease losses (provisions).[6] The increase in interest rates also leads to a decline in the value of fixed-rate securities held by banks; this impact is small relative to the change in projected provisions and PPNR.

In aggregate, funding stress with moderate stagflation leads to significantly lower projected provisions than severe stagflation, driven by the milder path of the economic variables. In addition, the more moderate conditions, coupled with the increased interest rates, lead to higher PPNR (see figure 5).

PPNR is composed of interest and noninterest income. In both funding stress elements, higher interest rates lead to higher projected interest income and expenses.[7] The deposit funding shock puts some downward pressure on net-interest income. However, in both elements, increases in interest income more than compensate for increases in funding costs from the deposit shock.

Figure 4. Minimum stressed CET1 ratio

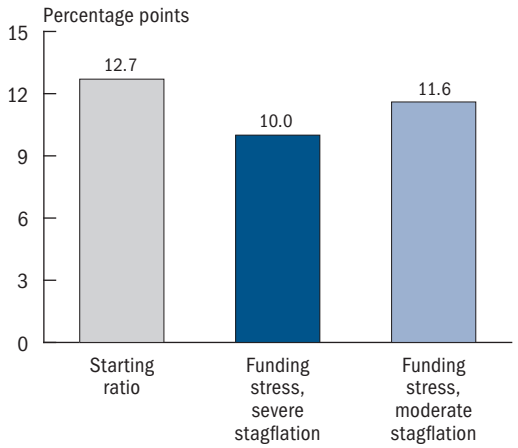
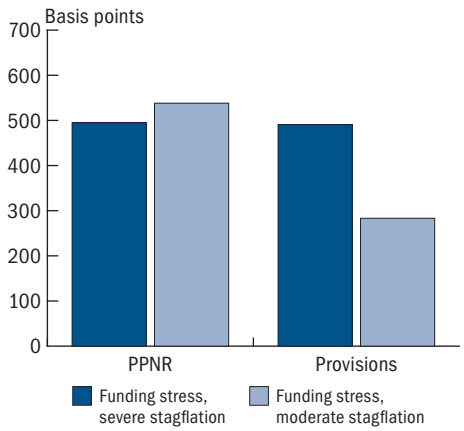


Figure 5. PPNR and provisions through 2026:Q1 under the funding stress elements, as a percent of risk-weighted assets



Note: The key identifies bars in order from left to right.

The funding stress assumptions related to deposit shifting represent between a 200- and 250- basis point reduction in the aggregate capital ratio across the two funding stress elements

[5] The charts show CET1 ratios calculated with the global market shock from the supervisory severely adverse scenario applied to relevant banks to ensure the results are comparable.

[6] Provisions for loan and lease losses equal projected loan losses plus the amount needed for the allowance to be at an appropriate level at the end of each quarter.

[7] For both the supervisory severely adverse scenario and the exploratory analysis, the stress test models use a flat balance sheet assumption. In other words, the models assume that a bank would take actions to maintain the current level of assets over the planning horizon. This assumption impacts the estimated level of interest income earned in the exploratory analysis.

throughout the projection horizon. Absent the funding stress, the net-interest income projections would have been even higher under the economic conditions in the exploratory analysis.

Lessons Learned

The exploratory analysis aims to inform supervisory analysis and deepen the Federal Reserve's understanding of the resilience of the banking system.

The exploratory analysis shows that large banks are generally well-positioned to withstand a sudden funding shock in the form of shifting deposits. Bank net interest income appears to be resilient in a high-rate environment, even when including the funding shock assumptions.

The results of the exploratory analysis suggest that banks are projected to be able to withstand a severe stagflation event, but their resilience would depend on a combination of factors, including the asset and funding mix of the banks and the effects of higher interest rates on borrowers' capacity to repay or refinance their loans.

Exploratory Market Shock Results

The next two elements of the exploratory analysis are aimed at understanding the vulnerability of the largest banks to two exploratory market shocks. One of the market shocks includes a sharp increase in long-term Treasury rates due to an adverse outlook for inflation over time. The other market shock is characterized by expectations of a severe recession in the United States and other countries, leading to lower inflation expectations and thus a decline in interest rates. In addition, the five hedge funds that represent the largest hedge fund counterparty exposures for each bank fail.

Specifically, the first market shock element includes a weakened U.S. dollar and a sharp increase in Treasury rates (interest rate stress), while the second market shock element includes an appreciation of the U.S. dollar, a decline in Treasury rates and a decrease in commodity prices (recession with flight to quality). Figure 6 contains a summary of the key differences between the market shocks. The effects on equity and credit markets are similar across the two shocks.

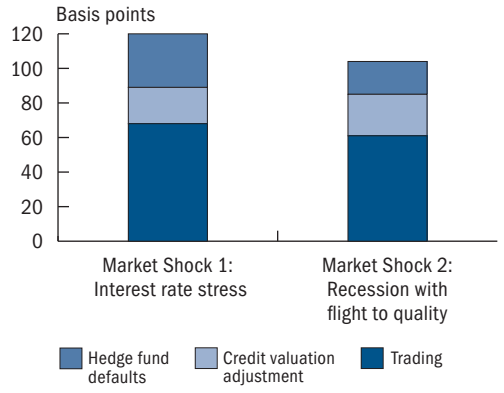
Figure 6. Differences between exploratory market shocks

Shock type	U.S. dollar strength	Treasury rates	Commodity prices
Market Shock 1: Interest rate stress	↓	↑	↑
Market Shock 2: Recession with flight to quality	↑	↓	↓

Results

The results of the market shock elements suggest that, in aggregate, the largest banks' losses under these shocks would total between 1.0 and 1.2 percent of their risk-weighted assets. This analysis suggests that the largest and most complex banks can withstand different types of market shocks.

Figure 7. U.S. G-SIB losses by type and exploratory market shock, as a percent of risk-weighted assets



Note: The key identifies bars in order from top to bottom.

Despite significant variation in some shock components, total losses are generally similar across the two exploratory market shocks. As shown in figure 7, trading losses vary modestly. The results indicate that for the asset classes tested in these shocks (rates, foreign exchange, and commodities), the U.S. G-SIBs appear to have relatively balanced trading exposures.

Hypothetical defaults of the five hedge funds with the largest counterparty exposures at each bank lead to material losses under both exploratory market shocks (see box 1). The largest hedge fund counterparties for each bank are different across the two sets of shocks. The exploratory market shocks indicate that a different set of counterparties are impacted by movements in different shock components, including the scale and direction of rate changes.

Lessons Learned

The purpose of the market shock elements is to assess the potential risk of a wider variety of shocks and inform supervisory analysis.

Despite significant variation in the performance of certain asset classes, results show that banks are well-positioned against various potential outcomes, particularly in their trading books.

The hedge fund counterparty exposures are less predictable and can vary significantly based on the specific set of shocks. Banks would have material exposures to hedge funds under certain market conditions. Supervisors can use the information from the market shock analysis to better understand banks' counterparty risk management.

Box 1. Hedge Fund Exposure

Bank exposures to hedge funds have risen over the past several years, and at the same time, hedge fund leverage has increased.[1] As of the third quarter of 2023, average leverage at hedge funds reached its highest level on record.[2]

The exploratory market shocks examine the banking system's exposure to hedge funds under different market conditions with a focus on risks from the current interest rate environment. In both shocks, market volatility leads to higher margin requirements. Hedge funds unable to meet these higher margin requirements are forced to unwind their positions at a loss. As a result, the five largest hedge fund counterparties at each bank fail.[3]

Under the hedge fund default component, aggregate losses from the assumed default of the hedge funds are material, amounting to between $13 billion and $22 billion.

The hedge fund default component sheds light on how exposures to certain counterparties may increase under stress. In the first market shock, banks' exposure to hedge funds increases due to the sharp decline in the value of interest rate-sensitive collateral received from hedge funds as interest rates increase. Banks receive this collateral to facilitate securities financing transactions for hedge funds. By comparison, in the second market shock, banks' exposures to hedge funds increases due to the rise in values of banks' derivative positions as interest rates decrease.

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[1] For additional research on recent hedge fund developments, see Daniel Barth, R. Jay Kahn, and Robert Mann, "Recent Developments in Hedge Funds' Treasury Futures and Repo Positions: Is the Basis Trade 'Back'?," FEDS Notes (Washington: Board of Governors of the Federal Reserve System, August 30, 2023), https://doi.org/10.17016/2380-7172.3355.

[2] Measured as mean gross leverage, which includes on- and off-balance-sheet leverage. Leverage at the largest funds was significantly higher than average. At the top 15 hedge funds by gross asset value (GAV), average on-balance-sheet leverage rose to about 18-to-1 in the third quarter of 2023, which is near, but not at, peak leverage over the last decade. See the Board's April 2024 *Financial Stability Report* at https://www.federalreserve.gov/publications/financial-stability-report.htm.

[3] This analysis does not assess the creditworthiness of these hedge funds, nor does it predict that this number of hedge funds would fail, even under the conditions laid out in the exploratory market shocks. Rather, this component allows us to test the size of bank exposures to these funds.

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