



Annual Report to Congress 2019



On June 21, 2019, President Trump appointed me to serve as Director of our Office of Financial Research (OFR or Office). I am honored to have earned his confidence.

I am also honored to work with dedicated professionals in our Office to reliably execute on an important mission — that is, furthering financial resilience as a member of the Financial Stability Oversight Council (FSOC) and as a reliable source of research, analysis, and data for the FSOC and its members.

While my directorship can be counted only in months, the OFR's mission is very familiar. Throughout my career in business, education, and public service, I have enjoyed developing and sharing firmly grounded perspectives on financial and economic matters, with a close eye on the fundamental role that financial resilience plays in growing economic opportunities for all Americans. With that important motivation and dedicated expert support from staff members throughout our Office, I am honored to submit the OFR's 2019 Annual Report to Congress.

Financial Stability and Economic Opportunity

When it comes to creating economic opportunity, the United States continues to stand as the world's leader. A resilient financial sector is vital to maintaining that lead and, more importantly, reliably increasing the welfare of American households and businesses. The last three decades have been punctuated by severe financial crises, however, and remind us that we can do even better.¹

While the global financial crisis is sometimes characterized as a perfect storm, it did not have to happen.² Credible warnings were plentiful.

As early as 2004, some monetary policymakers warned that "too big to fail" was reaching critical levels and emphasized the importance of addressing increasing risks during the tranquil period *before* a crisis.³

The following year, the President’s Council of Economic Advisers started drafting the *Economic Report of the President* for 2006. A chapter from that report focused on how financial services can expand economic opportunities for households and businesses alike. It also cautioned, however, that these critical services could threaten financial stability, and highlighted how risks can spread throughout the banking sector.⁴

Despite their accessibility and timeliness, none of these warnings could mitigate—let alone stop—the crisis that was to come. Reflecting on this history, Raghuram Rajan, a prominent economist and former central banker, eschewed calls for more regulation of an already heavily regulated sector. Instead, he highlighted opportunities for data analysis and monitors to increase transparency for inter-institution exposures and concentrations of risk in the system.⁵

OFR: A Simple but Consequential Mission

Directly or indirectly, Rajan had called for the type of data and research services that our Office delivers today. The Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 (Dodd-Frank Act) created the OFR to, in considerable part, increase the likelihood that future warnings will be more easily heard when grounded in economic fundamentals and informed by high-quality data and research.⁶ One of the OFR’s primary charges as set forth in the Dodd-Frank Act is to support the FSOC and its members with data and research that work toward that important end.⁷

Risks to financial stability have become reality too many times in our history. And the economic consequences of realizing those risks can hit hardest households seeking financial services to bridge a bit of bad luck, move to a safer neighborhood, or access better schools for their families.

Americans have long enjoyed the greatest of economic opportunities. Even more are available through increased financial stability. Our Office is taking concrete steps to strengthen that foundation by tailoring research and data services to the Council and member needs.

The Dodd-Frank Act's first title establishes both the FSOC and our Office. Council members regularly meet to share information about financial vulnerabilities and consider appropriate responses. Our Office contributes to those considerations as both a non-voting Council member and as a research and data resource for the FSOC and its members. In particular, the Dodd-Frank Act charges the OFR to support the FSOC by:

- collecting data for the Council,
- standardizing data formats,
- developing applied and long-term research, and
- measuring and monitoring risks.

Fiscal year (FY) 2019 has been a year of continued change and rebuilding for the OFR and its workforce. Internally, the latter half of FY 2019 focused on filling critical vacancies with qualified, talented professionals. This effort allows current staff members to focus on the highest-value contributions associated with their roles, and strengthens our organizational abilities to best serve the Council and its members. Following this workforce reshaping initiative, I have prioritized a bold human capital strategy to ensure that all employees are fully equipped to further the value of our Office while thriving personally and professionally in a safe, collegial, and fulfilling environment. Strengthening management and staff accountability is critically important to our Office's mission.

About This Report

Like our Office's previous *Annual Reports*, this year's version evaluates the state of the U.S. financial system as required by the Dodd-Frank Act, including an analysis of threats to the financial stability of the United States, key findings from the OFR's research and analysis, and advances in reliable data standards. We also discuss our progress toward fulfilling our mission.

In this report's financial stability assessment, we find that risks to the financial stability of the United States remain in the medium range. Across different dimensions of the financial system, we find a mix of low, medium, and high risks. Solvency and leverage risk continues to be low, as financial institution capital is higher than before the 2007-09 financial crisis and earnings are healthy. Most other types of risk to stability are moderate. Of those moderate risks, macroeconomic risk is higher than a year ago. Credit risk is still moderate. Market risk can appear elevated. Asset prices have appreciated with the strong U.S. economy. High asset prices can be a plus, but as past financial crises have shown, elevated prices can also be vulnerable to declines.

This report also covers various accomplishments of the Office throughout the year. The Office passed a significant milestone with the issuance of a final rule to collect data on transactions in the \$4 trillion market for repurchase agreements, or repos, which provides funding to securities dealers and others. The vulnerability of repos to runs and fire sales poses potential threats to financial stability. The repo collection will also support an alternative to the London Interbank Offered Rate, or LIBOR. LIBOR has been a widely used interest rate benchmark in global financial markets, but doubts about LIBOR's integrity have led to efforts to devise an alternative. The repo collection began in October 2019.

The OFR continued to enhance its information technology (IT) environment and offerings. We saved more than \$12 million in FY 2019 by transitioning to cloud computing for services. Working from our 2018 roadmap objectives, OFR IT redesigned our data onboarding to ensure data are accurate and easy to access, reducing time, effort, and total cost of ownership. We also brought on several new datasets to strengthen our data analytics and reporting capabilities and improve our overall collection. Finally, regarding our IT and data contract procurement operations, the OFR received a clean audit opinion from the Department of the Treasury Office of Inspector General.

In the coming year, we will continue to monitor and research risks to U.S. financial stability; share what we learn; and strive to improve the scope, quality, and accessibility of financial data. I am honored to lead our OFR and look forward to another year of accomplishments and exceptional work in the

field of financial stability. I appreciate the dedication of each OFR employee and am committed to encouraging greater communication, collaboration, transparency, and a sense of fulfillment for a job well done. Together, we will continue to meet the OFR's mission of promoting financial stability by delivering high-quality financial data, standards, and analysis for the FSOC, Congress, and the public.



Dino Falaschetti
Director, Office of Financial Research

¹ Charles W. Calomiris and Stephen H. Haber, *Fragile by Design: The Political Origins of Banking Crises & Scarce Credit* (Princeton, N.J.: Princeton University Press, 2014), ix.

² Olivier Blanchard, "The Perfect Storm," *Finance and Development*, June 2009, 37. <https://www.imf.org/external/pubs/ft/fandd/2009/06/pdf/blanchard.pdf>; Anthony H. Catanach, Jr., and Julie Anne Ragatz, "2008 Market Crisis: Black Swan, Perfect Storm or Tipping Point? Buzzwords Make It Possible to Deflect Responsibility for Financial Cataclysm," *Bank Accounting and Finance* 23, no. 3 (April-May 2010): 20. <https://go.gale.com/ps/anonymous?id=GALE%7CA225580490&sid=googleScholar&v=2.1&it=r&linkaccess=abs&issn=08943958&p=AONE&sw=w>.

³ Gary H. Stern and Ron J. Feldman, *Too Big to Fail: The Hazards of Bank Bailouts* (Washington: Brookings Institution Press, 2004).

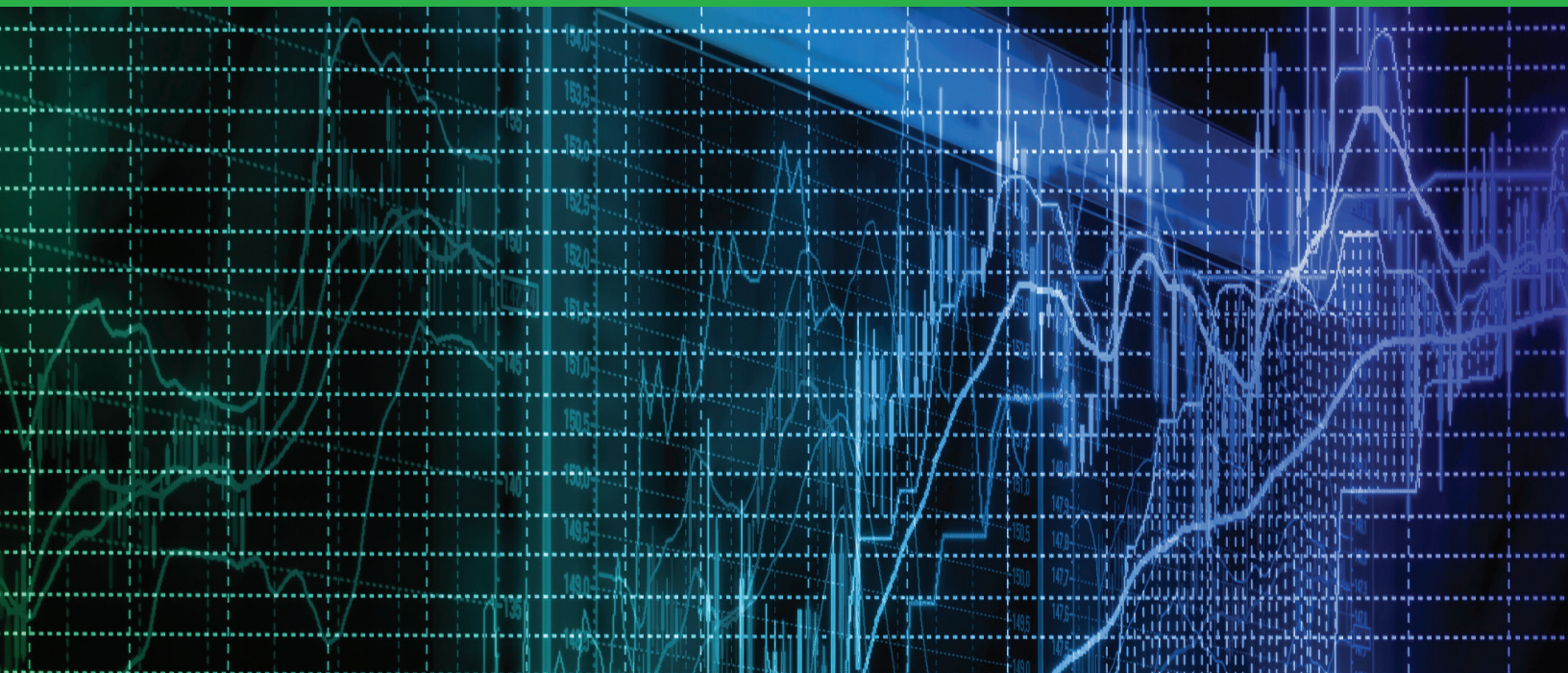
⁴ White House, *Economic Report of the President, Transmitted to the Congress February 2006, Together with the Annual Report of the Council of Economic Advisers* (Washington: Government Printing Office, 2006), 208-210. <https://www.govinfo.gov/content/pkg/ERP-2006/pdf/ERP-2006.pdf>.

⁵ Justin Lahart, "Mr. Rajan Was Unpopular (But Prescient) at Greenspan Party," *The Wall Street Journal*, Jan. 2, 2009. <https://www.wsj.com/articles/SB123086154114948151>; Raghuram G. Rajan, *Fault Lines: How Hidden Fractures Still Threaten the World Economy* (Princeton, N.J.: Princeton University Press, 2010), 173.

⁶ As one post-crisis author puts it, "increasing financial complexity with decreasing data quality is a toxic mix." William A. Barnett, *Getting it Wrong: How Faulty Monetary Statistics Undermine the Fed, the Financial System, and the Economy* (Cambridge, Mass.: The MIT Press, 2012), xxxi.

⁷ "The purpose of the Office is to support the Council in fulfilling the purposes and duties of the Council and to support member agencies." *Dodd-Frank Wall Street Reform and Consumer Protection Act*, Public Law 111-203 (Washington: U.S. Government Printing Office, July 21, 2010), Sec. 153. <https://www.gpo.gov/fdsys/pkg/PLAW-111publ203/pdf/PLAW-111publ203.pdf>.

FROM THE DIRECTOR	i
SUMMARY	1
Financial Stability Assessment and Key Findings	2
Status of the OFR's Efforts in Meeting Its Mission	3
FINANCIAL STABILITY ASSESSMENT AND KEY FINDINGS	7
Macroeconomic Risk	10
Market Risk	15
Credit Risk	19
Solvency and Leverage Risk	27
Funding and Liquidity Risk	30
Contagion Risk	36
Other Risks	37
STATUS OF THE OFR'S EFFORTS IN MEETING ITS MISSION	47
Data Initiatives	47
Repo Data Collection and Alternative Reference Rate Activities	47
Data Standards	48
Reporting of Standardized Derivatives Data	50
Data Products	50
Interagency Data Inventory Update	51
Information Technology	52
Major Initiatives	52
IT and Data Procurement Operations	53
IT Security	53
Data Management	53
Data Gathering	54
Support and Collaboration	55
Support of the FSOC and Its Members	55
Financial Research Advisory Committee	55
Conferences Cosponsored	56
Post-Reorganization Staffing, Growth, and Mission Focus	58
Organization	58
Workforce	60
Budget	60
GLOSSARY	63
ENDNOTES	83
BIBLIOGRAPHY	88



OFR 2019 Annual Report to Congress

With this report, the Office of Financial Research (OFR) presents its assessment of the state of the U.S. financial system, as required by the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 (Dodd-Frank Act). Our 2019 Annual Report to Congress meets the requirement that the OFR submit a report to Congress within 120 days after the end of the fiscal year.

This report also reflects our duty to inform policymakers, regulators, market participants, and the American public about our work to monitor, investigate, and report on changes in systemwide risk levels and patterns. Our efforts support sound risk management for the entire financial system.

For fiscal year (FY) 2019, we organized the report in two main parts:



1 Financial Stability Assessment and Key Findings



2 Status of the OFR's Efforts in Meeting Its Mission



Financial Stability Assessment and Key Findings

This first part of the report combines our financial stability assessment with key findings from our research and analysis.

Our data and research support a finding that risks to U.S. financial stability remain in a medium range overall. To reach this conclusion, we evaluate financial system vulnerabilities and their changes.¹ We also go beyond this evaluation by drawing on broader financial system surveillance, data analysis, and research to pinpoint the source of any changes and their implications for financial stability. Also, risks can emerge or evolve with changes and innovations within the financial system. We monitor these changes and report on their financial stability implications when warranted.

We frame our risk assessment using several categories familiar to the financial industry. Macroeconomic, market, and credit risks arise from the interplay between the financial sector and the rest of the economy. Solvency and leverage, funding and liquidity, and contagion risks are associated with connections among firms within the financial sector. Vulnerabilities in any of these areas can originate, amplify, or transmit shocks and stress.

Our assessment suggests that market risk is elevated. Asset price appreciation reflects, in part, the strong performance of the U.S. economy and expectations for continued economic growth. However, there are also indications that valuations for many important asset types, including stocks, corporate debt, and some types of real estate, are above historic levels.

Risk from cybersecurity also deserves careful monitoring in light of the exposures it can create for critical economic and financial system infrastructure. In addition, networks can make the transmission of risk more complex and thus harder to manage.

Risk is moderate in four categories: macroeconomic risk, credit risk; liquidity and funding risk; and contagion risk. Macroeconomic risk is elevated relative to a year ago. Nonfinancial corporate credit risk has continued to rise, but household credit risk has improved. Liquidity and funding risk rose temporarily at times during the past year, but then moderated. Contagion risk is little changed.

Risks associated with solvency and leverage appear relatively low. Banks and insurers maintain leverage ratios consistent with low risk. However, leverage continues to rise among large hedge funds that may be interconnected with systemically important financial firms.



Status of the OFR's Efforts in Meeting Its Mission

Data Initiatives

The OFR worked to fulfill its data-related mandates in FY 2019 through an array of data initiatives. These initiatives include issuing a final rule to collect data regarding transactions in the \$4 trillion market for repurchase agreements (repos), which provides funding to securities dealers and others. Data gaps remain regarding securities financing transactions, including those associated with repos and securities lending.

The repo data collection will also support an alternative to LIBOR. LIBOR has been a widely used interest rate benchmark in global financial markets and the economy, but doubts about LIBOR's integrity have led to efforts to devise a reliable, widely accepted, and transparent alternative.

The OFR also pursued several data standards initiatives during the fiscal year, including advances in the adoption of the Legal Entity Identifier (LEI). LEI use continues to grow rapidly, with more than 1.46 million identifiers issued through the second quarter.

Information Technology

The OFR evaluated and updated its information technology (IT) systems and services in FY 2019. The Office transitioned to cloud computing services. Cloud computing provides stakeholders and users with secure, effective, and standardized services at a reduced cost. This initiative has saved \$12 million in capital spending and will reduce annual operating expenses. The OFR also enhanced its data onboarding capabilities to streamline data management and reduce costs.

As in prior years, one of OFR IT's main focuses remains IT security. The Office continues to strengthen its multitiered program that includes risk assessments, strict access controls, and regular penetration testing.

Support and Collaboration

The Financial Stability Oversight Council (FSOC) is the OFR's primary stakeholder. Its needs are key in guiding the work of the Office. The OFR supports the FSOC and its members by providing data, research, and analysis.

The OFR leads the FSOC Data Committee; collects, maintains, and shares supervisory and commercial datasets with the FSOC; is working to launch a system for secure data sharing among the FSOC, its members, and the OFR; responds to requests from the FSOC for research and analysis that help the FSOC identify threats to financial stability; and works with FSOC members on research and data projects. In addition, the OFR Financial Research Advisory Committee provides a range of expertise to help the OFR fulfill its mission.

Finally, our Office cosponsored two financial stability conferences during the fiscal year, one with the University of Michigan's Center on Finance, Law, and Policy, and the other with the Federal Reserve Bank of Cleveland.

Organization

As a result of an organization-wide reexamination in the previous year, FY 2019 focused on workforce reshaping. Most notably, at the end of FY 2019, a new Director, Dino Falaschetti, was appointed to lead the Office. Director Falaschetti implemented a broad human capital strategy to strengthen management accountability and employee engagement.

While the Office is still undergoing efforts to fill positions, its organizational structure remains unchanged from the prior year, including the legislatively mandated Data Center and Research and Analysis Center.

The OFR obligated \$58.6 million in FY 2019 — 43 percent for labor and 57 percent for other expenses. A large portion of the nonlabor spending covers OFR spending for data acquisition (\$6.5 million) and technology software and hardware (\$13.5 million) to support the OFR's unique mandates.



Financial Stability Assessment and Key Findings



In our assessment, risks to U.S. financial stability remain in a medium range. This assessment is based on our analysis of vulnerabilities that, in combination with stress or shocks, have the potential to destabilize the financial system. Vulnerabilities are underlying weaknesses that can turn into financial system disruptions by originating, amplifying, or transmitting shocks and stress. We analyze vulnerabilities to fulfill our responsibility to monitor, investigate, and report on threats to the financial stability of the United States.

Our assessment is informed in part by the OFR's monitoring of financial system vulnerabilities, as well as our Office's broader financial system surveillance, data analysis, and research. All data cited in this report are as of Sept. 30, 2019, unless otherwise noted.

Our Office structures its assessment around seven categories of risk: (1) macro-economic, (2) market, (3) credit, (4) solvency and leverage, (5) funding and liquidity, (6) contagion, and (7) other risks.

This report reviews a mix of vulnerabilities that our Office regularly monitors, and highlights the most important to discuss based on our Office's analysis as well as concerns voiced by financial regulators, financial market participants, and other financial system stakeholders. Some of these vulnerabilities have played a role in past crises; others have not. Early recognition of possible weaknesses provides time to consider how financial resilience can be fortified.

To appreciate the importance of monitoring vulnerabilities before they turn into weaknesses, consider how the Y2K event was addressed. The vulnerability then was that the underlying computer code for financial systems would fail to work properly on Jan. 1, 2000. That vulnerability was identified several years

in advance. The vulnerability was unusual in that the deadline for planning and executing a fix could not be changed. That such an event had never occurred before and was difficult to plan for was no excuse for ignoring its potentially devastating implications for financial stability. Although regulators and industry leaders felt well-prepared by New Year's Eve, no one knew for sure that this vulnerability would not threaten the financial system until time had passed and the potential risk to financial stability had been successfully mitigated.

Our Office's mandate is to monitor and research risks and share what we learn — our data and findings — so that others can see what we see. In this way, our Office can bring increased transparency to vulnerabilities and support sound risk management for the entire financial system. The system is healthiest when all participants are monitoring risks, their own and those of others. In the following sections, we detail support for our finding that financial stability risks remain in a medium range.

Key Takeaways from the 2019 Assessment

- **Solvency and leverage risk is generally low.** Bank capital ratios remain higher than before the 2007-09 financial crisis and exceed U.S. regulatory minimums. Life insurance companies' capital ratios also exceed minimums set by state regulators.
- **Macroeconomic risk is elevated.** The U.S. economy continues to perform well. However, fading momentum in some key U.S. and global indicators could pose risk to the outlook. Uncertainty about outcomes of trade negotiations and the United Kingdom's exit from the European Union could also contribute risk to the outlook.
- **Market risk remains elevated.** Fundamental asset price appreciation reflects strong economic performance and expectations for continued growth. Indicators also highlight, however, that valuations for important asset types, including stocks, corporate debt, and some types of real estate, are above historic levels.
- **Credit risk remains moderate on balance.** Increased borrowing by nonfinancial businesses is consistent with a strong outlook for the U.S. economy. In addition, household credit risk is low and somewhat improved from a year ago. Several metrics also suggest, however, that nonfinancial corporate debt and leverage may be elevated. Weaker creditor protections, combined with lower subordinated debt cushions, could result in creditors recovering less money on leveraged loans in the next downturn.
- **Funding and liquidity risk is moderate.** Risk from market illiquidity is moderate, but can change quickly with market sentiment. Some recent periods of higher market volatility saw trading liquidity temporarily weaken. Also, there was a spike in repo rates in September 2019 associated with reduced market liquidity. This event was short-lived.
- **Contagion risk remains moderate.** For the largest banks and insurers, contagion risk is generally little changed since 2016. However, this risk rose around the end of 2018, when market stress spiked. Connectivity among financial firms is a key driver of changes in contagion risk. As market risk receded, so did risk of contagion.
- **Other risks continue to grow in importance.** Cybersecurity risk remains a concern. Several major cybersecurity events in the financial sector highlighted this risk, including how technology firms contribute to it. Brexit poses operational risk associated with potential disruptions to supply chains and financial contracts. Failure to prepare adequately for the end of LIBOR is another threat to financial stability. As with Brexit, the transition from LIBOR requires renegotiating many contracts, creating risk. Digital financial assets such as cryptocurrencies continue to potentially transform financial markets, but their risk to financial stability is lower than a year ago because of their reduced market capitalization.

Macroeconomic Risk

In the *2018 Annual Report*, our Office viewed macroeconomic risk as moderate, but higher than a year earlier. In the year since, macroeconomic risk has grown to an elevated level. The U.S. economy has continued to perform well overall, and the outlook remains favorable. However, fading momentum in some key U.S. and global economic indicators and uncertainty about future terms of trade and the outcome of Brexit account for this increase.

United States

In July of this year, the current U.S. economic expansion became the longest on record. The economy grew 2.9 percent in 2018, in line with OFR expectations. For 2019, growth is expected to move closer to the annual rate of 2.5 percent in the year's first half.

A strong labor market contributed to the economy's robust growth. Job gains remained solid. The economy added an average of 171,000 jobs a month in 2019 through September.

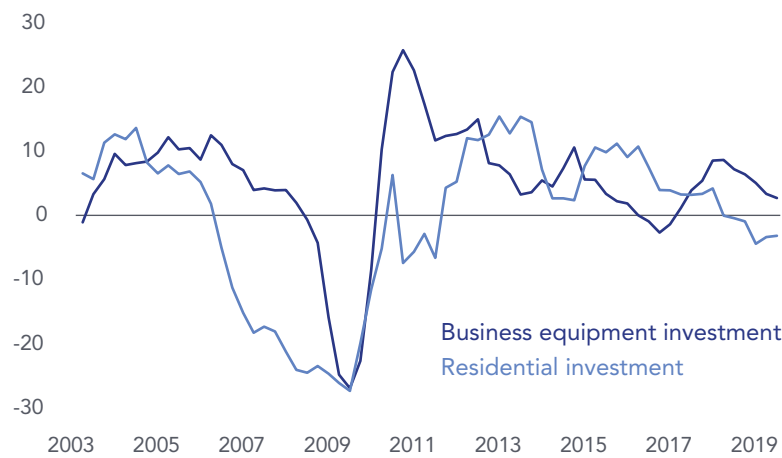
Unemployment has stayed near record lows for an extended period. And wages have been rising.

Performance of some other parts of the economy was more consistent with the later stages of a business-cycle expansion. Sectors of the economy sensitive to changes in interest rates, such as business investment and housing, are a prime example (see **Figure 1**). These sectors can grow rapidly early in an expansion. Later in the expansion, the pace of spending in these areas can slow. Another example is manufacturing. A key indicator is the Institute of Supply Management manufacturing purchasing managers index. It hit a post-recession high in August 2018 (see **Figure 2**). Manufacturing activity started to contract a year later, and hit a post-recession low in September 2019. Such contractions can occur in an economic expansion without a recession following, but they bear monitoring.

At the same time, some CEOs have expressed concern about trade conditions and global economic growth. If business leaders delay investment and hiring, the slower economy they feared could come to pass.

The yield curve has been very flat for several years, which made it easier for long-term rates to drop below short-term rates. The relationship between the 10-year and 3-month Treasuries is a widely followed part of the yield curve. Normally the curve slopes upward, indicating that yields on long-term bonds are higher than those on short-term bonds because investors demand a higher return to invest

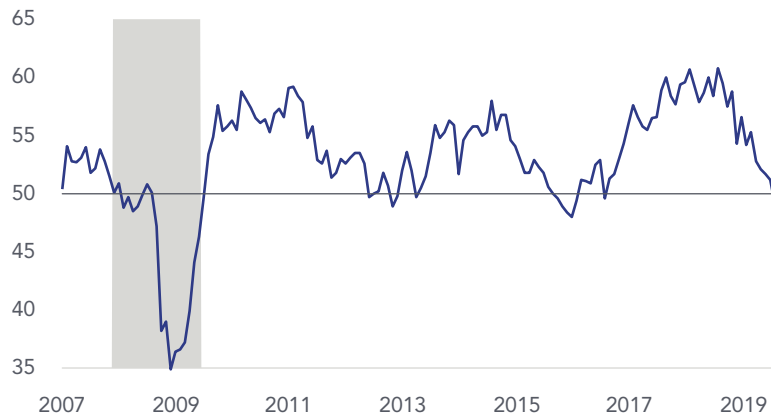
Figure 1. Interest-sensitive Sectors Reflect Some Cooling (percent change year over year)



Note: Components of real gross domestic product, billions of 2012 dollars, seasonally adjusted annual rate.

Sources: Bureau of Economic Analysis, Office of Financial Research

Figure 2. Purchasing Managers Report Some Slowing in Manufacturing (index)

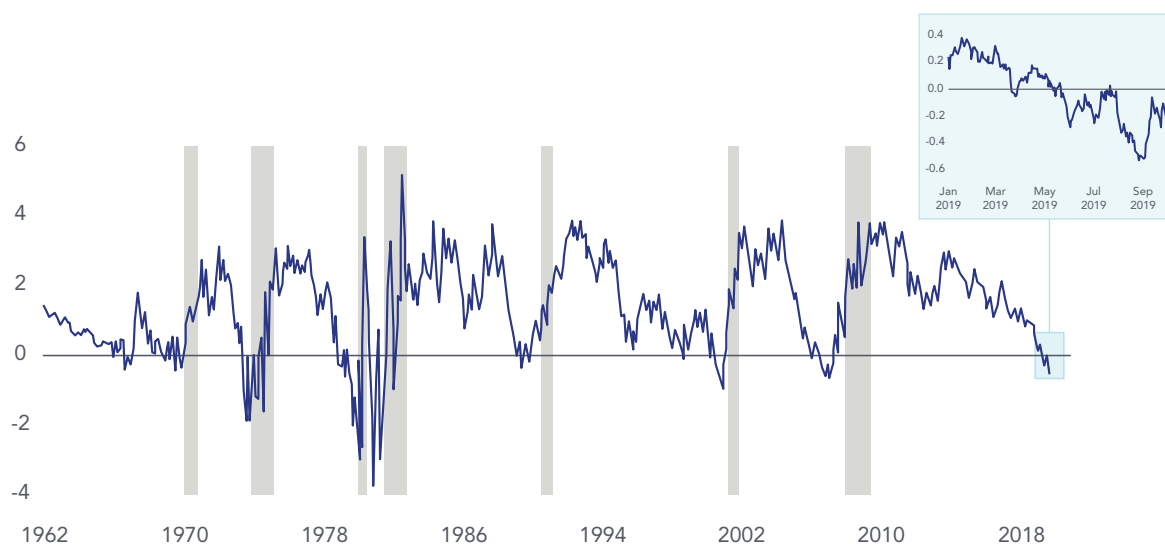


Note: Shaded area is U.S. recession. Institute for Supply Management (ISM) manufacturing purchasing managers composite index, seasonally adjusted. An index value above (below) 50 indicates an increase (decrease) in manufacturing activity.

Sources: ISM, Haver Analytics, Office of Financial Research

for longer. When the yields on long-term bonds are instead lower than those on short-term bonds, the curve slopes down and is said to be inverted. Long-term rates may decline if market participants expect a weaker economy, lower inflation, or a Federal Reserve interest-rate cut. That's what happened in March. Market expectations of easier monetary policy ahead and a weaker global growth outlook drove yields on 10-year notes below 3-month bill rates. The initial inversion lasted for five days. Then, at the end of May, the curve for those two rates inverted again (see Figure 3). In August, the inversion increased to as much as 51 basis points, and another part of the yield curve inverted when the yield on the 10-year note fell below that of the 2-year note. A basis point is one-hundredth of a percentage point. As of September 30, the curve remained inverted.

Figure 3. U.S. Treasury Yield Curve Inverted in Mid-2019 (percentage points)



Note: Spread of 10-year Treasury note over 3-month Treasury bill rate from Federal Reserve H.15. The secondary market rate is used if the constant maturity rate is unavailable. Shaded areas are U.S. recessions.

Sources: Board of Governors of the Federal Reserve System, Federal Reserve Bank of St. Louis FRED, Office of Financial Research

Global Conditions

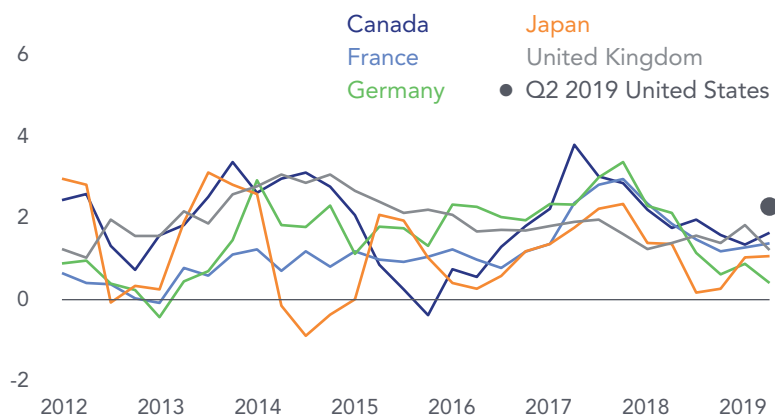
Global economic conditions remain a headwind for the United States. Signs of an aging expansion are more pronounced outside the United States. Growth in real gross domestic product (GDP), for example, started softening in late 2017 in major U.S. trading partners and continued to do so in 2019 (see Figure 4). The weakness was concentrated in manufacturing. Trade tensions and uncertainty about Brexit accompanied the cooling trend.

In the second quarter of 2019, the German and U.K. economies contracted from the previous quarter.

Germany accounts for 29 percent of euro area GDP, so the euro area's expansion heavily relies on its economic performance. In

the U.K., economic growth was volatile in 2019, largely because of uncertain Brexit prospects. Businesses built stocks of raw materials and

Figure 4. Growth Has Slowed for Many Major Economies (percent change from previous year)



Note: Data through June 30, 2019. Real gross domestic product, percent change from corresponding quarter of previous year, seasonally adjusted.

Sources: OECD Main Economic Indicators, Office of Financial Research

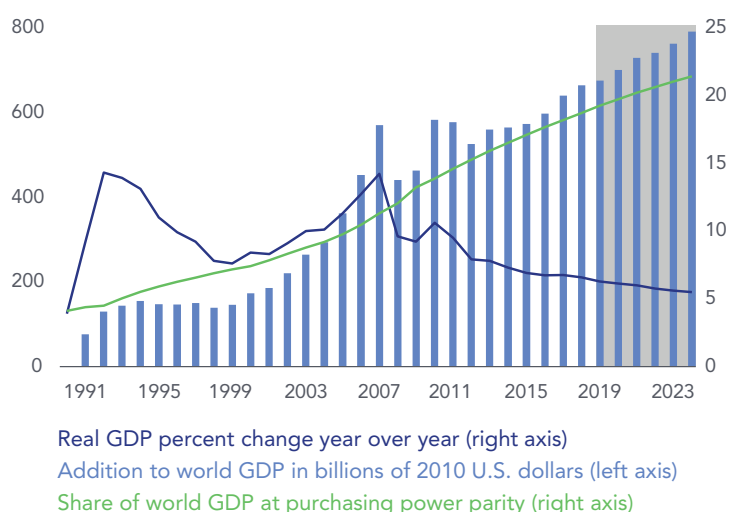
finished goods as insurance against disruptions to supply chains across borders.

In 2019, China's economic growth continued the deceleration that began in 2017. Trade tensions contributed to an uncertain near-term growth outlook. A deeper-than-expected slowdown in China's economy could modestly affect the U.S. economy. A percentage point slowdown in China could reduce U.S. GDP by 0.1 to 0.2 percentage points after one year, according to one estimate.² Higher U.S. tariffs on Chinese goods are a risk to the Chinese economy in the near term. Domestic factors, such as China's high corporate debt or rapidly rising property prices, are a risk to growth longer term. Real GDP growth in China is expected to decrease from 6.2 percent in 2019 to 5.5 percent in 2024, based on International Monetary Fund estimates. Despite this forecast, China's role as a driver of global economic growth is likely to expand (see *China's Contribution to World GDP Expected to Grow*).

China's Contribution to World GDP Expected to Grow

As China's economy continues to develop, it will need to shift from relying on exports to relying on domestic consumption. As it does, its growth rate will trend lower toward one more typical of advanced economies. That trend is normal for a developing economy but raises concerns about the impact on global growth. The concern may overstate the potential impact. For example, China's 6.6 percent growth rate in 2018 added \$663 billion to China's and world GDP in 2010 U.S. dollars (see Figure 5). That is more than the \$582 billion added in 2010 when China's economy grew 10.6 percent. Looking ahead, even as China's economic growth slows to 5.5 percent by 2024, according to International Monetary Fund forecasts, the country's contribution to global GDP growth will still exceed that of any other single country.³

Figure 5. As China's Economy Slows, the Amount It Adds to World GDP Is Expected to Increase (\$ billions, percent)



Note: Shaded area indicates estimates by the International Monetary Fund.
 Sources: International Monetary Fund World Economic Outlook Database, Office of Financial Research

Monetary Policy

The Federal Open Market Committee (FOMC) pivoted in January from expecting rate increases through 2019 to a more patient stance about future changes to its target range for the federal funds rate. U.S. core inflation (inflation excluding food and energy prices) fell off fairly sharply in the first half of 2019 after being essentially at the FOMC target of 2 percent for most of 2018. Some measures of inflation expectations declined as well. Against the backdrop of muted inflation, weak global growth, and trade uncertainty, FOMC members lowered their assessments of the appropriate future path for monetary policy. In July, the FOMC cut its target rate by 25 basis points, the first cut in more than a decade. Citing weak inflation and global developments, the FOMC followed with cuts in September and October. Those cuts brought the target range to 1.50 percent to 1.75 percent.

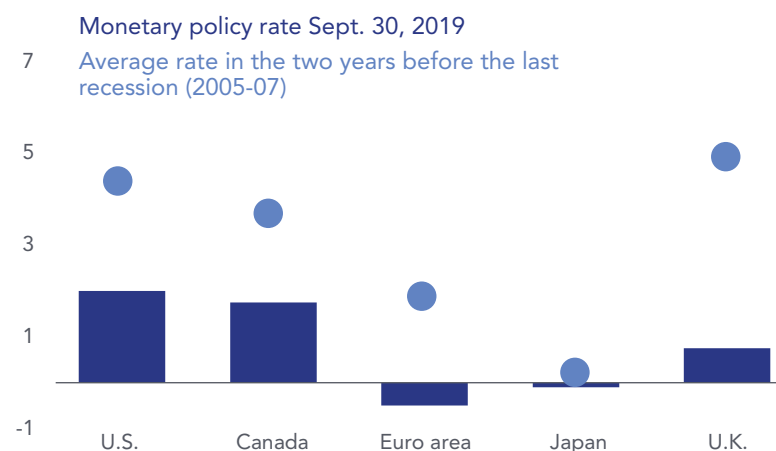
In September, the European Central Bank (ECB) lowered its own target rate. The ECB's cut was part of a broader monetary stimulus package aimed at countering weak inflation and a

prolonged period of weak growth in the euro area. The ECB also announced in September that it would restart its quantitative easing program of bond-buying, which it had ended in December 2018.

Interest rates and inflation across advanced economies remain at low levels. In this environment, the scope for central banks to act to mitigate the risk of a recession gets greater weight in the OFR's risk assessment. Central banks have less room to stimulate their economies, if desired, by lowering interest rates. Once a central bank lowers its policy rate to zero, it

has to use less-traditional policy tools to ease further. In this expansion, some central banks purchased government securities and other assets to lower market interest rates. Some also set their policy rates below zero. Those central banks have not yet unwound all of these actions, but may have to turn to them again in the next downturn. The FOMC made more progress raising its policy rate toward a more normal level than did central banks in other countries. But even the FOMC has less room to lower rates than it did before the last recession (see Figure 6).

Figure 6. Compared to the Last Recession, Central Banks Have Little Room to Lower Policy Rates (percent)



Note: U.S. federal funds rate (upper bound of target range), Canadian overnight rate, euro area deposit rate, Japan policy rate (overnight call rate 2005-07), U.K. bank rate.

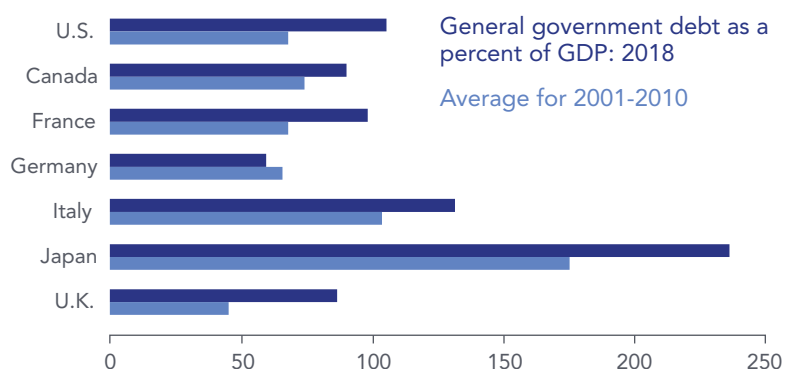
Sources: Bank of Canada, Bank of Japan, Bank of England, European Central Bank, Board of Governors of the Federal Reserve System, Haver Analytics, Office of Financial Research

Fiscal Policy

We assess risk from the U.S. fiscal situation as low in the short term. Congressional Budget Office (CBO) projections of the U.S. fiscal path are relatively unchanged from a year ago. However, the OFR continues to closely monitor the longer-term U.S. debt situation. The CBO estimates that deficits will run between 4.4 percent and 4.8 percent of GDP. That projection is relatively unchanged from a year earlier, but above the average of 2.9 percent for the past 50 years.⁴ The CBO expects interest rates on the debt to rise slightly but remain low by historical standards. Faster-than-expected increases in interest rates could heighten vulnerabilities from the fiscal situation.

Fiscal policy may need to play a bigger policy role in the next downturn, given the limited room central banks might have to lower interest rates (see **Figure 7**). But many countries could face constraints in their use of fiscal policy as well. Today, high government debt levels as a share of GDP and the rising burden of financing that debt may leave countries less room for

Figure 7. Countries Generally Have More Debt Than Before the Financial Crisis (percent)



Note: GDP is gross domestic product. International Monetary Fund (IMF) World Economic Outlook, April 2019, Statistical Appendix Table A-8, gross debt of the general government as a percent of GDP, on a consolidated basis except for Japan.

Sources: IMF, Office of Financial Research

fiscal policy to mitigate the risk of a recession.

Market Risk

As has been the case for several years now, market risk — the risk to financial stability from movements in asset prices — appears elevated across key markets. Asset price appreciation reflects, in considerable part, strong performance of the U.S. economy and expectations for continued economic growth. Against this backdrop, however, valuations for important asset types, including stocks, corporate debt, and some types of real estate, are above historic levels.

Where high valuations might reflect a vulnerability, sudden price declines could threaten U.S. financial stability if the assets were widely held by investors that use high leverage or rely on short-term funding. High leverage magnifies losses from price shocks. Falling collateral values can reduce access to short-term funding. In a crisis, short-term funding costs could increase quickly.

Stock Markets

Current stock valuations are supported by low interest rates and by market expectations for modest corporate earnings growth. However, stock prices could

decline if investors' outlook for earnings weakens. Such worries in late 2018 helped push the S&P 500 index down almost 20 percent from the peak. This decline was one of the drivers of the late 2018 increase in the OFR's Financial Stress Index, which provides a daily indicator of market stress and its components (see *The OFR Financial Stress Index*).

Against the backdrop of low interest rates and rising profits, overall stock market volatility has remained low (see **Figure 8**). Last year's *Annual Report* presented findings from OFR research into what drives the odds of a transition to very high volatility.⁵ The research suggests that economic

conditions usually contribute more to the odds of very high volatility than do financial conditions. Exceptions do exist, however. During the 1960s and mid-1970s, for example, financial factors were more significant than economic ones. The same was true during the last few years, when probabilities based on financial factors were historically high. However, in both periods, the likelihood of a very high volatility regime remained low overall based on strong economic indicators.

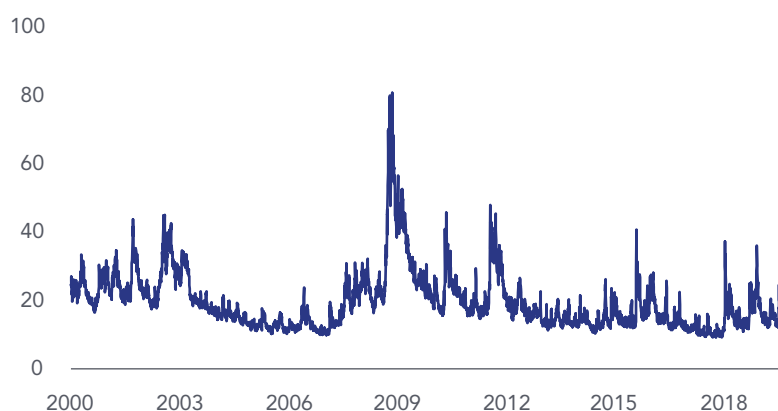
Bond Markets

The yield curve flattening and inversion earlier this year captured the attention of market

participants. As discussed in the **Macroeconomic Risk** section, the yield curve's flatness is due, in part, to a negative term premium. That premium is the difference in return between buying longer-term Treasury debt and rolling over shorter-term debt. At first glance, the sentiment reflected through the yield curve appears to contradict that of equity and corporate credit markets. The yield curve is signaling that Treasury bond investors foresee tame inflation and a slow-down in economic growth. Meanwhile, the equity and corporate credit markets are signaling that the economic expansion is likely to continue. One way to interpret all of this may be that, while earnings growth is slowing, the reduction in interest rates is offsetting this by boosting stock valuations.

Bond prices decrease with increases in interest rates. Bond duration — a measure of bonds' price sensitivity to interest rate changes — remains near its all-time high, set in early 2018. The duration of the Bloomberg Barclays U.S. Aggregate Bond Index is 5.8 years. Its average since 1990 is 4.8 years. Given the

Figure 8. Stock Market Volatility Remains Low (VIX index)



Note: VIX stands for Chicago Board Options Exchange Volatility Index. The index is a measure of implied volatility in the S&P 500 stock index.

Sources: Cboe, Bloomberg Finance L.P., Office of Financial Research

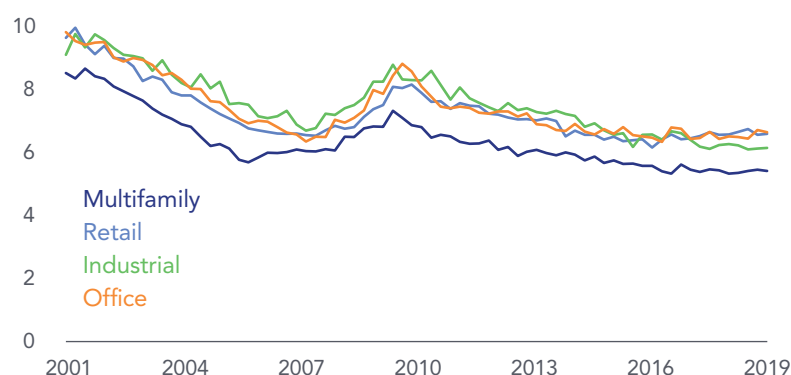
current duration, a percentage point increase in interest rates would lead to a \$1.4 trillion decline in the value of the Barclays Index. Investors are more willing to take on duration risk when they expect interest rates to remain low.

Real Estate Markets

Single-family home prices are moderately high relative to rents and incomes. However, there is much variation across the country in home price changes. For the year ended in July, home prices increased in 19 of the 20 metropolitan markets tracked by the S&P CoreLogic Case-Shiller indexes. However, eight of those markets remained below their 2006 or 2007 peaks.

Relatively high housing prices have pros and cons for lenders. High prices support collateral values, allowing lenders to recover money owed by borrowers who default on their mortgage payments. However, high prices encourage lending that can become riskier than anticipated. A significant increase in such lending does not appear to be occurring now (see **Household Credit Risk**).

Figure 9. Capitalization Rates Have Generally Declined Since 2010 (percentage points)



Note: The capitalization rate is the ratio of net operating income to property value.
Sources: Real Capital Analytics, Bloomberg Finance L.P., Office of Financial Research

Financial stability risk from commercial real estate remains low, but could rise if the economy's growth moderates. The increasing trend of interest-only loans since 2010 heightens the risk of credit losses from loan defaults.⁶ The share of interest-only loans among new commercial mortgage-backed securities issues rated by Moody's Investors Service was 75 percent in the second quarter of 2019, up from 5 percent in 2010. To date, strong growth and low interest rates have kept property cash flows and prices high. Capitalization rates — which measure annual income relative to prices for recently transacted properties — have continued to decline as property prices rise (see

Figure 9). The spread of these rates over Treasury yields has been low. This means investors are willing to accept a relatively lower return for the risk they accept.

Risks vary by property type. The retail sector has continued to decline. Increased online commerce sales play a role. Chain stores are closing some or all of their locations. Mall occupancy generally has declined, and some malls are closing. Their owners are looking for other uses for the buildings or the land. This trend is expected to continue.⁷ In the multifamily housing sector, considerable new construction is still underway. Added supply is driving up vacancy rates and

The OFR Financial Stress Index

The OFR's daily Financial Stress Index (FSI) supports our monitoring of stress in the financial system. Stress is a disruption in the normal functioning of the system. While vulnerabilities might signal future instability, measures of stress can indicate disturbances as they occur.

The OFR's FSI is a daily market-based snapshot of stress in global financial markets. It is constructed

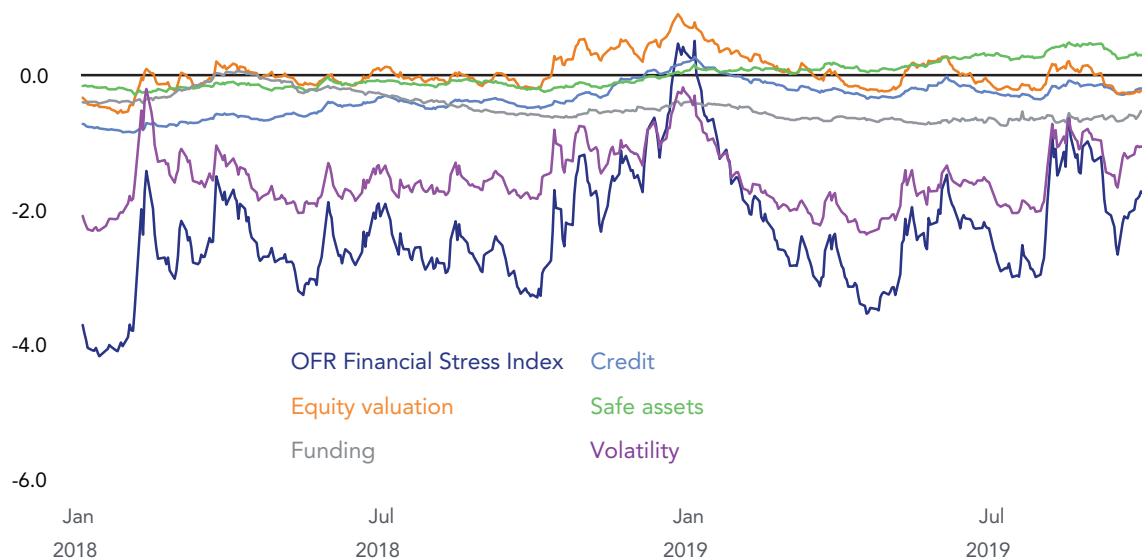
from 33 financial market indicators. The indicators are organized into five categories: (1) credit, (2) equity valuation, (3) funding, (4) safe assets, and (5) volatility.

The index measures system-wide stress. It is above zero when stress levels are above average, and below zero when stress levels are below average. Unlike financial stress indexes produced by others, the OFR's FSI can be decomposed into contributions from each of the categories. It also can be broken

down by each of the regions covered.

The FSI shows that financial market stress rose above average in the fourth quarter of 2018 for the first time in two years. This sign of slightly above-average levels of stress was the first in two years (see **Figure 10**). Within a week into 2019, stress again fell below average as risk sentiment improved. Stress remained at the low levels seen in recent years throughout the period since.

Figure 10. The OFR Financial Stress Index and Its Market Components Show Mostly Below-Average Stress in Last Two Years, Except in Late 2018 (indexes)



Note: Indexes equal zero when stress is average. Indexes are above (below) zero when stress levels are above (below) average. Technical information about this index is available at <https://www.financialresearch.gov>.

Sources: Bloomberg Finance L.P., Haver Analytics, Office of Financial Research

putting downward pressure on rents.⁸ Vacancy rates are also rising in the office sector and similarly pressuring rents.⁹

Commercial property demand can be highly sensitive to trends in employment and the economy. As our economic expansion continues, demand for space could slow, moderating property values. If values decline enough, losses on commercial mortgages could rise. A significant downturn in commercial real estate values could depress lenders' capital base. However, data on one segment of real estate debt, commercial mortgage-backed securities, indicate delinquencies are at post-crisis lows.¹⁰ In light of these data, it would likely take a fairly large market correction for the deterioration of commercial real estate conditions to threaten financial stability.

Credit Risk

Credit risk — the risk of borrowers or counterparties not meeting their financial obligations — remains moderate overall. However, vulnerabilities can build during what has been a very long period of low interest

rates. By several measures, U.S. corporate debt is higher than before the financial crisis. Increased corporate debt and leveraged loans, however, may reflect investors' appetite for risk in what has been a reliably growing economy (see *What Is a Leveraged Loan?*). In addition, household credit risk remains fairly low.

Nonfinancial Corporate Credit

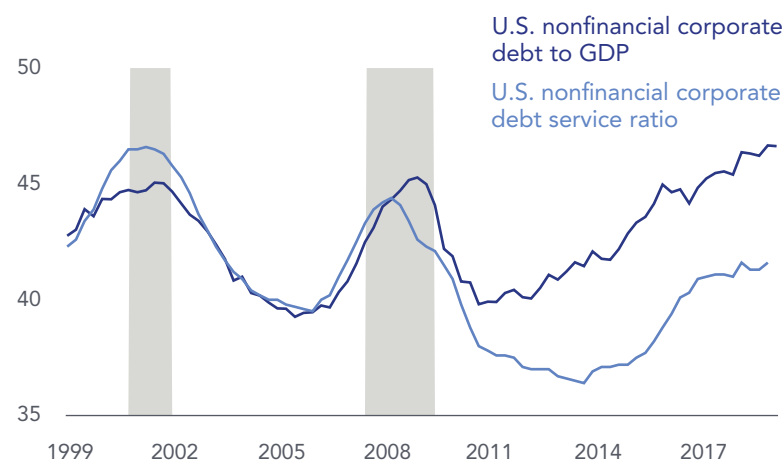
Businesses tend to take on debt during an expansion. But if growth slows, that leverage in good times could work against their ability to repay or roll over debts in a weaker economy. This vulnerability can

become a financial stability risk if losses lead to financial institution failures or credit market disruptions. This vulnerability increases as corporate leverage and debt service burdens rise (see Figure 11).

Investment-grade debt.

About \$2.8 trillion of the \$4.8 trillion in investment-grade corporate bonds in the ICE BofAML U.S. nonfinancial index were rated BBB as of Sept. 30, 2019. Of the \$2.8 trillion in bonds rated BBB, \$795 billion, about 28 percent, were rated BBB-, just one notch above high yield (see Figure 12).¹¹ The prevalence of lower-rated but still investment-grade corporate

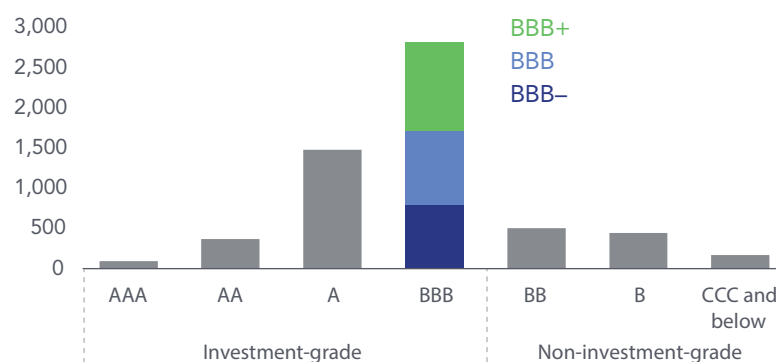
Figure 11. Corporate Leverage Is the Highest Since the Financial Crisis (percent)



Note: Data through June 30, 2019. Shaded areas are U.S. recessions. The debt service ratio is the ratio of debt payments to income.

Sources: Federal Reserve Bank of St. Louis, Bank for International Settlements, Office of Financial Research

Figure 12. Distribution of Investment-grade and Non-investment-grade Bonds (\$ billions)



Note: Credit ratings for bonds included in the ICE BofAML U.S. Non-Financial Index (CFOX) and the U.S. Non-Financial High Yield Index (HONF).

Sources: ICE Data Services, Bloomberg Finance L.P., Office of Financial Research

debt could disrupt credit markets, even without a sharp rise in default rates. Bonds downgraded from investment-grade to high-yield are called fallen angels. Such downgrades could see increased sell-offs, especially by investors with strict mandates to hold only investment-grade debt.

Investors in high-yield debt may not step in to buy all the fallen angels. The amount of BBB-rated nonfinancial bonds outstanding has grown to 2.5 times that of high-yield bonds (see Figure 13). If downgrades and an ensuing sell-off were concentrated over a short period of time, then market liquidity

could be adversely affected. High-yield bonds trade less frequently, and fewer are outstanding compared with investment-grade bonds.¹²

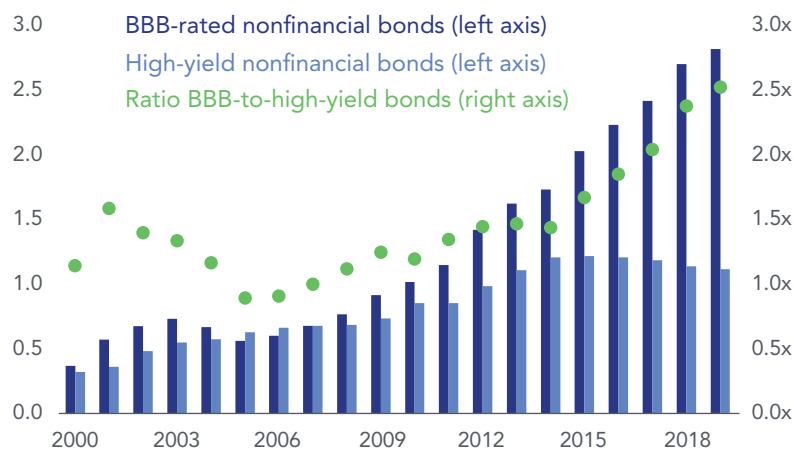
Non-investment grade

debt. Sizing the overall non-investment grade, or high-yield, debt market is a challenge because sizing the leveraged loan portion is difficult. Since 2010, high-yield bonds and the institutional loan portion of the leveraged loan market together have grown at an annual rate of 6 percent to about \$2.2 trillion in September 2019 (see Figure 14). The share of non-investment grade companies that are highly leveraged — those with debt-to-earnings ratios exceeding six times — has increased from 25 percent in 2010 to 30 percent last year.

What Is a Leveraged Loan?

Leveraged loans have negotiated terms but usually share several traits. These loans have credit ratings of BB+ or lower (that is, non-investment grade, also called high yield). They pay a floating rate of interest at a spread to a reference rate. They also hold a senior secured position in the borrower's capital structure. Leveraged loans can be either middle-market loans or broadly syndicated loans. Middle-market loans are mostly originated and held by direct lenders. Syndicated loans are originated by groups of lenders, including banks and nonbanks, with many of these loans then subsequently sold to institutional investors.

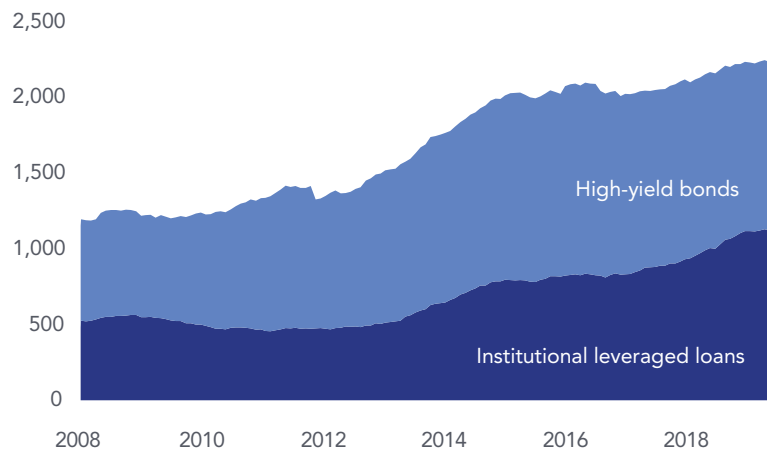
Figure 13. BBB-rated Bond Growth Outstrips High-yield Bond Growth (\$ trillions, multiple)



Note: Data are year-end for 2000-2018 and through September 30 for 2019. Based on ICE BofAML U.S. Non-Financial High Yield Index (H0NF) and BBB U.S. Non-Financial Corporate Index (C4NF).

Sources: ICE Data Services, Bloomberg Finance L.P., Office of Financial Research

Figure 14. High-yield Nonfinancial Debt Outstanding Saw Rapid Growth in the Immediate Wake of the Crisis (\$ billions)



Note: High-yield bonds are bonds in the ICE BofAML U.S. Non-Financial High Yield Index. Institutional leveraged loans are loans to nonfinancial issuers that are included in the S&P/LSTA Leveraged Loan Index. The chart omits data on other segments of the leveraged loan market and so it understates total leveraged finance debt outstanding.

Sources: ICE Data Services, S&P Leveraged Commentary and Data, Office of Financial Research

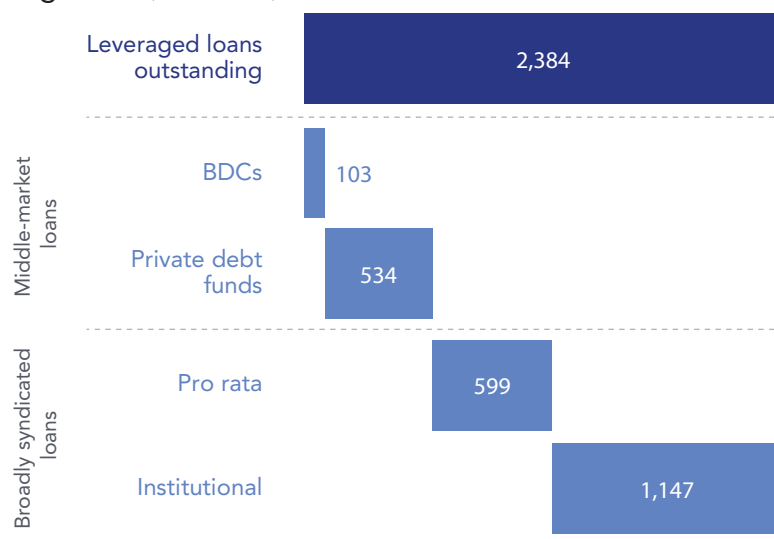
We estimate the size of the entire leveraged loan market to be about \$2.4 trillion as of year-end 2018 (see **Figure 15**). The largest segment is the \$1.1 trillion institutional loan market. Institutional loans are term loans originated by bank syndicates that are then sold to institutional investors. The S&P/LSTA Leveraged Loan Index tracks this segment. Pro rata loans are the second largest segment at about

\$600 billion. Pro rata loans include revolving credit facilities and amortizing loans held by banks. Private debt-fund assets account for about \$535 billion. The smallest segment is business development company (BDC) assets at just over \$100 billion. These latter two segments consist of nonbanks lending directly to mostly middle-market corporate borrowers.

The institutional leveraged loan market has more than doubled in size from about \$500 billion in 2010.¹³ Collateralized loan obligations (CLOs) are the largest buyers. They hold more than 50 percent of the total amount outstanding.¹⁴ CLOs buy leveraged loans as part of the pool of collateral that generates cash flows for the CLOs' investors. CLOs are sold to investors in slices called tranches, each with a different priority of claim on the cash flows of the collateral. Debt tranches pay a coupon and usually receive a credit rating. The higher-rated debt tranches receive cash flows before the lower-rated tranches. An unrated tranche, called the equity tranche, acts as a first-loss cushion to the rated tranches. The AAA-rated debt tranche typically represents about 60 percent of a CLO's total capital structure.¹⁵

Other major buyers of leveraged loans include nonbank investors such as insurance companies, pension funds, mutual funds, and exchange-traded funds (ETFs). In addition to buying loans directly, these investors and others, including banks, gain exposure by buying CLO tranches (see **Figure 16**).

Figure 15. Size of the U.S. Leveraged Loan Market and Its Segments (\$ billions)

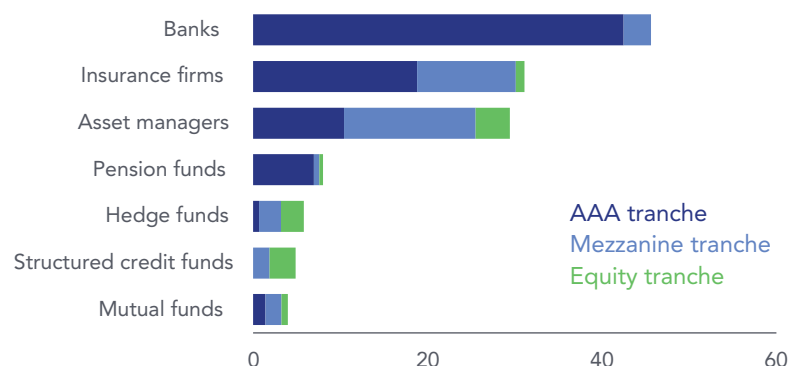


Note: Data through December 2018 except for pro rata, which is through September 2018. Totals include loans to both financial and nonfinancial firms. BDCs stands for business development companies. Private debt fund amount is based on assets under management and includes uninvested committed capital of investors in private funds. Some private debt fund loans are other than middle-market loans. Pro rata loans are originated and held by banks. Amount shown in this chart is an estimate based on data from the Shared National Credit Program; it relies on banks' own definitions, which may not be consistent. The amount includes undrawn portions of revolving credit facilities; it could also include exposures that are included in other categories provided by other sources. Institutional loans are originated by bank syndicates that sell the loans to institutional investors.

Sources: S&P Leveraged Commentary and Data, Shared National Credit Program, Preqin, S&P Global Market Intelligence, Office of Financial Research

Leveraged loan covenants have deteriorated in what has become a more borrower-friendly market since the financial crisis. Lenders are willing to accept weaker investor protections such as covenant-lite loan agreements and more frequent earnings adjustments. While there is no single definition of a covenant-lite loan, these loans place fewer restrictions on borrowers compared to traditional loans. For example, they do not require borrowers to maintain certain financial ratios that reflect the borrower's ability to repay. Earnings adjustments often take the form of projected cost savings added back to profits for the purpose of lowering the borrower's leverage ratio. Further, about 29 percent of first-lien term loans in 2018 were to borrowers without any subordinated debt, up from 18 percent in 2007.¹⁶ Historically, smaller subordinated debt cushions have led to lower recoveries given default for senior loan investors. Weaker investor protections, combined with lower subordinated debt cushions, could result in investors recovering less money in the next downturn. Moody's estimates that recoveries of about 60

Figure 16. Estimated CLO Buyers by Investor Type and Tranche, 2018 (\$ billions)



Note: CLO stands for collateralized loan obligation. The OFR estimated the proportion of total CLO issuance allocated to each investor type and tranche. Tranche size is the fraction of total issuance associated with the tranche category. Unrated tranches are categorized as equity. Tranches with ratings other than AAA are categorized as mezzanine. Citigroup CLO Research estimates are used to allocate fractions of each tranche category to investor types. Citigroup is the largest CLO arranger, but these estimates may not be representative of the market. Asset managers include CLO managers and institutional investors not covered in other categories.

Sources: Citigroup CLO Research, S&P Leveraged Commentary and Data, Office of Financial Research

percent are likely versus the historical average for covenant-lite loans of 77 percent.¹⁷ The OFR first highlighted the risk of leveraged lending in its 2013 *Annual Report*.¹⁸

If leveraged loan prices were to fall sharply in the next downturn, some CLO managers could face margin calls on the lines of credit they use to buy loans to launch new CLOs. The line of credit used is a warehouse credit facility, which is usually provided by a bank. The loans are used as collateral to draw on the warehouse line. If a deal is

unable to come to market, then the manager may be forced to sell the loans in the warehouse.

CLOs have generally come under scrutiny because of similarities to crisis-era collateralized debt obligations (CDOs). However, today's CLOs may not pose as much risk as these other securitized products did during the crisis (see *CLOs and Crisis-era Mortgage-backed CDOs: What's the Difference?*)

CLOs and Crisis-era Mortgage-backed CDOs: What's the Difference?

Collateralized loan obligations are a type of structured finance product that has grown rapidly in the last decade. This has led to comparisons between CLOs and other structured finance products, such as the mortgage-backed collateralized debt obligations that precipitated the financial crisis.

Like CDOs, CLOs transform lower credit-quality collateral into higher credit-quality financial products. During the financial crisis, CLOs suffered fewer losses than CDOs, and, unlike CDOs, no AAA-rated CLO tranche defaulted. CLOs are also more robust and transparent than crisis-era CDOs.¹⁹

- **CLOs are better able to withstand market fluctuations than were crisis-era CDOs.** Several features of CLOs make them more resilient. First, they have stable funding from the issuance of debt with maturities similar to the loans in which they invest. As a result, CLOs have less liquidity risk than crisis-era CDOs, some of which relied on funding from rolling over short-term debt.²⁰ Second, the debt issued by CLOs have collateralization tests based on principal amounts with haircuts rather than market prices, as did crisis-era CDOs. This means that if prices of leveraged loans were to abruptly fall, CLOs likely would not all at once be forced into asset fire sales that amplify market stress. Third, CLOs hold only loans and no other structured finance products, unlike CDO-squared and other complex crisis-era structures. Also, CLOs have larger subordinated tranches than in the crisis. These tranches absorb losses before the AAA and AA tranches.
- **CLOs are more transparent about the credit risks they are taking than were crisis-era CDOs.** Information on the individual corporate loans held in CLO portfolios is available to investors. The vast majority of these loans receive a credit rating from one of the three major ratings agencies. Ratings assigned to CLO tranches held by investors account for the risk of the individual loans in the collateral portfolio. This is in stark contrast to crisis-era CDOs, which lacked transparency and were ultimately backed by mortgages, which have no credit ratings.
- **CLOs have more risk management tools than did crisis-era CDOs.** The collateral held by CLOs is actively managed. CDOs tended to have collateral that did not change. CLO managers have discretion to replace individual loans within a CLO, subject to a few constraints. Violation of the constraints diverts cash flows from the equity tranche to higher-rated debt tranches.

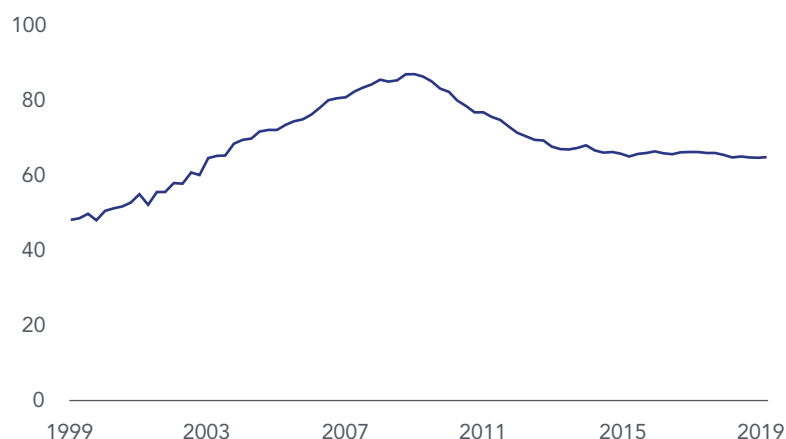
CLOs performed well in the crisis in part because the leveraged loan market did not have the same questionable underwriting practices as the subprime mortgage market. But in recent years, the credit quality of leveraged loans has deteriorated as covenant-lite loans and earnings adjustments have become more common. For these reasons, CLOs may perform worse in the next downturn than they did in the crisis.

Household Credit

Household credit played a major role in the severity of the financial crisis. In December 2008, aggregate household debt was more than 116 percent of personal annual after-tax income and reached a 20-year high of 87 percent of GDP (see **Figure 17**). These levels were not sustainable. The average debt-to-GDP ratio was 57 percent between March 1999 and March 2004. The large debt build-up before the crisis meant households had to reduce spending to make their debt payments during the crisis. This further weakened the demand for goods and services and magnified the economic downturn.

Since 2013, outstanding debt has increased steadily at an average annual rate of 3.6 percent, and stood at \$13.9 trillion in June 2019. However, the buildup in vulnerabilities appears limited. A long economic expansion reduced household debt to about 65 percent of GDP by mid-2014, where it has stayed since. Debt is likely to remain a moderate share of GDP in the near term as the demand for credit, measured by credit account inquiries, remains relatively

Figure 17. Household Debt as a Percentage of GDP Has Stabilized (percent)



Note: GDP is gross domestic product. Household debt is derived from the Federal Reserve Bank of New York's Quarterly Report on Household Debt and Credit. The nominal seasonally adjusted annualized GDP series is used for this calculation.

Sources: Equifax, Federal Reserve Bank of New York, Haver Analytics, Office of Financial Research

subdued. Credit account inquiries are a measure of credit demand because when someone requests a loan or line of credit, the lender pulls the credit report. The number of inquiries averaged 229 million every six months between June 2001 and December 2007. Inquiries totaled 139 million during the six months ended June 2019, slightly above the post-crisis low.

The ability of households to pay their bills has also improved. This improvement in part stems from a strong labor market and many years of low interest rates. Household debt service payments were less than 10

percent of after-tax personal income at the end of 2018, the lowest since records began in 1980. While these are signs of reduced household credit risk, it is of some concern that households have not made more progress paying down debt. A lower ratio of household debt to GDP achieved in good times gives households more capacity to meet debt obligations in bad times without cutting spending and intensifying the downturn.

Mortgage debt is two-thirds of household debt and reached a new high in June 2019, but the risk to financial stability may be minor. Mortgage debt has fallen from a high of 64 percent of GDP in December 2008 to 44 percent in June 2019. The credit quality of mortgage borrowers remains higher than before the crisis. Borrowers taking out new mortgages had a median credit score of 758, which Experian classifies as very good.²¹ Only 3.6 percent of mortgage originations by volume were to high-risk borrowers, those with a credit score of less than

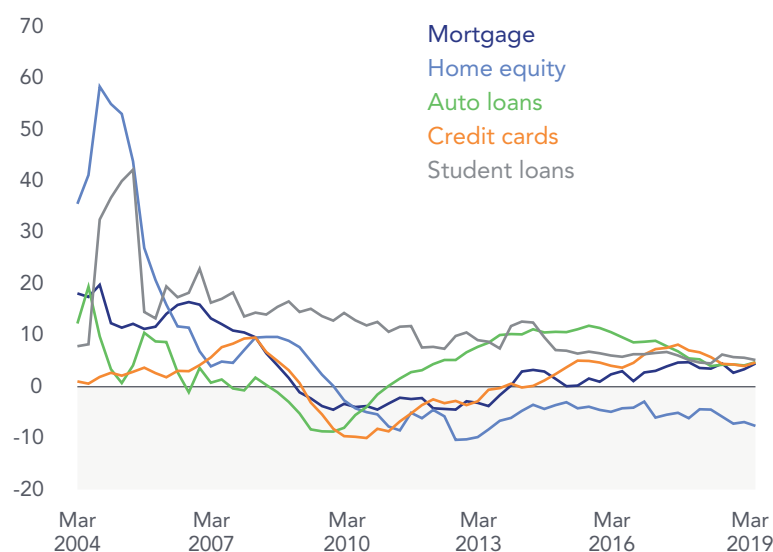
620. That share is well below the pre-crisis peak of 15.2 percent. Mortgages 90 or more days delinquent declined to 1.1 percent at the end of 2018 from 1.5 percent at the end of 2017.

Risks are somewhat higher from nonmortgage consumer debt, which totaled \$4 trillion or about 19 percent of GDP at the end of 2018. Student loans, auto loans, and credit card balances have each reached all-time highs. Total student loan balances were \$1.5 trillion at the end of 2018, up only slightly from a year earlier. The rate of growth

has slowed since 2014 (see **Figure 18**). The share of student loan accounts delinquent for at least 90 days remained high but stable at 11.4 percent in 2018. Student loan debt can be particularly constraining for household spending and economic growth because it is not forgiven in bankruptcy.

Auto loan balances reached a new high of \$1.3 trillion at the end of 2018, and serious delinquencies were up for the year. The share of loans delinquent for at least 90 days was 4.5 percent at the end of 2018, versus 4.1 percent a year earlier. The post-crisis peak was 5.3 percent. Credit card debt rose to \$870 billion at year-end 2018 from \$834 billion a year earlier. However, delinquency rates remain relatively low and stable, suggesting that credit card debt is manageable.

Figure 18. Growth in Student and Home Equity Loans Has Fallen Markedly (year-over-year percent change)



Note: Data through June 30, 2019. Year-over-year change in outstanding household debt, excluding those in bankruptcy. Data derived from Equifax consumer credit panel. Population controlled for inactive accounts.

Sources: Equifax, Federal Reserve Bank of New York, Haver Analytics, Office of Financial Research

Solvency and Leverage Risk

A financial firm becomes insolvent if its liabilities exceed its assets. Policymakers require regulated firms to meet capital requirements to mitigate the risk. Setting minimum capital thresholds involves balancing the trade-off between financial resilience and the efficient provision of financial services. Here we discuss banks, life insurance companies, and hedge funds. These three types of institutions can give rise to systemic risks due to their size, complexity, and interconnections within the financial system. They also provide services vital to the functioning of the economy. These services include commercial and investment banking, insurance, and asset management, among others.

For the financial system as a whole, solvency and leverage risk is low. In second quarter 2019, financial sector leverage was at a record low based on data available since 1945 (see Figure 19).

Banks

A bank's capital is the difference between its assets and liabilities. Bank

Figure 19. Financial Sector Leverage Reaches a New Low (ratio)



Note: Leverage measured as total liabilities over total financial assets of the financial sector. Excludes hedge funds and other private funds.

Sources: Board of Governors of the Federal Reserve System, Haver Analytics, Office of Financial Research

capital includes equity and other financial instruments that can similarly absorb losses. The more capital there is, the more a bank can absorb losses on its assets before it becomes insolvent. Bank capital ratios remain higher than before the 2007-09 financial crisis. Bank earnings growth also lowers insolvency risk because earnings can be retained to replenish capital. Net income for all Federal Deposit Insurance Corporation (FDIC)-insured depository institutions rose 6 percent from the first half of 2018 to the first half of 2019, with the majority of institutions posting increases.²²

A recently finalized revision to bank regulations will keep capital requirements the same for the eight U.S. global systemically important banks (G-SIBs).²³ However, the Federal Reserve estimates that it will lower required capital ratios 0.6 percent, in aggregate, for other banks with assets of \$100 billion or more.²⁴ There is much debate about how high capital standards should be.²⁵

The new rule also will bring capital requirements more in line with differences in large banks' systemic risk. The new requirements account for measures of a bank's complexity as well as its size. The change is

consistent with the OFR's analysis of the effects of complexity on bank solvency risk.²⁶ OFR analysis finds that considering factors such as interconnectedness, substitutability, and complexity, along with size, is better than size alone for determining systemic importance.

Stress tests can be an effective tool to see what could happen to bank capital during a period of financial instability. The universe of bank holding companies (BHCs) undergoing U.S. stress tests shrank this year because of a 2018 law change. Previously, BHCs with \$50 billion or more in assets were subject to the Dodd-Frank Act Stress Tests (DFAST). The Economic Growth, Regulatory Relief, and Consumer Protection Act of 2018 raised the asset threshold for annual tests to \$250 billion. BHCs with assets between \$100 billion and \$250 billion are tested less frequently. Those with less than \$100 billion in assets are no longer subject to testing. The change meant 18 BHCs went through the 2019 tests, down from 35 in 2018.

DFAST results, which are reported as part of the Federal Reserve's

Comprehensive Capital Analysis and Review, suggest the 18 BHCs tested could incur substantial losses and still continue to operate.²⁷ The stress test evaluates bank capital under hypothetical economic and financial scenarios set by the Federal Reserve. The results suggest that, in the aggregate, the 18 BHCs would have substantial losses under both the adverse and severely adverse scenarios, but could keep lending to businesses and households. BHCs are subject to several regulatory capital ratios. The Tier 1 common equity ratio measures the BHC's core (highest-quality) capital, mostly common stock and retained earnings. In the severely adverse scenario, this ratio for the BHCs as a group would fall from 12.3 percent at year-end 2018 to its estimated minimum of 9.2 percent, before rising to 9.7 percent in 2022.

Insurance Companies

From 2017 to 2018, risk-based capital (RBC) ratios for most of the largest U.S. life insurers generally remained well above the regulatory minimum set by state regulators. RBC ratios are an insurer's capital divided by a measure that includes factors for asset

risk, underwriting risk, and other risks common for a particular insurance type.²⁸ As discussed in the OFR's *2018 Annual Report*, RBC ratios were expected to be lower in 2018 than in 2017 due to the reduction in the federal corporate income tax rate. Also, the National Association of Insurance Commissioners (NAIC) revised the risk factors to reflect the lower corporate tax rate, which also reduced RBC ratios.

As with banks, these capital reserves provide a degree of protection against insolvency from unexpected losses. They are sized to cover 95 percent of loss scenarios. However, the extent to which capital could cover losses during a crisis also matters. NAIC guidance adopted by most states (often with variations) calls for larger, more complex insurance companies to annually assess their solvency in normal and stressed environments. Since 2015, these companies are required to report their findings confidentially to the lead state regulator for their insurance group. Each company can use its judgment in conducting the assessment, but it is expected to use stress tests or similar quantifiable

methods when appropriate. A strength of this approach is that it allows each company to best account for its own risk profile. A drawback is that the discretion can also limit outsiders' ability to compare companies.

Insurance companies manage large investment portfolios subject to market risk. Continued low interest rates remain a concern for insurers' earnings. In a low interest-rate environment, firms may put a greater share of their portfolios in higher-yielding and riskier investments.²⁹ This change in asset allocation can increase the risk that resides in these companies and, hence, their risk of disruption or distress. Risk-based capital is meant to protect policyholders against individual insurance company insolvency. At present, no capital standards apply to an insurer's parent firm or insurance group. The NAIC is developing a tool for assessing capital adequacy for insurance groups. The tool is being tested by a number of volunteer firms.

The Federal Reserve has proposed capital requirements for insurance savings and loan holding companies.³⁰ The proposal builds on existing state-based

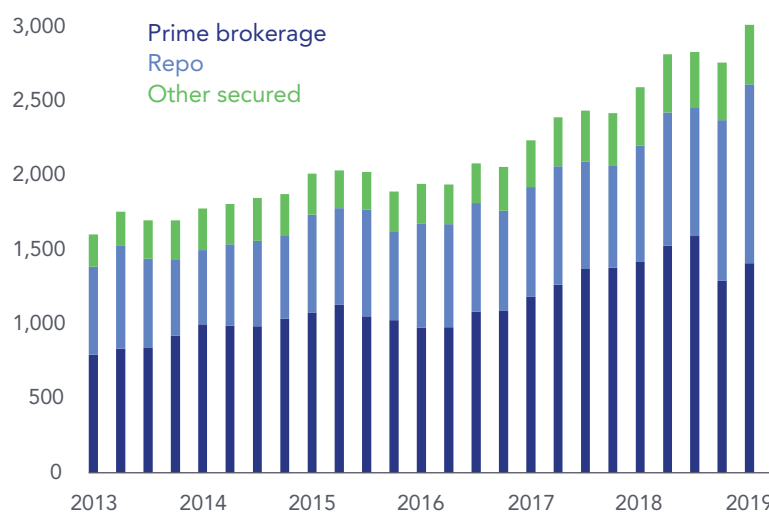
insurance standards, while also establishing minimum capital requirements that are specific to the business of insurance. Under the proposed framework, holding companies significantly engaged in insurance activities would be required to aggregate their state-based capital requirements and combine them into a consolidated requirement. The proposal would establish both a minimum requirement and a buffer on top of the minimum. The approach accounts for risks that are specific to the

business of insurance and is different from the calculations used for bank capital requirements. However, the minimum standard would be comparable to one of the key measures of a bank's health, the minimum total capital ratio, which is set at 8 percent for banks.

Hedge Funds

Collateralized borrowing by large hedge funds rose to more than \$3.1 trillion as of June 2019, up \$341 billion from a year earlier (see Figure 20). The amount of borrowing can matter for

Figure 20. Hedge Fund Secured Borrowing Reaches a New High (\$ billions)



Note: Data through June 30, 2019, based on Form PF Question 43. Data include only qualifying hedge funds that file quarterly. Qualifying hedge funds are those with at least \$500 million in net assets and whose advisor has \$1.5 billion or more in gross assets managed in hedge funds.

Sources: SEC Form PF, Office of Financial Research

financial stability. A broad increase in borrowing could make the industry more vulnerable to liquidity crises. It also may increase counterparties' exposure to hedge fund stress.

The increase in borrowing was not accompanied by an increase in equity capital, which held steady at less than \$3.2 trillion. Consequently, hedge fund investments are more heavily financed by debt. Leverage — measured as the ratio of gross assets (the value of assets on a fund's balance sheet) to net assets (the value of investors' equity) — rose from 1.90 in March 2013, when data were first collected, to 2.0 in June 2018, and to 2.13 in June 2019. All else equal, a leverage ratio of 1.90 implies gross assets would be \$720 billion smaller in June 2019 than with a ratio of 2.13. The leverage ratio is the highest it has been since the data became available in 2013.

For a given level of assets, higher leverage makes a fund more susceptible to margin calls and forced asset sales. These sales can depress prices and lead to margin calls and forced asset sales for a wider set of investors. This scenario played out in 1998 with Long-Term Capital Management, which was leveraged upwards of 25 to 1. The Federal Reserve facilitated the organization of a private-sector consortium to wind down the fund. Without the consortium, the hedge fund likely would have become insolvent and could have risked global financial instability. In the 2007-09 financial crisis, disruptions in the market for secured borrowing left a variety of leveraged investors unable to roll over their financing, leading to a rapid unwinding of illiquid positions, fire sales, and insolvency. Regulators still cannot assess this risk from hedge funds because they have little visibility into the collateral that supports borrowing.

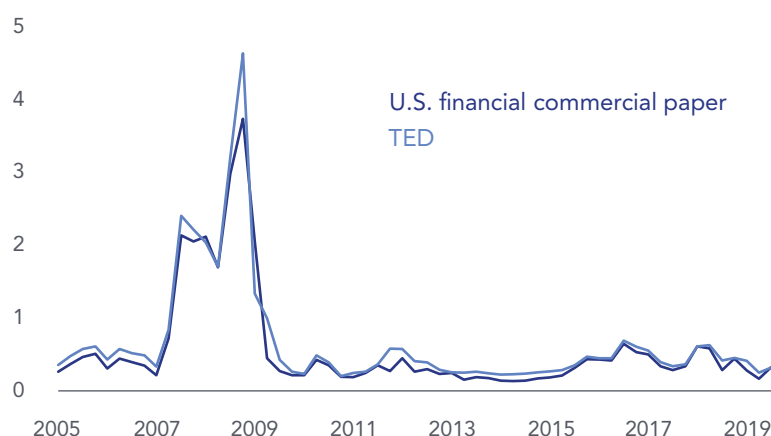
Funding and Liquidity Risk

Funding and liquidity risk is moderate for the U.S. financial system, but a number of factors are contributing to volatility in short-term funding markets. A market is liquid when buyers' and sellers' valuations are not too far apart and they can easily trade assets without much price impact. An illiquid market risks fire sales — when participants can't sell securities without contributing to downward price pressures. When financial firms lose the confidence of lenders, lenders can curb their willingness to provide funding going forward (see *How Runs Can Threaten Financial Stability*).

Financial Markets

Market liquidity risk is moderate right now, but the risk can change quickly with market sentiment. There have been some recent periods of higher market volatility when trading liquidity temporarily weakened. These temporary but limited effects of sentiment appear in two general indicators of short-term funding and liquidity risk (see **Figure 21**). The TED spread is an indicator of liquidity in the interbank market, where large

Figure 21. Commercial Paper and TED Spreads Remain Narrow, Indicating Favorable Funding Conditions (percent)



Note: The commercial paper spread is the difference between three-month U.S. financial commercial paper and Treasury bill rates. The TED spread is the difference between three-month U.S. dollar LIBOR and Treasury bill rates.

Sources: Bloomberg Finance L.P., Office of Financial Research

international banks lend money among themselves. The TED spread is the difference between the three-month U.S. dollar LIBOR and Treasury bill rates. LIBOR, in turn, affects the interest rate paid by corporate borrowers on floating-rate loans. The commercial paper spread is the difference between the three-month U.S. financial commercial paper and Treasury bill rates. This spread reflects the market's collective view of the credit risk of providing short-term funding to financial firms. Both the TED and commercial paper spreads widened substantially during the 2007-09 financial crisis.

Recently, these two spreads were at typical levels.

Some aspects of corporate bond market liquidity continue to warrant monitoring. The OFR delved into this topic in last year's *Annual Report*.³¹ Certain segments of the market may be less liquid. Examples include larger bond trades, certain individual bond issues, and interdealer trading. In a time of market stress, lower liquidity could amplify market losses and spreads could widen materially, tightening financial conditions. Under such conditions, the willingness of dealers to make markets

for corporate bonds would determine the availability of liquidity.

In February, the OFR Financial Research Advisory Committee provided the OFR its views on U.S. corporate bond market liquidity.³² The committee, made up of experts from academia and industry, offers advice to the OFR on its research and its data management and standards. The committee concluded that a wide range of factors may be diminishing market liquidity, although opinions differed on the extent of the problem. For example, regulatory and structural market changes appear to have reduced market-making activities. This finding is consistent with the OFR's finding that interdealer trading has declined. The committee also found that developments in technology have boosted market transparency, discouraging traders from making large trades so as not to reveal their positions. This finding is also consistent with the OFR's finding of reduced liquidity in the market segment for large bond trades.³³

Among the regulatory factors affecting corporate bond market liquidity is the

Volcker Rule. The Volcker Rule is a provision of the Dodd-Frank Act that generally prohibits proprietary trading of corporate bonds and other financial instruments by commercial banks. An intent of the Volcker Rule was to prohibit banks from speculative proprietary investments similar to those that contributed to the financial crisis. To better understand potential risks, OFR researchers studied the effects of the Volcker Rule on corporate bond market liquidity.³⁴ When the rule went into effect, many other changes were going on in regulation and in markets. To filter out effects of those unrelated changes, the OFR researchers focused on the rule's underwriting exemption. That provision allows banks that underwrite securities to participate in market-making activities to maintain market liquidity. The research shows that the Volcker Rule reduced corporate bond market liquidity from 20 to 45 basis points, depending on the type of trade. This is economically significant because the average roundtrip cost (the cost of both the purchase and subsequent sale of a bond) for trades in the data was 54 to 73 basis points. The researchers conclude

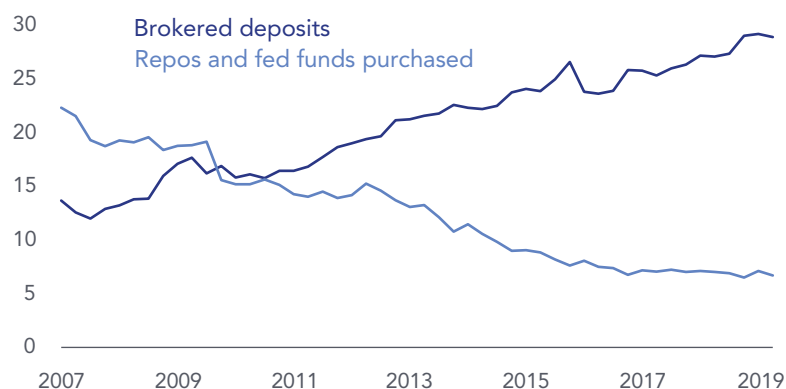
that some bond dealers affected by the rule incurred costs that they passed on to their counterparties, which resulted in these dealers losing market share. The study did not address the broader effects that prohibiting trading by banks might have on reducing systemic risk.

Financial Institutions

Commercial banks. The availability of bank wholesale funding is sensitive to shifts in confidence. For example, wholesale funding includes federal, or fed, funds (overnight interbank borrowing to maintain reserves at the Federal Reserve) and security

repurchase (repo) agreements. A repo is the sale of a security with an agreement to buy it back later at a set price. Risk from banks' dependence on wholesale funding appears moderate, while the mix of funding sources has changed. U.S. banks have reduced their reliance on repo and fed funds borrowing over the last decade (see Figure 22). Given the crisis-period revelation of risks associated with repos, this trend tends to reduce banks' funding risk. A sharp jump in repo rates in September 2019 did not alter this trend (see *Factors Behind September Spike in Repo Rates*). However, some of the reduction in risk is

Figure 22. FDIC-insured Depository Institutions Replace Repo and Fed Funds Borrowing With Brokered Deposits (percent of wholesale funding)



Note: Data through June 30, 2019. Wholesale funding includes foreign and brokered deposits, repurchase agreements (repos) and federal (fed) funds purchased, Federal Home Loan Bank advances, and other borrowed money.

Sources: Federal Deposit Insurance Corporation, Haver Analytics, Office of Financial Research

offset by a greater reliance on brokered deposits. A brokered deposit is any deposit that is obtained, directly or indirectly, from or through the mediation or assistance of a deposit broker. These funds can leave the bank quickly when a competitor offers a higher rate.³⁵

Banks tend to borrow short term and lend long term, and earn their money by effectively managing the associated maturity transformation. This year's yield curve inversion could raise banks' funding costs relative to their yields on earning assets, such as loans and securities. As of second quarter 2019, that had not happened. While the cost of funding earning assets at all FDIC-insured depository institutions rose from 0.70 percent in second quarter 2018 to 1.02 percent in second quarter 2019, the yield on earning assets rose, too. The difference, the net interest margin, rose 1 basis point, that is, one-hundredth of a percentage point.³⁶

Federal Home Loan Banks (FHLBs). The 11 FHLBs remain a source of liquidity and funding for their bank and nonbank members. They meet members' needs

through letters of credit and advances. Advances are loans secured by eligible collateral, such as residential mortgages.³⁷ The majority of advances are for less than a year. While advances remain below pre-crisis levels, they have grown steadily. Since 2012, the FHLBs have steadily increased their reliance on short-term debt to finance their growth (see **Figure 23**). That's partly due to increased demand for these types of short-term instruments from money market funds.

In August 2018, the Federal Housing Finance Agency

Factors Behind September Spike in Repo Rates

Overnight borrowing rates spiked during a period of several days in September, due to tight financing conditions in the repo market. These conditions briefly spilled over into the federal funds market, prompting the Federal Reserve to use repos to provide additional liquidity to the market. While any disruption in repo markets tempts a comparison to the runs in repo that began in 2007, the 2019 spike in financing rates was not a run. It was not a reflection of lender concerns about institutions or types of collateral. Instead, it was a temporary shortage of liquidity brought on by market changes over time in combination with short-term seasonal cash needs. These shortages are not uncommon in repo markets, though they are typically less severe and tend to occur around reporting periods, which this one did not. The event highlighted the need for more research into the dynamics of repo funding.

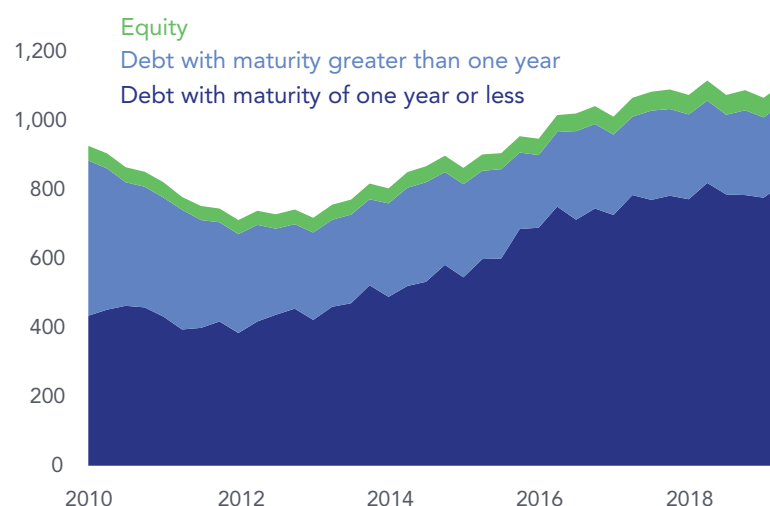
issued guidance to the FHLBs to ensure they maintain sufficient liquidity to continue lending if a market disruption were to occur.³⁸ This guidance mitigates potential funding risks arising from market disruptions associated with the FHLB lending channel.

Mutual funds and exchange-traded funds.

With traditional open-ended mutual funds, an investor can redeem shares directly with the fund at a specified time, usually the end of the trading day. The price is based on the fund's estimated net asset

value per share. The investor bears the risk that the fund's market value will change between when the investor chooses to sell and when the net asset value is computed at the end of the trading day. In recent years, investors have favored taxable-bond funds over stock funds (see **Figure 24**). Bonds can be less liquid than stocks. If mutual funds have to sell the underlying assets quickly to meet investor redemptions, that might put downward pressure on asset prices, possibly causing other market disruptions.

Figure 23. Federal Home Loan Banks Increase Use of Short-term Debt (\$ billions)



Note: Data through June 30, 2019. Debt with maturities of one year or less include discount notes and bond obligations with contractual maturities of less than one year. Debt with maturities greater than one year include bond obligations with contractual maturities greater than one year, mandatory redeemable capital stock, and subordinated debt.

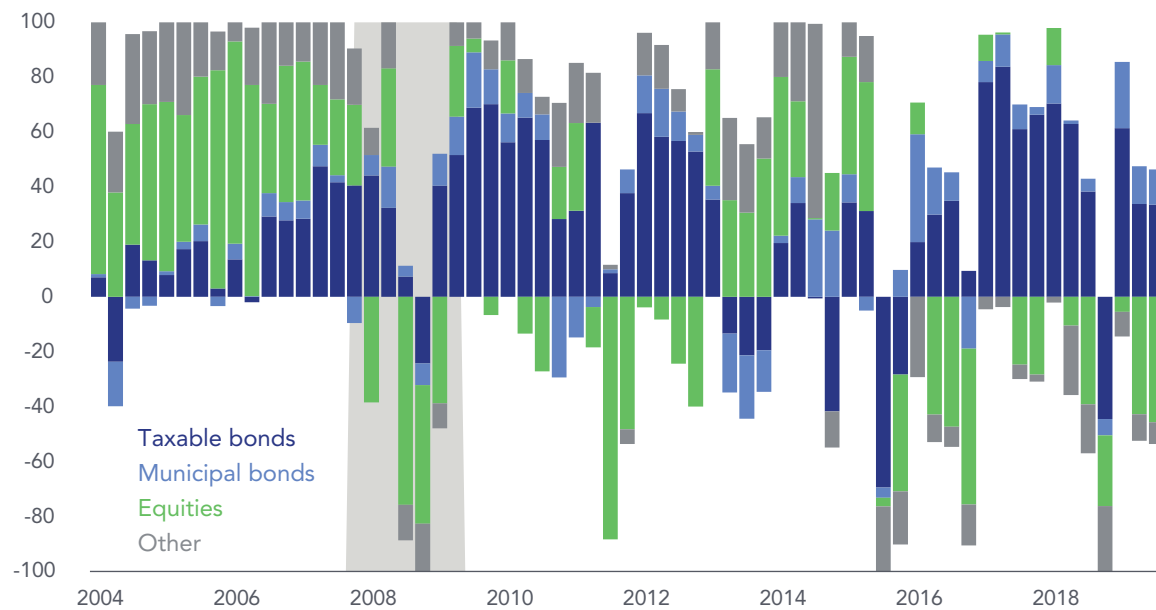
Sources: Combined Annual and Quarterly Financial Reports of the Federal Home Loan Bank System, Office of Financial Research

How Runs Can Threaten Financial Stability

Bank runs were the primary threat to U.S. financial stability during the Great Depression. Runs find people rushing to withdraw deposits in anticipation of their bank encountering a lack of liquidity or an outright insolvency. Banks facing a run often do not have enough funds on hand to meet the demand for withdrawals. Runs can also make depositors' fears a reality — driving banks into insolvency. Deposit insurance at competitive premiums can help manage the threat of bank runs by reassuring depositors that their funds are safe, even if their bank fails.

Banks and other financial firms depend on a variety of sources for short-term funding. Any funding that can be withdrawn on short notice is "runnable."³⁹ Uninsured bank deposits, money market fund shares, commercial paper, and repurchase agreements are just some runnable sources of funding. Runs increase the odds that affected firms could default on their financial obligations to others. Fears of such defaults can fuel more runs.

Figure 24. Taxable Bond Funds Dominate Recent Net Inflows to Mutual Funds (percent of net inflows)



Note: Chart shows flows for open-end mutual funds, net of money market funds and funds of funds. Shaded area is U.S. recession.

Sources: Morningstar, Office of Financial Research

Unlike with mutual funds, ETF investors trade shares as they would stocks, rather than redeeming shares directly with the funds. This allows investors to sell out of their investments at any time during the trading day. Investors often choose ETFs over mutual funds with similar holdings, in part, because of this perceived intraday liquidity. ETFs depend on authorized

participants — usually banks or brokerages — to provide end-of-day liquidity. Redemptions by authorized participants help align market prices of the funds with the values of underlying assets. Authorized participants are not obligated to redeem shares. They could step away in stress situations, dislocating markets for the funds or underlying assets.

Contagion Risk

Contagion risk remains moderate. Contagion occurs when losses at some financial firms or markets spread to others. One indicator of contagion risk, SRISK (the systemic risk a firm adds to the financial system), rose in late 2018 because market stress, a component of SRISK, increased.⁴⁰ In 2019, market stress returned to the very low levels of recent years, and SRISK moderated.

In 2015, OFR researchers developed an alternative measure of contagion risk. The OFR Contagion Index measures the loss that could spill over to the rest of the financial system if a given financial firm were to default. The index accounts for a firm's size, leverage, and connectivity, and is calculated as:

Contagion Index = Connectivity x Net Worth x (Outside Leverage -1).⁴¹

Connectivity is measured as the share of the firm's unsecured liabilities that are held by other financial institutions.⁴² With higher connectivity, a firm's failure has a potentially larger impact on the rest of the financial

system. Net worth is the difference between a firm's assets and its liabilities, and serves as a measure of firm size. A larger firm's failure can have a bigger impact on the financial system, other things equal. Outside leverage is the ratio of a firm's claims on *nonfinancial* entities to its net worth. Those claims are the debt of households and nonfinancial businesses the firm holds (such as mortgages and corporate loans and bonds). Outside leverage can capture how vulnerable the firm is to shocks to the real side of the economy. The potential for mortgage defaults, for example, to trigger contagion, as happened in the crisis, can be captured by this term. Putting the pieces together, a firm with a higher contagion index tends to pose a greater systemic risk in that it is more susceptible to failure (from high leverage), its failure has a bigger impact (from its size), and its failure can have a larger impact on the rest of the financial system.

The OFR's Contagion Index has several advantages over SRISK. SRISK measures the capital shortfall of a firm if a severe market decline

occurs.⁴³ In contrast, the OFR's index is not limited to risk from a severe market decline. It does not require estimating the market value of the firm's equity in such a decline. And it does not require knowledge of the network among financial firms to determine connectivity.

Contagion index values for the eight U.S. G-SIBs are generally little changed since 2016. Some large banks continue to have index values that are more than twice the average of the others. Their higher values are mostly due to their degree of connectivity with the rest of the financial system and to their size. The indexes are measured in dollars and, in theory, can go as high as a firm's total liabilities to other financial institutions.

Contagion index values for the eight largest life insurers are also little changed. Because the firms do not publish the needed data on their consolidated operations, the analysis is limited to their domestic life insurance businesses. As a group, these life insurers have lower contagion index values than do the

G-SIBs. Two factors drive this. The first is the lack of data for the insurers' other operations (their non-life insurance entities, foreign subsidiaries, and non-insurance activities). With the availability of these data, the contagion indexes might be higher, as those business lines may be more interconnected to the rest of the financial system. Second, most of the insurers' liabilities are owed to policyholders rather than to other financial firms. Thus, there is less risk that an insurance company's failure would spill over to other financial firms. That said, individual firms can contribute more or less contagion risk.

Other Risks

We group risks that do not fit nicely into any of the OFR's vulnerability categories under the heading of "other risks." This category includes the potential for risks from emerging financial products and technologies. For example, the packaging of mortgage-backed securities (MBS) was a financial innovation from decades earlier that had improved risk sharing in the financial system. However, MBS proved toxic when, in the years leading to the crisis, these securities were produced on a massive scale, then combined and sold in other securities.

Operational Risk

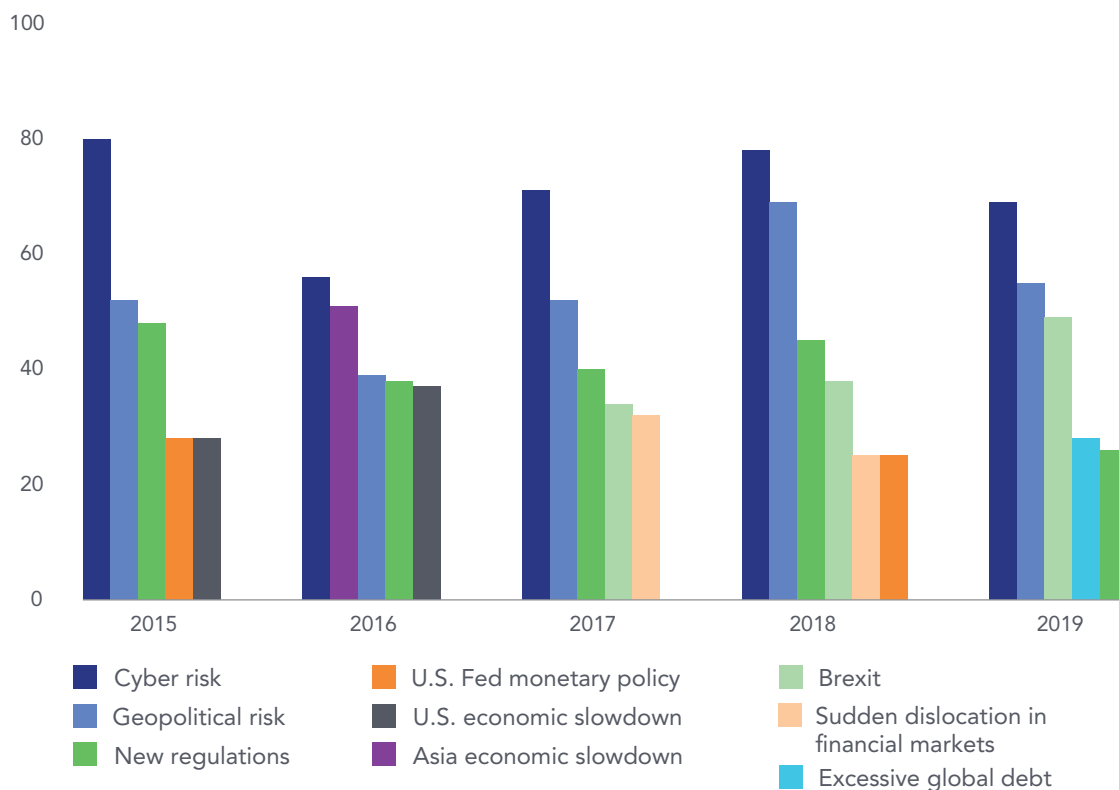
Operational risk is the risk of loss from internal inadequacies or failures — problems from lapses by people, processes, or systems — or from external events. Examples include risks from physical disasters, fraud, information technology failures, and maintenance lapses. Operational risk could become systemic if losses reduce firm market values and increase leverage, or spill over to other firms.⁴⁴

Representatives of leading financial services industry firms routinely cite such risks as a concern. For several years, respondents to a survey of industry leaders have ranked cyber risk as the top risk facing the financial system (see **Figure 25**). Geopolitical risk almost always has ranked second. Brexit risk has come in third or fourth in recent years.⁴⁵

Here we discuss operational risks from cyber events, Brexit, and the shift away from U.S. dollar LIBOR, as well as the potential for risks from environmental events.

Cyber risk. Financial services executives are not alone in rating cyber risks above all others as a threat to financial stability. The OFR has ranked it as a major concern since its inception. Policymakers rank it that way, too. Federal Reserve Chair Jerome Powell has described it as the largest risk now challenging the Fed, financial institutions, and financial markets.⁴⁶ Cyber risk looms so large because the critical infrastructure for the economy and the financial system is computer-driven and networked. Networks are growing and changing, making the transmission of risk more complex.

Figure 25. Cyber Risk Tops Systemic Stability Risks Cited by Financial Industry Leaders (percent of respondents)



Note: The Depository Trust & Clearing Corporation (DTCC) regularly conducts a Systemic Risk Barometer Survey that asks representatives of financial services firms and other industry leaders to identify risks they think could affect the stability of the global financial system. Figure shows the percent of respondents ranking each risk among their top five. Results shown for 2015-17 are for the first quarter survey. The survey became annual in 2018.

Sources: DTCC, Office of Financial Research

In its prior reports, the OFR has identified three channels through which a cyber breach somewhere in the financial system could cause financial instability.⁴⁷ One is through a lack of availability of an essential financial service. Financial markets often rely on a small number of firms to provide critical functions. Those providers can be other financial

sector firms, such as a firm that clears transactions. Or they can be from outside the financial sector, such as a firm that provides cloud storage for data. Financial markets could find an essential service unavailable if a cyber breach interrupts a key provider's operations. A second channel is through a loss of data integrity. Corruption or destruction of

data could disrupt transactions or payments. The third channel is through a loss of confidence that drives financial market participants to rush to pull their funds, causing runs on financial institutions and asset fire sales.

Several high-profile financial institutions experienced cyber breaches in 2019. In

mid-August, the European Central Bank shut down one of its websites after it found that intruders had infected the site with malware. The intruders might have stolen data about bankers who subscribe to the site.⁴⁸ The ECB said the site was on an outside server, separate from its internal systems. Still, the central bank cautioned that the intruders could trick victims via phishing, that is, fraud attempts through emails that seem to come from trusted sources.

Just a few weeks earlier, the Federal Bureau of Investigation (FBI) arrested a Seattle hacker accused of stealing personal information on about 106 million U.S. and Canadian credit card applicants and customers from Capital One Financial Corp.⁴⁹ The breach had been occurring since March. The data were stored on Amazon Web Services cloud servers. Both Capital One and Amazon have said the hacker gained access via the bank's network, not through Amazon.⁵⁰ Capital One estimated the breach would cost it up to \$150 million. However, it is too soon to tell what the total costs will be. Prosecutors have alleged that the same

hacker stole data from more than 30 other unspecified companies.⁵¹ Even at a single firm, it can take time to tally the costs — at least those traceable to the event. In July, two years after it was hacked, credit bureau Equifax announced it had reached a settlement to pay between \$575 million and \$700 million to resolve claims arising from that breach, which compromised personal records affecting about 147 million people.⁵²

An open question is what triggers a loss of confidence that can generate runs and redemptions and how those losses might spread to create broader financial system stress. The Council of Economic Advisers (CEA), however, has found that even without a widespread loss of confidence, cybersecurity events reduce affected firms' stock returns relative to returns to the whole stock market.⁵³ This loss, called the Cumulative Abnormal Return (CAR) from the cybersecurity event, is part of the cost of the event. It reflects changes in confidence in firms' future returns and the likelihood of future cyber events. For example, after the 2017 Equifax breach, there were calls for government action,

pressure for top executives of the credit bureau to resign, and questions about whether Equifax would survive. Equifax's stock price fell almost 35 percent from pre-breach prices, according to the CEA, and there was a negative total CAR of 41 percent over the seven days after the breach became public.

The Equifax breach also affected competitors and firms reliant on Equifax for consumer credit scores. The CEA estimates that an equal-weighted portfolio of TransUnion and Experian stock had a negative CAR of more than 18 percent over the same seven days. An equal-weighted portfolio of firms reliant on Equifax had a negative CAR of 9 percent over that period.⁵⁴ This shows the possibility of contagion and spillovers from a cyber event at a financial firm.

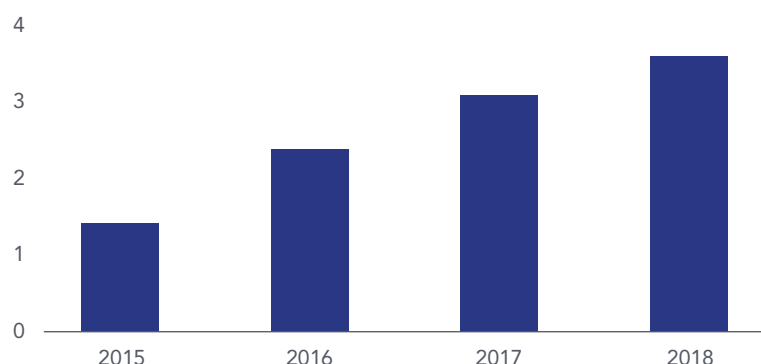
Data on the number and severity of cyber events in the financial sector are limited. Many events are not reported. Some firms may not even know their systems have been breached. Verizon's annual *Data Breach Investigations Report* shows 927 cyber incidents reported by financial and

insurance entities for the 12 months through Oct. 31, 2018. Of those, 207 were confirmed data breaches — incidents where data were disclosed to an unauthorized party.⁵⁵ While the financial sector routinely has far fewer reported incidents than some other sectors, it still ranks third in breaches. The data, however, are based on a sample of voluntarily reported incidents and are not representative.

A source of cybersecurity risk for the financial sector is through insurers' exposure to claims. Premiums on cyber insurance policies written have been rising (see **Figure 26**). At the same time, the insurance industry is concerned that it lacks a good sense of its potential exposure to claims in a major cybersecurity event. The industry also lacks good data to support its pricing and underwriting policies, which itself is a vulnerability.⁵⁶

Brexit. The United Kingdom's pending exit from the European Union could add to operational risks. The European Council granted an extension to Jan. 31, 2020, for the U.K. to complete its exit from the EU. Most politicians in the U.K. and EU publicly

Figure 26. Cyber Insurance Premiums Have Risen Rapidly (\$ billions)



Note: Total U.S. cyber insurance premiums written. Includes premiums for stand-alone and package cybersecurity insurance written by U.S. insurers as reported by the National Association of Insurance Commissioners (NAIC). Excludes reinsurance premiums.

Sources: NAIC, Office of Financial Research

favor an orderly separation, whether or not they support Brexit. In assessing the financial system's resilience to Brexit, we focus on a worst-case scenario of a no-deal Brexit.

One concern is that problems in the real economy could feed through to the financial system. In a no-deal Brexit, the U.K. government expects disruptions to supply chains and the movement of people, goods, and services. Such disruptions could cause volatility in financial markets with unpredictable spillovers. Supply chain disruptions also could result in some businesses lacking the materials needed to continue operating,

reducing their earnings and pressuring their ability to meet debt payments. Spillovers to financial institutions could ensue. While there are some official contingency plans, uncertainty remains.⁵⁷

Other operational risks include those from the unwinding of contractual agreements. Without a negotiated withdrawal agreement, the "passporting" of some rights between the U.K. and EU would end. Passporting allows firms from EU nations to sell their services across the EU, without having to comply with each country's separate regulations, or having to have subsidiaries to conduct business in a certain

jurisdiction. The United States would be affected by the U.K.'s loss of passporting because the U.K. would become a third party to EU-U.S. agreements. The loss of passporting is a major factor associated with contractual agreements.⁵⁸ Here we discuss three of the channels through which contractual problems can play out: contract continuity, regulatory alignment, and legal recognition of central clearing.

Contract continuity. London is a global hub for investment flows, with many of the world's financial products based on U.K. law and subject to EU passporting rights. Brexit creates uncertainty for these flows. The possibility of a no-deal Brexit raises the question of whether existing financial contracts will be valid and enforceable. Concerns generally revolve around what are known as lifecycle events, such as whether a contract may be rolled over, terms amended, or options exercised.⁵⁹ These events could trigger cross-border licensing, additional fees, and other possibly expensive requirements. This could make it more difficult for firms to manage risks.

To mitigate Brexit risks, U.S. and U.K. financial services firms have begun to shift banking and underwriting to other EU member countries. Moving assets and operations raises the firms' near-term operating costs. No one location has emerged as a replacement for London as a financial hub for the EU.

Regulatory alignment. One benefit of the EU is the alignment of regulations among EU member states. U.K. and EU authorities have provided public information outlining the regulations that will apply to banking entities after Brexit, albeit not permanently.⁶⁰ An agreement based merely on the EU's present "equivalence" framework may not be a reliable long-term basis for either the U.K. or the EU as economies and markets evolve. One proposed solution is for countries to recognize each other's regulations once the U.K. loses financial passporting rights, but that proposal has not gained EU support.

Whatever agreement is made to address a post-Brexit U.K., Brexit may increase the complexity of regulatory coordination. The United States invested more than a decade synchronizing

its regulatory regime with that of the EU. What a U.K. outside the EU means for regulatory harmony is unclear. For instance, the largest U.S. banks may need to modify their living wills, which are plans for how they can be resolved if they fail. The plans, which are required by the Dodd-Frank Act, will need to account for obstacles that arise after Brexit. New frictions in the bankruptcy or orderly liquidation processes may arise, along with obstacles to a firm continuing to operate during the resolution process.

Legal recognition of central clearing. U.K. central counterparties (CCPs) handle a sizable share of clearing activity in major markets. Clearing is essential to orderly and liquid markets. It would be operationally difficult to transfer such a large volume of clearing activity to an EU CCP without an appropriate transition period. For certain products, there currently are no EU CCPs that could fill the role. Financial regulators have agreed to contingency plans for clearing activities in the case of Brexit, at least for a limited time. Under those agreements, U.K. CCPs can continue to

clear EU derivatives through 2020.

Transition from U.S.

dollar LIBOR. The London Interbank Offered Rate (LIBOR) is a set of widely used reference rates, or benchmarks, that determine interest rates for borrowing in different currencies. LIBOR, including the U.S. dollar LIBOR, is determined from bank reports of what they charge other banks for short-term loans. Because of concerns about the reliability of the process, the world financial system is in the midst of a multiyear transition to other reference rates.

The U.K.'s Financial Conduct Authority secured voluntary agreement from banks that are LIBOR panel submitters to continue reporting through the end of 2021, but will not compel banks to submit after that date. Due to a sharp decline in activity underpinning LIBOR, banks already have few transactions on which to base their submissions. As a result, the end of U.S. dollar LIBOR could come at any time after the end of 2021. With two years to go, many firms remain underprepared for the transition from LIBOR to other benchmarks. In a recent survey by the consulting firm Accenture, only one

in five firms reported being operationally ready for the transition from LIBOR.⁶¹

A new reference rate, the Secured Overnight Financing Rate (SOFR), has been chosen as an alternative to U.S. dollar LIBOR. The OFR has helped to develop, oversee, and ensure a source of data to support the SOFR. The SOFR has gained significant traction since its launch, with more than \$310 billion in floating instruments issued to date.⁶² However, an enormous amount of LIBOR-linked instruments remains outstanding, and firms continue to issue LIBOR-linked instruments that mature after 2021.

Two primary threats to financial stability could arise from the failure to prepare adequately for the end of LIBOR:

- First, not all contracts referencing LIBOR that extend beyond 2021 contain appropriate fallback provisions. For example, a common provision requires that, in the event LIBOR is not available, parties to a contract must themselves attempt to poll banks for quotes. If they fail in that attempt,

which seems likely, then their contracts often specify use of the last value of LIBOR. Relying on the last value of LIBOR could increase firms' interest rate risk. This type of fallback could also cause contracts to behave in a way that was never intended. This unintended contract behavior could increase legal uncertainty and litigation risk. As a result, it is important from a financial stability standpoint to develop a consistent solution for these legacy contracts.

- Second, there are operational risks for LIBOR-linked contracts that do contain fallback provisions. Every additional contract that references LIBOR is an additional contract that will need a new benchmark after LIBOR is discontinued. The more contracts that need to be changed, possibly at an unexpected point in time, the higher the risk of error.

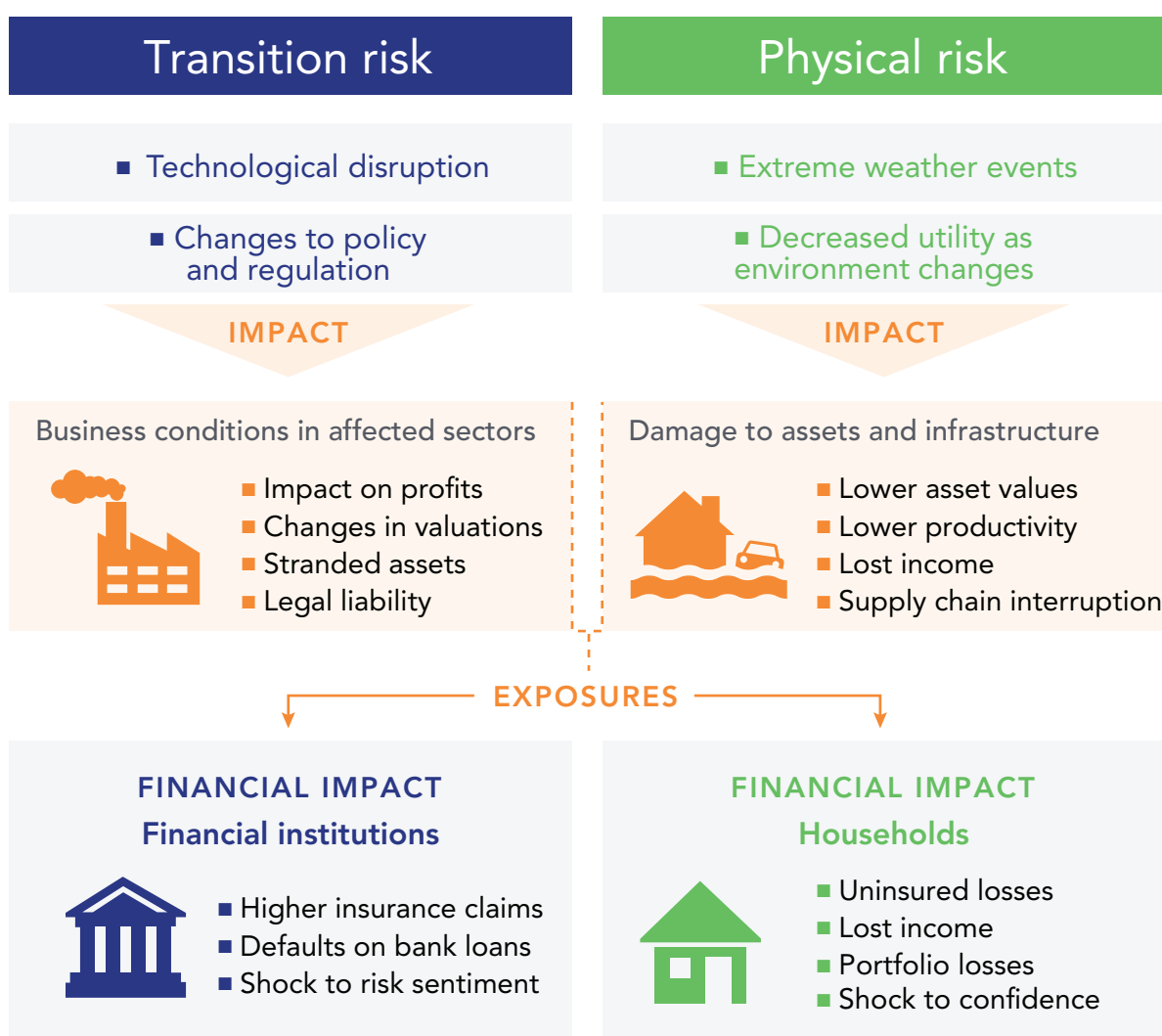
Natural disasters. An increase in the frequency and severity of natural disasters could pose risks to financial stability, and

have gained attention from central banks, including the Bank of England, European Central Bank, and Federal Reserve.⁶³ In our *2018 Annual Report*, we discussed risk to the insurance industry stemming from natural disasters.⁶⁴

Researchers from those three central banks identify two types of financial stability risk arising from natural disasters: physical risk and transition risk (see **Figure 27**). Physical risk is the risk of loss natural disasters pose by damaging property and

infrastructure, disrupting supply chains, and reducing agricultural production. These losses can impair the balance sheets of banks, insurers, and other financial institutions, as well as households. Transition risk arises from adapting or failing to adapt to changes in

Figure 27. Risk Transmission Channels for Changes in the Frequency and Severity of Natural Disasters



Sources: Bank of England, European Central Bank, Federal Reserve Bank of San Francisco, Office of Financial Research

the frequency and severity of natural disasters. That risk covers adjusting to abrupt technological change, policy actions, sudden swings in financial asset prices, or economic shifts as people or industries relocate or fail to do so. Both types of risk bear monitoring.

Risks from Emerging Financial Technologies

The OFR has a mandate to assess emerging threats to financial stability. We monitor financial technology, or fintech, developments from that perspective. We also monitor not-so-recent financial innovations. Sometimes, as with mortgage-backed securities, it is hard to envision the risks an innovation can pose when it gains scale.

In some ways, all financial firms are fintech firms, as technology plays an increasing role in the financial sector. But new technologies are leading to an influx of firms, as well as considerable changes in how the sector operates. These firms can reside outside the purview of traditional financial regulation. A disruptive technology can alter the usual channels through which risk can be

transmitted from one part of the financial sector to another.

Last year's *OFR Annual Report* discussed how digital financial assets were transforming the financial sector and considered their potential to introduce new risks.⁶⁵ These assets rely on cryptographic distributed ledger technology, or blockchain. We focused on the largest subset of the market for digital assets, the cryptocurrency market, and evaluated how it might relate to financial stability. We found that cryptocurrencies could amplify some financial stability risks, especially market risk and liquidity risk, but did not rise to a current threat.

Compared to last year, cryptocurrencies' risk to financial stability appears to be lower. Their market capitalization peaked in January 2018, and is less than half that peak, even after a recovery in 2019. However, new risks emerged as cryptocurrencies' footprint in the financial system expanded. A growing number of financial firms and institutional investors either participate or operate in cryptocurrency markets. Through these exposures, volatility

or reputational risk from the market could be transmitted to the traditional asset markets in which these entities are also large participants.⁶⁶ To address such developments, the Treasury Secretary established a Financial Stability Oversight Council working group on digital assets to monitor associated risks.⁶⁷

Because cryptocurrencies have no intrinsic value, cash flow, or guarantee of value, their prices are driven by investor sentiment. Most of the time, prices are largely uncorrelated with broader financial markets and, thus, a possible source of diversification for investors. In one survey of 441 institutional investors, 47 percent cited cryptocurrency as worth holding in their portfolios.⁶⁸

Cryptocurrencies also are prone to theft and fraud. Losses reportedly totaled as much as \$1.2 billion in the first quarter of 2019.⁶⁹ Some governments have increased oversight and enforcement. In April, the New York Department of Finance for the first time refused an operating license for a cryptocurrency exchange. The department cited weak anti-money laundering and counter-terror

financing procedures at the exchange.⁷⁰

Liquidity risk remains a concern from cryptocurrency markets. Stablecoins — so named because they claim to maintain a fixed value backed by reserves — may become a source of liquidity in those markets and possibly a means of payment in the broader economy. If their use becomes commonplace, disruptions in their availability may affect the financial system in a variety of ways. Because stablecoins, like other types of digital assets, tend to be produced and used in global networks, such disruptions can transmit risk to entities that are not obviously connected.

In June, Facebook and 27 partners announced plans for a type of payment system built around a cryptocurrency called Libra.⁷¹ Libra's value would be based on a basket of official currencies, giving it some stability, rather than pegged to a single currency as are the stablecoins. Libra has the potential to achieve unprecedented scale for a cryptocurrency if it is able to leverage Facebook's network of more than 2 billion users. However, prospects are unclear. In

October, several founding members of the Libra Association said they were leaving the organization.⁷²

The current regulatory regime in the United States is evolving with the market for cryptocurrency and other digital assets to mitigate financial stability risk. Tomorrow's regulatory framework may need to accommodate a central role for large technology firms.⁷³



Status of the OFR's Efforts in Meeting Its Mission

Data Initiatives

Repo Data Collection and Alternative Reference Rate Activities

As the largest short-term wholesale funding market in the United States, the stability and proper functioning of the repurchase agreement, or repo, market is critical to the stability of the overall U.S. economy. Facilitating low-risk cash investment, monetization of assets, transformation of collateral, and hedging, the repo market is an important means for transferring cash and securities throughout the financial system.

To improve transparency and risk monitoring of the market, the FSOC recommended a permanent collection of repo data in its *2016 Annual Report* and again in its *2017 Annual Report*. The OFR proposed a rule in July 2018 for a collection of data on centrally cleared repo transactions comprising about one-quarter of all U.S. repo market transactions. The Office finalized the rule in February 2019. Over the course of proposing and finalizing the rule, the OFR collaborated with the Federal Reserve, the Securities and Exchange

Commission (SEC), and others, particularly in the development of reporting instructions and technical guidance.

The OFR collection, which began in October 2019, has two primary purposes: 1) to identify and monitor financial stability risks, as noted above, and 2) to support the calculation of reference rates, including the Secured Overnight Financing Rate (SOFR). The SOFR relies on data relating to repo transactions backed by Treasury securities in three segments of the U.S. repo market, two of which will be collected pursuant to the OFR rule.

The rate that became known as the SOFR was selected by the Alternative Reference Rates Committee (ARRC) as its preferred alternative to U.S. dollar LIBOR in June 2017. The ARRC, an industry-led effort convened by the Federal Reserve Board and Federal Reserve Bank of New York, has not only worked to identify an alternative to LIBOR, but also to propose a transition away from LIBOR to an alternative rate. The OFR collection is an important component in the desired transition from LIBOR, as it will support the continued reliability of data

inputs for the computation of the SOFR.

The ARRC Paced Transition Plan proceeds. The Federal Reserve Bank of New York, in cooperation with the OFR, began publishing the SOFR in April 2018. Cleared futures and swaps referencing the SOFR were launched in May and July 2018, respectively, and outstanding volumes in these derivatives continue to grow. In cash products, 29 institutions have issued more than \$180 billion in floating-rate instruments linked to SOFR since July 2018.

Data Standards

Legal Entity Identifier (LEI – ISO 17442)

Global adoption of the Legal Entity Identifier (LEI) continues to grow, with more than 1.46 million LEIs issued through the second quarter, up from just 500,000 in 2017. The LEI is a data standard for precisely identifying parties to financial transactions. Growth continues to be driven primarily by regulatory requirements for LEI use around the world. To date, the greatest expansion of LEI issuances resulted from new regulations in the European Union that

required entities involved in securities and derivatives trading to possess and use their LEI in transactions. However, even in countries lacking widespread regulatory requirements for an LEI and where the number of LEI issuances versus the absolute number of eligible entities is relatively low, the outstanding amount of securities issued by entities possessing an LEI is frequently high. These data are consistent with LEI use becoming common among large corporations and financial institutions. In some jurisdictions, its use has even begun to expand beyond financial regulation, with, for example, the LEI being mandated as an enterprise identifier for products passing through customs controls.

Greater adoption of the LEI is also being fueled by its growing use by industry for its own purposes, though this greater industry recognition of the value of the LEI is itself driven by its expanded regulatory use. Industry representatives note that as more firms possess and use LEIs, these data identifiers become more useful when companies conduct their own internal risk management and compliance tasks. This

network effect encourages greater industry use of the LEI, which results in even more LEI issuances, particularly given that the cost of acquiring an LEI has dropped considerably over the past several years.

LEIs will soon be used in other financial data identifiers, including the new Unique Transaction Identifier (UTI – ISO 23897) currently in development. The UTI, discussed in more detail below, uses a counterparty's LEI as a prefix to identify the party generating the financial transaction.

LEI use in the OFR repo rule. One of the new regulations requiring the use of the LEI as an identifier is the OFR's Data Collection Rule covering centrally cleared funding transactions in the U.S. repo market. This rule, promulgated by the OFR on Feb. 12, 2019, requires that central counterparties with average daily total open repo commitments of \$50 billion or more report to the OFR certain information about these transactions. The OFR expects that this new requirement will enhance the abilities of the OFR, the FSOC, and FSOC members to identify potential risks to U.S. financial stability through a better understanding of

repo market participants' exposures, concentrations, and network structures. By requiring that the LEIs used satisfy the relevant global standard, the OFR also expects that this rule will help improve the quality of the data that the LEI conveys.

Improving LEI Level 2 data. Improving the quality of LEI data also underlies the OFR staff's continued work with the Global LEI Foundation (GLEIF) and the LEI Regulatory Oversight Committee (LEI ROC). The GLEIF is the not-for-profit organization that serves as the central operating unit for the Global LEI System. The LEI-ROC consists of more than 60 regulatory authorities from around the world that oversees the GLEIF. One area of particular interest to the OFR is ongoing work on LEI "Level 2 data" (that is, data submitted by legal entities acquiring an LEI regarding their "direct accounting consolidating parent" and their "ultimate accounting consolidating parent"). Level 2 data allow counterparties to a transaction to use LEIs not only to identify with whom they are transacting, but also to identify the entity that owns (and bears any corresponding risks of) the entity with

which they are transacting. This type of data can be crucial for market participants mapping their risk exposures.

During the 2007-09 financial crisis, many firms did not realize they held indirect exposures to failing entities until those entities failed. LEI Level 2 data are meant to help remedy this problem. The OFR is committed to working with the GLEIF so the quality of these data are sufficient for industry use.

Governance of new data identifiers. The international Financial Stability Board (FSB) has proposed that the LEI ROC take on the role of overseeing the governance of the UTI, Unique Product Identifier (UPI), and the Critical Data Elements (CDE) used in reporting derivatives transactions to trade repositories and swap data repositories. These identifiers, discussed in detail below, differ from the LEI and from each other, but all require a supporting governance structure to help ensure the quality and integrity of the data. The LEI ROC's experience and expertise with data identifier governance makes it a good fit to oversee the governance of these other identifiers and data elements, which would

avoid creating redundant work with a new international regulatory committee. Over the next year, the OFR will continue working with FSOC members to develop a proposal for the process through which the LEI ROC can undertake this expanded charge, while maintaining the LEI ROC's commitment to governance of the Global LEI System.

Reporting of Standardized Derivatives Data

Over the past year, OFR staff, along with Council members from the Commodity Futures Trading Commission (CFTC), SEC, and Federal Reserve Board, continued to lead and participate in derivatives data analysis and planning as members of the FSB Working Group on UTI and UPI Governance (GUUG) and the Committee on Payments and Market Infrastructures – International Organization of Securities Commissions (CPMI-IOSCO) Working Group for Harmonisation of Key Over-the-Counter (OTC) Derivatives Data Elements (Harmonisation Group).

A key advance during the year was the OFR's input and support for the FSB

GUUG to approve and transfer responsibility for the development and maintenance of the UTI to the International Organization for Standardization (ISO) as ISO 23897. The OFR will continue to provide analysis as a member of the ISO working group that is completing development of the standard. ISO 23897 is expected to be available for industry use in 2020.

A second milestone reached by the FSB GUUG, with leadership contributions from the OFR, is the designation of the Association of National Numbering Agencies (ANNA) Derivative Service Bureau (DSB) as the service provider for the UPI. In this role, the ANNA DSB will issue UPIs, as well as manage the UPI repository. The OFR contributes to the ongoing analysis, development, and promotion of the UPI as an ISO standard. This work was initiated in the fourth quarter of FY 2019.

In 2019, the OFR also assisted the CPMI-IOSCO Working Group in analyzing and publishing a final report on the governance of CDEs. This report included the recommendation to incorporate CDEs into the existing ISO 20022 standard, which is the international

standard for financial industry messaging. To meet this goal, the working group initiated analysis of required changes to the standard to support these data, with the OFR providing ISO 20022 subject matter expertise. This work is being conducted in partnership with the Society for Worldwide Interbank Financial Telecommunication (SWIFT), the registration authority for ISO 20022, and is expected to continue into 2020. As the CPMI-IOSCO Data Harmonisation Group reached its sunset date in June 2019, the CDE analysis work was assumed by the FSB GUUG, with the OFR maintaining its active role.

Data Products

The Dodd-Frank Act requires the OFR to develop tools for risk measurement and monitoring. The OFR's tools, found on our website, include:

- **Financial Stress Index (FSI):** The daily index supports the monitoring of stress in the financial system. It is constructed from 33 financial market indicators, such as yield spreads, valuation measures, and interest rates. The index can be

decomposed by region or type of stress.

- **Financial System Vulnerabilities Monitor (FSVM):** The quarterly monitor is a heat map of 58 indicators of vulnerabilities in the financial system. It is a starting point for monitoring U.S. financial stability. It is designed to provide early warning signals of potential vulnerabilities that merit further investigation.
- **G-SIB Interactive Chart:** The interactive online tool shows systemic importance scores and score components for global systemically important banks.
- **U.S. Money Market Fund Monitor:** The monthly monitor converts data from the SEC's Form N-MFP into a user-friendly format. Users can examine individual funds and the industry as a whole.

The OFR envisions its data products as high-quality monitoring tools used by key stakeholders, such as the FSOC and its members, members of Congress, financial industry participants, academics, the news media, and the public.

We intend for the tools to show emerging trends in the financial system and to further the OFR as a leader in financial stability monitoring and analysis. These data products do not duplicate the work of other financial regulators; instead, they provide the OFR opportunities to collaborate with regulators. We plan to create more tools that complement existing ones and leverage other agencies' expertise.

Interagency Data Inventory Update

The FSOC Interagency Data Inventory is a catalog of the data collections of FSOC members and other government organizations. The inventory does not contain data; it holds metadata — data about data — on each collection. These metadata are publicly available but are sometimes hard to find. The inventory can be used to search for data collections more easily and to analyze gaps and overlaps in data collections. Each FSOC member organization determines which of its data collections to include in the inventory.

The interagency inventory contains a brief description of each data collection and

basic information such as the collecting organization, the name and number of the form used to collect the data, and the type of collection, such as financial or supervisory. In FY 2018, the FSOC expanded the inventory so its member organizations could include additional information, such as the frequency of the collection, the website address and link to instructions and forms, and the website where the underlying data are found if the data are publicly available.

Now that the inventory has been collected over several years, the OFR can undertake an analysis of its content. This will help inform decisions about how to move forward with the inventory and make it more useful. Ultimately, we plan to serve as the knowledge center for financial data and financial data standards, with a focus on financial stability.

Information Technology

Major Initiatives

In FY 2019, the OFR continued to critically evaluate and strategically redesign its information technology (IT) systems and services to meet our mission and best serve our agency and stakeholders. The OFR's mission requires the collection of data necessary to identify risks to financial stability, while minimizing the burden of regulation and direct costs to the Office and the public. OFR IT follows a multiyear strategic technology plan that takes into account emerging best practices; OFR IT focuses on maintaining an IT environment that fosters business innovation through efficient, accurate decision-making.

In recent years, the federal government has embraced cloud computing solutions to provide secure, effective, and standardized services at reduced cost. The OFR's newly architected IT infrastructure incurs costs only for cloud services that we use, delivering savings in capital expenditure of

Move-to-the-Cloud Initiative

The OFR's information technology work in FY 2019 focused on building and testing the underlying services required to establish new systems in the cloud. The major advances included:

- an authentication and authorization solution to manage access to OFR systems and data, as well as integration with access control automation;
- a cloud-native data architecture, allowing data users to access any combination of datasets from the OFR's data collection without IT intervention, while paying only for resources as needed;
- high-performance computing-on-demand technologies, allowing the OFR to gain insight from "big data" (hundreds of terabytes), when needed, and avoid the recurring costs common to traditional, large-scale national labs and research groups;
- evaluation of email, collaboration, and messaging services; as well as backup and archival systems; and
- Personal Identity Verification (PIV) authentication for different types of network access.

The OFR will continue to assess cloud services in FY 2020, with an eye to flexibility or cost savings. We also plan to move forward with upgrading core systems and reengineering the OFR's telecommunication network.

\$12 million in FY 2019 and achieving a significant reduction in annual operating costs (see *Move-to-the-Cloud Initiative*).

The move-to-the-cloud initiative is proceeding in collaboration with the Treasury Office of the Chief Information Officer (OCIO), Office of Management

and Budget OCIO, and Department of Homeland Security Cybersecurity teams to assess and design the most secure and compliant cloud solutions.

IT and Data Procurement Operations

The Department of the Treasury Office of Inspector General (OIG) in April 2019 completed an in-depth performance audit of all of the OFR's contract activities and procedures, including OFR's IT and Data procurement contracts. The audit resulted in no recommendations and concluded that the OFR "effectively and efficiently acquired goods and services to accomplish its mission and those acquisitions were made in compliance with applicable procurement regulations."

IT Security

As security of OFR data is paramount to our mission, the Office's information security program complies with guidance from the National Institute of Standards and Technology (NIST), which recommends performing risk assessments

for all new or changed IT capabilities.

All data received by the OFR are stored in government-approved systems and accessible only via government-certified networks; no data are reachable via the Internet. Upon arrival, the data are immediately encrypted and stored in protected file systems. Data access is provided on a need-to-view basis, monitored, audited, and cross-checked with Memoranda of Understanding, Interagency Agreements, and contracts to guarantee compliance.

To determine appropriate security controls and other protection requirements, data are categorized based on Federal Information Processing Standard (FIPS) Publication (PUB) 199 and other models developed by federal financial agencies. Throughout the data acquisition process, OFR staff work with each data provider to address any unique security concerns. Additionally, independent third parties perform annual penetration testing and vulnerability assessments of our perimeter security and insider threat risks.

Data Management

Using 2018's roadmap objectives as the baseline for FY 2019, the OFR has been implementing data management solutions focused on increased efficiencies, data quality, and data integration.

In FY 2019, OFR IT redesigned its data onboarding to align with industry best practices and reduce the time, effort, and cost of ownership for data management. All data brought in by the OFR are now entered, processed, loaded, and made available for research and analysis using open source technologies and repeatable design patterns. OFR-wide enhancements to standards and procedures make the Office's data consistent with data from other FSOC members, related agencies, academia, and private industry, ensuring repeatable work output and smoother collaboration. This work enables the OFR's cloud migration project to deliver a world-class repository of both structured and unstructured data to support varied analytic needs.

In FY 2019, the OFR created an automated data profiling function that allows

validation of the data received and supports visual checks for data anomalies, ultimately increasing the confidence of our data products. When we identify anomalies, we communicate our concerns to the data provider for resolution at the source.

Data Gathering

The OFR's data-gathering efforts in FY 2019 focused on a first data collection under our rulemaking authority. The Office will take in data on the two centrally cleared portions of the repo market. The data will be integrated with existing datasets for enhanced monitoring. This collection marks the first time that the OFR has gone directly to industry to collect financial market information.

New Datasets Support Analysis

The OFR has brought on two new regulatory datasets to strengthen our data analytics and reporting capabilities, as well as the breadth and depth of our data collection.

- In January 2019, the OFR started to receive the Financial and Operational Combined Uniform Single Report (FOCUS), which enables the Office to assess potential vulnerabilities in U.S. registered broker-dealers and in the markets they serve.
- In May 2019, the OFR acquired Municipal Securities Rulemaking Board (MSRB) Regulatory Electronic Municipal Market Access (EMMA) data. These data allow the OFR to better monitor liquidity conditions in a broader set of financial markets.



Support and Collaboration

Support of the FSOC and Its Members

As the OFR's primary stakeholder, the FSOC's needs are key in guiding the work of the OFR. The Office supports the FSOC and its members by providing data, research, and analysis. We collect data from nonbank financial institutions at the request of the FSOC, and the Director of the OFR serves as a nonvoting member of the FSOC.

The OFR provides research and analysis to help the FSOC identify threats to financial stability. We respond to requests from the Council for research and analysis, as well as collaborate with FSOC members on research and data projects. To focus the Office's research and data agendas, the OFR and FSOC Secretariat work together to ensure that proposed research and data topics, projects, and publications are consistent with the OFR's mission.

The OFR leads the FSOC Data Committee, which shares information and coordinates action on data-related topics. The development of the Interagency Data Inventory is overseen by the Committee. The Office also collects, maintains, and shares supervisory and commercial datasets with the FSOC. The OFR has provided the FSOC with more than 65 datasets and is currently working to launch a system that will allow secure data-sharing between the FSOC, its members, and the OFR.

At the FSOC meeting held in March 2019, an OFR researcher jointly delivered a presentation with analysts from the Federal Reserve System on nonfinancial corporate credit. The presentation also covered the increasing importance of nonbank lenders, particularly in leveraged loans, and exposures of banks to corporate credit markets. For additional information regarding the OFR's findings on nonfinancial corporate

credit, refer to the **Credit Risk** section of this report.

Financial Research Advisory Committee

The OFR Financial Research Advisory Committee (FRAC) provides industry, academic, and government expertise to assist the OFR in fulfilling its mission. The Advisory Committee focuses on and informs the OFR's work on both research and data issues. The FRAC consists of members who are experts in business, economics, finance, data science, risk management, and IT.

The Advisory Committee meets twice each year and is governed according to the Federal Advisory Committee Act. The agenda and minutes of each meeting are available on the OFR's public website. Since July 2018, the Advisory Committee has been issued specific charges, or research requests, that are then discussed at a subsequent FRAC meeting. The FRAC

generates a responsive report to each charge, which is also published on the OFR website.

In February 2019, the Advisory Committee delivered its reports in response to three charges on the issues of regulatory reporting, central counterparty resolution, and market liquidity. In July 2019, the Advisory Committee provided responses to two charges relating to the transition from LIBOR to SOFR and whether leveraged lending poses a risk to financial stability.

Conferences Cosponsored

In FY 2019, the OFR cosponsored two conferences:

The OFR and University of Michigan's Fourth Annual Financial Stability Conference – Functions and Firms: Using Activity and Entity-based Regulation to Strengthen the Financial System

The OFR and the University of Michigan's Center on Finance, Law, and Policy hosted their fourth annual Financial Stability Conference Nov. 15-16, 2018, at the Department of

the Treasury in Washington, D.C. In 2017, Treasury released a series of major reports on core principles for financial regulation, which signaled a move toward an activities-based approach to financial stability risk monitoring and regulation. Regulators, policymakers, lawyers, economists, financial institutions, investors, financial technology companies, and experts on data science, cybersecurity, and finance addressed the following topics during the two-day conference:

- How should regulators pursue an activities-based approach to promoting financial stability?
- How can our regulatory structure adapt to this approach, particularly given the rise of financial technology and emerging financial products?
- For an activities-based approach to be effective and efficient, what kind of data do regulators need to be able to access?

Financial Research Advisory Committee Meetings

Feb. 28, 2019 • Department of the Treasury

The 13th meeting of the Advisory Committee, held in the Cash Room at Treasury Department headquarters, included the delivery of Advisory Committee Working Group reports on regulatory reporting, central counterparty resolution, and market liquidity. New charges were issued on transitioning from LIBOR to SOFR and on leveraged lending as it affects financial stability.

July 11, 2019 • Federal Reserve Bank of New York

The 14th meeting of the Advisory Committee, held in the Benjamin Strong Room at the Federal Reserve Bank of New York, included the delivery of Advisory Committee Working Group reports on leveraged lending and on the transition from LIBOR to SOFR. Two new charges were issued on encouraging market discipline to enhance financial system resilience.

- In addressing these challenges, what can we learn from other countries, industries, and academic disciplines?

The OFR and Federal Reserve Bank of Cleveland's Annual Financial Stability Conference – Markets and Spillovers

The OFR and the Federal Reserve Bank of Cleveland hosted their annual Financial Stability Conference Nov. 29-30, 2018, in Washington, D.C., which brought together policymakers, industry

representatives, and scholars from computer science, economics, engineering, finance, and related fields. The conference focused on advancing dialogue and highlighting research on the dynamics governing financial markets and their implications for financial stability. Participants discussed the transmission channels for financial market disruptions, the resulting spillovers to financial institutions and other markets, and regulatory policies that may help quell or amplify these effects.



Post-Reorganization Staffing, Growth, and Mission Focus

Organization

As a result of a reexamination of the Office's mission, culture, and structure in the previous year, the OFR underwent major change in FY 2019, first with workforce reshaping, resulting in a reduction in force in October 2018. Following the implementation of additional restructuring efforts, the Office began to rebuild through recruitment efforts for critical skills.

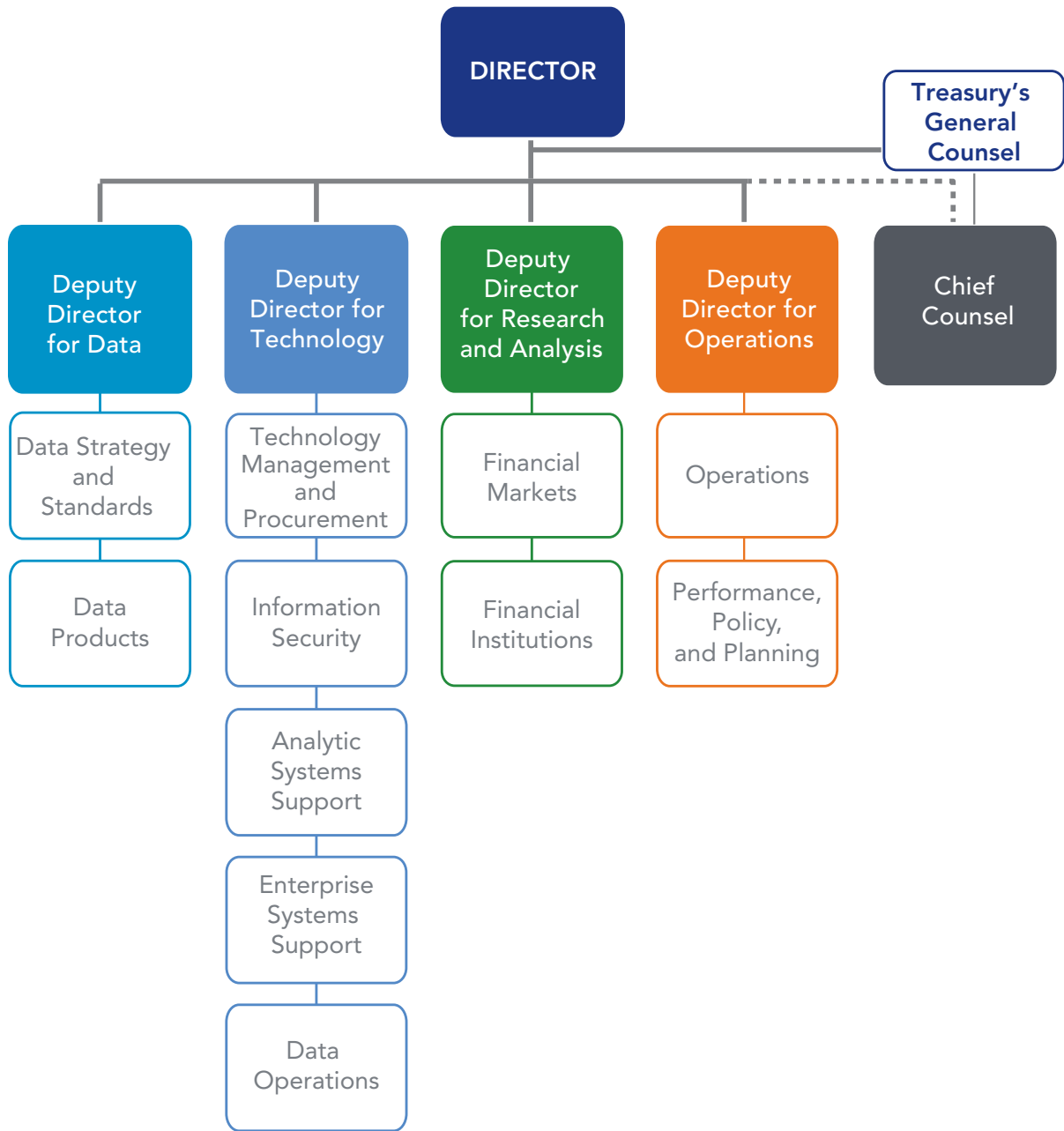
The first OFR Director, Richard Berner, was confirmed by the Senate in January 2013 and left the Office in December 2017. Kenneth Phelan, Chief Risk Officer at the Treasury Department, oversaw the OFR in the absence of a Director from January 2018 through January 2019. Subsequently, Michael Kipp Kranbuhl, as the Acting Assistant Secretary for Financial Institutions at the Treasury Department, oversaw the OFR from February 2019 through late June, until the Senate confirmed Dino Falaschetti to be the

Director of the OFR for a term of six years.

The OFR's organizational structure comprises three centers and two support divisions (Operations Division and Office of the Chief Counsel) to achieve the goals set by the Dodd-Frank Act (see **Figure 28**):

1. **The Data Center** leads and supports global efforts to develop and improve data standards for efficiencies in reporting and analyzing financial data. The center also develops data products and promotes appropriate data-sharing to meet stakeholder needs.
2. **The Research and Analysis Center** conducts applied and essential long-term research and analysis to support the stability of the U.S. financial system. The center produces financial stability monitors, research and briefings for the FSOC and other stakeholders, and evaluations of financial stability policies.
3. **The Technology Center** oversees OFR IT systems and system security, including an IT platform to support analysis with large-scale datasets. The center also acquires commercial, nonpublic, and proprietary data through procurements, provider agreements, and the OFR's own collection activities.
4. **The Operations Division** provides expertise, implementation, policy, and oversight for organizational strategy and performance, budgeting, OFR publications, travel, administrative support, human resources, procurement, and facilities.
5. **The Office of the Chief Counsel**, which reports to the Treasury Department's Office of General Counsel, provides legal guidance on research and analysis, data acquisition and usage, policy initiatives, procurements, and agreements with other organizations. It also

Figure 28. OFR Organizational Chart



coordinates the OFR's responses to oversight bodies, such as auditors and Congress.

In addition, the OFR's Office of the Director maintains relationships and communicates with a broad array of stakeholders, including Congress, industry, and international entities.

Workforce

The reshaping initiative aimed at reducing support positions and functions, while also retaining functions related to the core OFR mission. In October 2018, the OFR reduced its workforce to approximately 110 employees through attrition, use of incentives for voluntary separation and early retirement, and a reduction in force.

The first half of FY 2019 focused on continued reshaping and post-reduction-in-force activities. In the second half of FY 2019, the Office began efforts to recruit for key positions and skills. Critical vacancies included the Deputy Director for Operations, the Deputy Director for Technology, and the Chief Counsel, along with various Researcher and IT positions. The Deputy

Director for Operations position was filled in late FY 2019; however, the Deputy Director for Technology and Chief Counsel positions remain vacant. Senior management is continuously reviewing the organization and workforce to ensure critical hiring needs are met. The Office staff totaled 96 as of Sept. 30, 2019. Overall, once fully staffed (projected in FY 2021), the Office will employ up to 145 people.

Upon the appointment of the current OFR Director, Dino Falaschetti, a renewed focus on human capital strategy has emerged. The OFR Director is committed to building sound working relationships with employees and supporting team-building with an emphasis on public service. In an effort to improve the OFR culture and employee engagement, the OFR Director is hosting small-group OFR Employee Lunches to identify what employees need to succeed and to solicit employee recommendations to further inform the OFR's human capital strategy. Additionally, during the last half of FY 2019, in partnership with Treasury's Office of Strategic Planning and Performance Improvement, the OFR undertook a formal

information-gathering process to identify concrete steps to improve the OFR's internal coordination, collaboration, and overall functioning.

The OFR Director's initial priorities included a focus on security to ensure employee safety in the workplace and on management transparency in conducting business. Through his support of interaction and collaboration-based team-building in the OFR post-reduction-in-force environment, the Director has communicated that the Office understands and acknowledges the importance and role each employee has in achieving the mission of the OFR.

Budget

The OFR obligated \$58.6 million in FY 2019 — 43 percent for labor and 57 percent for other expenses (see **Figure 29**). A large portion of the nonlabor figure is due to significant OFR expenses for data acquisition (\$6.5 million) and technology software and hardware (\$13.5 million) to support the OFR's unique mandates.

As the OFR is an office within the U.S. Department

of the Treasury, it is overseen by Congress and government auditors. Since its establishment, the OFR has responded to: four audits from the Government Accountability Office and interviewed for another five; seven audits by the Treasury Inspector General; and one audit by the Council of Inspectors General on Financial Oversight and interviewed for another one. OFR leaders have testified before Congress on six occasions: the current Director testified in September 2019; former Director Richard Berner testified four times as Director; and a former Chief Operating Officer testified once before the former Director's confirmation.

Though part of the Treasury Department, the OFR is not funded by annual Congressional appropriations, but by semiannual assessments from bank holding companies with total consolidated assets of \$100 billion or more each and nonbank financial companies supervised by the Board of Governors of the Federal Reserve System.

The OFR pays the Treasury Department nearly \$10 million per year for support for OFR human resources,

budget, travel, and acquisitions activities. In addition, the Office pays Treasury more than \$6 million annually for IT circuits; payroll services; and agency-wide systems for training, performance management, and

human resources management. The OFR Director must consult with the FSOC Chairperson in establishing the OFR budget and workforce.

Figure 29. OFR Funds Obligated in Fiscal Years, 2014-19 (\$ thousands)

	2014	2015	2016	2017	2018	2019
Compensation	24,168	29,036	32,485	37,379	31,991	18,095
Benefits	7,968	9,507	11,322	13,054	10,932	6,860
Benefits to Former Employees						292
Labor Total	32,136	38,543	43,807	50,434	42,923	25,247
Travel	296	453	556	447	147	156
Transportation						2
Communication and Utilities	5,332	3,811	62	179	131	68
Printing and Reproduction	27	31	26	22	8	7
Other Services	23,558	25,033	35,794	31,823	26,353	26,648
Supplies and Materials	4,947	8,060	8,312	6,508	5,649	6,118
Equipment	16,970	8,785	5,997	3,459	679	309
Grants			320			
Nonlabor Total	51,130	46,173	51,067	42,439	32,967	33,308
TOTAL	83,266	84,716	94,874	92,873	75,890	58,555

Note: Other services include rent and administrative support for human resources, conferences and events, facilities, and procurement.

Source: Office of Financial Research

Glossary

10-Year, 10-Year forward rate	The interest rate investors expect to receive on 10-year Treasury securities in 10 years.
Accommodation	Expansionary monetary policy in which a central bank seeks to lower borrowing costs for businesses and households to make credit more easily available.
Activities-based approach	An approach to examining risks to financial stability by examining a diverse range of financial products, activities, and practices.
Agency mortgage backed-securities	Securities made up of mortgages purchased by housing finance agencies Fannie Mae, Freddie Mac, and Farmer Mac, or guaranteed by housing finance agency Ginnie Mae. The agencies set underwriting requirements for the loans they will purchase or guarantee.
Aruoba-Diebold-Scotti Business Conditions Index	Index designed by Federal Reserve Bank of Philadelphia researchers to track real business conditions at high frequency by using a mix of economic and financial indicators.
Attestation	In an attestation engagement, a certified public accountant is engaged to issue or does issue an examination, review, or agreed-upon procedures report on subject matter, or an assertion about the subject matter that is the responsibility of another party. Under the Sarbanes-Oxley Act of 2002, independent auditors attest to and report on public company managers' assessments of internal controls over their companies' financial reporting.
Auditor opinion	Statements auditors include in their reports on company finances. Auditors issue adverse opinions when they have concerns that the statements have not been prepared along accepted principles or that the data supporting the statements have been misrepresented. They issue clean opinions when they find no significant exceptions to accepted accounting practices and disclosure requirements. Auditors issue opinions with an explanation for various reasons, including when they want to call out something that might be material.

Authorized participant	A liquidity provider to an exchange-traded fund. When there is a shortage of exchange-traded fund shares in the market, the authorized participant creates more shares. When there is an excess supply of shares, the participant redeems shares to reduce the number of shares on the market.
Bail-in	The rescue of a failed or near-failed entity in which its creditors write down their claims to make the entity solvent, as opposed to the provision of government support.
Bank for International Settlements (BIS)	An international financial organization that serves central banks in their pursuit of monetary and financial stability, helps to foster international cooperation, and acts as a bank for central banks.
Bank holding company (BHC)	Any company that has direct or indirect control of one or more banks and is regulated and supervised by the Federal Reserve under the Bank Holding Company Act of 1956. BHCs may also own nonbanking subsidiaries such as broker-dealers and asset managers.
Basel Committee on Banking Supervision (BCBS)	An international forum for bank supervisors that aims to improve banking supervision worldwide. The BCBS develops guidelines and supervisory standards, such as standards on capital adequacy, the core principles for effective banking supervision, and recommendations for cross-border banking supervision.
Basel III	A comprehensive set of global regulatory standards to strengthen the regulation, supervision, and risk management of the banking sector. The reform measures include bank-level regulation and system-wide regulation to strengthen firms' capital, liquidity, risk-management, and public disclosures to reduce the banking system's vulnerability to shocks.
Blockchain	Common name for cryptographic distributed ledger technology used to record online transactions. Blockchains are the basis of cryptocurrencies.
Bond duration	Measure of bond sensitivity to interest rate changes, measured in years. Market risk rises as duration increases.
Brexit	An abbreviation for "British exit," the departure of the United Kingdom from the European Union.
Brokered deposit	Large deposit that a bank obtains through a brokerage. These funds can leave the bank quickly when a competitor offers a higher rate.

Business development company (BDC)	Type of closed-end fund that primarily invests in small or developing companies. BDCs are often publicly traded companies and are regulated by the Securities and Exchange Commission.
Call report	A quarterly report of a bank's financial condition and income that all federally insured U.S. depository institutions must file.
Capital	The difference between a firm's assets and its liabilities, it represents the net worth of the firm or the firm's equity value to investors.
Capital conservation buffer	Additional capital banks are required to hold outside periods of financial stress, meant to be drawn down during times of stress. This buffer is meant to prevent breaches of minimum required capital ratios.
Capital requirement	The amount of capital a bank must hold to act as a cushion to absorb unanticipated losses and declines in asset values that could otherwise cause a bank to fail. U.S. banking regulators require banks to hold more high-quality, or Tier 1, capital against total risk-weighted assets under the Basel III international accord. Banks are classified as well capitalized, adequately capitalized, undercapitalized, significantly undercapitalized, or critically undercapitalized based on regulators' capital and leverage calculations.
Central clearing	A settlement system in which securities or derivatives of a specific type are cleared by one entity that guarantees the trades, such as a clearinghouse or central counterparty. Central clearing is an alternative to bilateral or over-the-counter trading (see over-the-counter derivatives).
Central counterparty (CCP)	An entity that interposes itself between counterparties to contracts traded in one or more financial markets. A CCP becomes the buyer to every seller and the seller to every buyer to help ensure the performance of open contracts.
Clearing	A system that facilitates the transfer of ownership of securities after they are traded.
Clearing bank	A commercial bank that facilitates payment and settlement of financial transactions, such as check clearing or matching trades between the sellers and buyers of securities and other financial instruments or contracts.
Clearing member	A member of, or a direct participant in, a central counterparty that is entitled to enter into a transaction with the CCP.

Collateral	Any asset pledged by a borrower to guarantee payment of a debt.
Collateralized debt obligations (CDO)	Securities that hold a pool of debt and are sold to investors in tranches with varying levels of risk. Leading up to the 2007-09 financial crisis, many CDOs consisted of repooled residential mortgage-backed securities (RMBS).
Collateralized loan obligations (CLO)	Securities that hold pools of corporate loans and are sold to investors in tranches with varying levels of risk.
Commercial mortgage-backed securities	Securities collateralized by commercial mortgages.
Commercial paper	Short-term (maturity of up to 270 days), unsecured corporate debt.
Committee on Payments and Market Infrastructures (CPMI)	A standing committee of the Bank for International Settlements. Representatives are senior officials of member central banks. The CPMI promotes safety and efficiency of payment, clearing, settlement, and related activities, and it serves as a global standard-setting body in this area.
Comprehensive Capital Analysis and Review (CCAR)	The Federal Reserve's annual exercise to ensure that the largest U.S. bank holding companies have robust, forward-looking capital planning processes that account for their unique risks and sufficient capital for times of financial and economic stress. The CCAR exercise also evaluates the banks' individual plans to make capital distributions such as dividend payments or stock repurchases.
Concentration risk	Any single exposure or group of exposures with the potential to produce losses large enough to threaten a financial institution's ability to maintain its core operations.
Conditional Value-at-Risk (CoVaR)	CoVaR indicates an institution's contribution to systemic risk, calculated as the difference between value-at-risk (VaR) of the financial system when the firm is under distress and the VaR of the system when the firm is in its regular, median state.
Contingent convertible (CoCo) bonds	Hybrid capital securities that absorb losses in accordance with their contractual terms when the capital of the issuing bank falls below a certain level. Due to their loss-absorbing capacity, CoCos can be used to satisfy regulatory capital requirements.
Countercyclical capital buffer	A component of Basel III requiring banks to build capital buffers during favorable economic periods. The buffers can be used to absorb losses in unfavorable periods.

Counterparty risk	The risk that the party on the other side of a contract, trade, or investment will default.
Covenant-lite loans	Loans that do not include typical covenants to protect lenders, such as requiring the borrower to deliver annual reports or restricting loan-to-value ratios.
Credit default swap (CDS)	A bilateral contract protecting against the risk of default by a borrower. The buyer of CDS protection makes periodic payments to the seller and, in return, receives a payoff if the borrower defaults, similar to an insurance contract. The protection buyer does not need to own the loan covered by the swap.
Credit default swap spread	The premium paid by the buyer of credit default swap protection to the seller.
Credit gap	A metric in which the ratio of debt-to-gross domestic product (GDP) is measured against its statistically estimated long-run trend.
Credit rating agency	Private company that assesses the creditworthiness of a company or a financial instrument.
Credit risk	The risk that a borrower may default on its obligations.
Cryptocurrency	Digital financial assets (cryptoassets) based on blockchain cryptographic technology. Bitcoin is the most widely used cryptocurrency.
Current expected-credit-loss (CECL) accounting standard	Requires financial institutions applying U.S. Generally Accepted Accounting Principles to hold loan loss allowances equal to expected credit losses for the lifetime of a loan.
Cybersecurity Assessment Tool	A tool designed to complement the NIST Cybersecurity Framework. The Federal Financial Institutions Examination Council (FFIEC) developed the tool to help financial institutions identify and address cybersecurity risks and determine their level of cybersecurity maturity in addressing those risks.
Default waterfall	The financial safeguards available to a central counterparty to cover losses arising from the default of one or more clearing members.
Defined-benefit pension plan	A plan where members' pension benefits are determined by formula, usually tied to years of service and earnings during service. This contrasts with a defined-contribution plan such as a 401-K, where benefits are determined by returns on a portfolio of investments.

Derivative	A financial contract whose value is derived from the performance of underlying assets or market factors such as interest rates, currency exchange rates, and commodity, credit, and equity prices. Derivative transactions include structured debt obligations, swaps, futures, options, caps, floors, collars, and forwards.
Distress Insurance Premium (DIP)	A systemic risk indicator that measures the hypothetical contribution a financial institution would make to an insurance premium that would protect the whole financial system from distress.
Distributed ledger technology	See blockchain.
Dodd-Frank Act	Short name for the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010, the most comprehensive financial reform legislation in the United States since the Great Depression. The Dodd-Frank Act seeks to promote financial stability by improving accountability in the financial system, adding transparency about over-the-counter (OTC) derivatives markets, and protecting consumers from abusive financial services practices.
Dodd-Frank Act Stress Test (DFAST)	Annual stress tests required by the Dodd-Frank Act for national banks and federal savings associations with total consolidated assets of more than \$250 billion. Institutions with assets between \$100 billion and \$250 billion are tested less frequently. A 2018 law change means banks with assets less than \$100 billion no longer go through DFAST.
Duration risk	The risk associated with the sensitivity of the prices of bonds and other fixed-income securities to changes in the level of interest rates.
Economic Growth, Regulatory Relief and Consumer Protection Act of 2018	Law that adjusted some provisions of the Dodd-Frank Act, as well as instituting tax law changes.
Emerging markets	Developing countries where investments are often associated with both higher returns and higher risk. Emerging market countries fall between developed markets such as the United States and more speculative frontier markets.
Eurozone or euro area	A group of 19 European Union countries that have adopted the euro as their currency.

Exchange-traded fund (ETF)	An investment fund whose shares are traded on an exchange. Because ETFs are exchange-traded products, their shares are continuously priced, unlike mutual funds, which offer only end-of-day pricing. ETFs are often designed to track an index or a portfolio of assets.
Fair value accounting	Standards for determining fair value of an asset. Fair value is how much the asset could be bought or sold for at a given time. Fair value accounting is required or allowed for certain assets in financial statements and for such things as determining the worth of collateral.
Fallen angel	Bond downgraded from investment grade to non-investment grade.
Federal Financial Institutions Examination Council (FFIEC)	An interagency body that prescribes uniform principles, standards, and report forms for the federal examination of financial institutions. The FFIEC makes recommendations to promote uniformity in banking supervision. Members include the Federal Reserve, Federal Deposit Insurance Corporation, National Credit Union Administration, Office of the Comptroller of the Currency, Consumer Financial Protection Bureau, and a representative of state financial supervisors.
Federal funds (fed funds)	Overnight interbank borrowing to maintain reserves at the Federal Reserve.
Federal funds rate	Interest rate at which depository institutions lend to each other.
Federal Home Loan Banks (FHLBs)	Eleven U.S. government-sponsored banks that provide funding for member banks mostly through advances secured by mortgages.
Federal Open Market Committee (FOMC)	Twelve-member body within the Federal Reserve System that sets national monetary policy, including setting the target range for the federal funds rate.
Financial contagion	A scenario in which financial or economic shocks initially affect only a few financial market participants and then spread to other parts of the financial system and countries in a manner similar to the transmission of an epidemic. Financial contagion can happen at both the international level and the domestic level.

Financial market utility (FMU)	A Dodd-Frank Act-defined entity, which, subject to certain exclusions, is “any person that manages or operates a multilateral system for the purpose of transferring, clearing, or settling payments, securities, or other financial transactions among financial institutions or between financial institutions and the person.”
Financial stability	The condition in which the financial system can provide its basic functions, even under stress. Those basic functions are (1) credit allocation and leverage, (2) maturity transformation, (3) risk transfer, (4) price discovery, (5) liquidity provision, and (6) facilitation of payments.
Financial Stability Board (FSB)	An international coordinating body that monitors financial system developments on behalf of the Group of 20 (G-20) nations. The FSB was established in 2009 and is the successor to the Financial Stability Forum.
Financial Stability Oversight Council (FSOC)	Created by the Dodd-Frank Act, a collaborative U.S. governmental body with a statutory mandate that creates collective accountability for identifying risks and responding to emerging threats to financial stability. Chaired by the Secretary of the U.S. Treasury, the Council consists of 10 voting members and five nonvoting members, including the OFR Director.
Fintech	Financial technology, usually referring to firms that operate on technology-based business models.
Fire sale	The disorderly liquidation of assets to meet margin requirements or other urgent cash needs. Such a sudden sell-off can drive prices below their fair value. The quantities sold are large relative to the typical volume of transactions.
Fiscal policy	Use of government spending and taxes to influence the economy.
Form N-MFP	A monthly disclosure of portfolio holdings submitted by money market funds to the Securities and Exchange Commission, which makes the information publicly available. SEC Rule 30b1-7 established the technical and legal details of N-MFP filings.

Form PF	A periodic report of portfolio holdings, leverage, and risk management submitted by hedge funds, private equity funds, and related entities. The report is filed with the Securities and Exchange Commission and the Commodity Futures Trading Commission, which keep the information confidential. The Dodd-Frank Act mandated the reporting to help the FSOC monitor financial stability risks.
Funding liquidity	The availability of credit to finance the purchase of financial assets.
Generally Accepted Accounting Principles (GAAP)	Accounting rules published in the United States by the Financial Accounting Standards Board.
Global systemically important banks (G-SIBs)	Banks annually designated by the Basel Committee on Banking Supervision for having the potential to disrupt international financial markets. The designations are based on banks' size, interconnectedness, complexity, dominance in certain businesses, and global scope.
Global systemically important insurers (G-SIIs)	Insurance companies annually designated by the Financial Stability Board for having the potential to disrupt international financial markets because of their size, market position, and global interconnectedness.
Gross notional exposure (GNE)	A measure of total portfolio leverage, for example in a hedge fund. GNE is calculated as the summed absolute values of long and short notional positions, including both securities and derivatives.
Haircut	The discount at which an asset is pledged as collateral. For example, a \$1 million bond with a 5 percent haircut would collateralize a \$950,000 loan.
Hedge fund	A pooled investment vehicle available to accredited investors such as wealthy individuals, banks, insurance companies, and trusts. Hedge funds can charge a performance fee on unrealized gains, borrow more than one half of their net asset value, short sell assets they expect to fall in value, and trade complex derivative instruments that cannot be traded by mutual funds (see qualified hedge fund).
Hedging	An investment strategy to offset the risk of a potential change in the value of assets, liabilities, or services. An example of hedging is buying an offsetting futures position in a stock, interest rate, or foreign currency.

High-frequency trading	The use of computerized securities trading platforms to make large numbers of transactions at high speeds.
High-quality liquid assets (HQLA)	Assets such as central bank reserves and government bonds that can be quickly and easily converted to cash during a stress period. U.S. banking regulators require large banks to hold HQLA to comply with the Liquidity Coverage Ratio.
High-yield debt	Bonds and other financial instruments rated below investment grade that pay a higher interest rate than investment-grade securities because of the perceived credit risk; also known as non-investment-grade or speculative.
Incurred-loss accounting standard	Requires financial institutions applying U.S. Generally Accepted Accounting Principles to hold loan loss allowances equal to losses related to incurred credit impairments.
Initial margin	A percentage of the total market value of securities an investor must pay to purchase securities with borrowed funds.
Institutional loans	When referring to the leveraged loan market, term loans originated by bank syndicates and sold to institutional investors.
Interest rate swap	A swap in which two parties swap interest rate cash flows, typically between a fixed rate and a floating rate (see swap).
Intermediation	Any financial service in which a third party or intermediary matches lenders and investors with entrepreneurs and other borrowers in need of capital. Often, investors and borrowers do not have precisely matching needs and the intermediary's capital is put at risk to transform the credit risk and maturity of the liabilities to meet the needs of investors.
International Monetary Fund (IMF)	An international organization created at the end of World War II to stabilize exchange rates and support international payment systems. The IMF provides credit to developing nations and those in economic distress, typically conditional on economic and financial reforms.
International Organization of Securities Commissions (IOSCO)	IOSCO is the international body for securities regulators, and is the recognized standard setting organization for the securities industry. IOSCO works closely with the G-20 forum of nations and the Financial Stability Board on global financial regulatory reforms.
Inverted yield curve	When yields on long-term bonds are lower than those on short-term bonds, the yield curve is said to be inverted. An inverted yield curve is seen as a sign of a possible recession.

Investment-grade debt	Securities that credit rating agencies determine carry less credit risk. Non-investment-grade securities, also called speculative-grade or high-yield debt, have lower ratings and a greater risk of default.
Legal Entity Identifier (LEI)	A unique 20-digit alphanumeric code to identify each legal entity within a company that participates in global financial markets.
Leverage	Leverage is created when an entity enters into borrowings, derivatives, or other transactions resulting in investment exposures that exceed equity capital.
Leverage ratio	The Tier 1 (highest quality) capital of a bank divided by its total exposure to derivatives, securities financing transactions, and on- and off-balance-sheet exposures.
Leveraged loan	There is no single definition of a leveraged loan. Broadly, leveraged loans are loans to companies with non-investment-grade (below BBB) ratings. Often, a leveraged loan is a loan for which the obligor's post-financing leverage, as measured by debt-to-assets, debt-to-equity, cash flow-to-total debt, or other such standards unique to particular industries, significantly exceeds industry norms. Leveraged borrowers typically have a diminished ability to adjust to unexpected events and changes in business conditions because of their higher ratio of total liabilities to capital.
LIBOR	Interest rate at which banks can borrow from other banks in London wholesale markets, as measured by a daily survey. LIBOR was a widely used reference rate, but is being phased out. Formerly known as the London Interbank Offered Rate, now ICE LIBOR.
Liquidity Coverage Ratio	A Basel III standard to ensure that a bank maintains enough high-quality liquid assets to meet its anticipated liquidity needs for a 30-day stress period. The ratio applies to banks with \$250 billion or more in total consolidated assets or \$10 billion or more in on-balance-sheet foreign exposure. A less-strict ratio is required of banks with \$50 billion or more in total assets.
Liquidity risk	The risk that a firm will not be able to meet its current and future cash flow and collateral needs, expected and unexpected, without materially affecting its daily operations or overall financial condition.
Liquidity transformation	Funding illiquid assets with liquid and demandable liabilities.

Living wills	Resolution plans required of U.S. banks with \$50 billion or more in total consolidated assets and nonbank financial companies designated by the FSOC for supervision by the Federal Reserve. Each living will must describe how the company could be resolved in a rapid, orderly way in the event of failure.
Macroeconomic risk	Risk from changes in the economy or macroeconomic policy.
Macroprudential policy	Government policy promoting the stability of the financial system as a whole, in contrast with policy focused on individual markets or institutions.
Macroprudential supervision	Supervision to promote the stability of the financial system as a whole (see microprudential supervision).
Margin call	A requirement by a broker that a borrower increase the collateral pledged against a loan in response to changes in the collateral's value.
Margin requirement	Rules governing the necessary collateral for a derivative, loan, or related security required to cover, in whole or in part, the credit risk one party poses to another.
Mark to market	Accounting for the value of an asset at its current market level, rather than in other ways, such as historical cost.
Market discipline	The idea that markets can rein in risk through individual participants behaving in their own interest. This should result in markets pricing risk effectively and curbing excessive risk-taking.
Market liquidity	The ability of market participants to sell large positions with limited price impact and low transaction costs.
Market risk	The risk that an asset's value will change due to unanticipated movements in market prices.
Market-making	The process in which an individual or firm stands ready to buy and sell a particular stock, security, or other asset on a regular and continuous basis at a publicly quoted price. Market-makers usually hold inventories of the securities in which they make markets. Market-making helps to keep financial markets efficient.
Maturity transformation	Funding long-term assets with short-term liabilities. This practice creates a maturity mismatch that can pose risks when short-term funding markets are constrained.
Metadata	Data about data. Metadata include information about the structure, format, or organization of other data.

Metadata catalog	An organized way to present metadata for discovery, exploration, and use of the related data.
Microprudential supervision	Supervision of the activities of a bank, financial firm, or other components of a financial system (see macroprudential supervision).
Monetary policy	Government or central bank use of interest rates and money supply to affect the economy.
Money market fund	A fund that typically invests in government securities, certificates of deposit, commercial paper, or other highly liquid and low-risk securities.
Moral hazard	Term in economics for conditions where people do not guard against risk because they expect someone else to pay for at least part of the cost of that risk.
Mortgage call report	A quarterly report of mortgage activity and company information created by state regulators and administered electronically through the Nationwide Mortgage Licensing System & Registry (NMLS).
Mutual fund	A pooled investment vehicle that can invest in stocks, bonds, money market instruments, other securities, or cash; regulated by the SEC.
National Association of Insurance Commissioners (NAIC)	An organization that represents U.S. state insurance regulators. Through the NAIC, regulators establish accreditation standards and practices, conduct peer review, and coordinate their regulatory oversights of insurance companies.
National Institute of Standards and Technology (NIST) Cybersecurity Framework	Voluntary guidance, based on existing standards, guidelines, and practices, for critical infrastructure organizations to better manage and reduce cybersecurity risk. The framework focuses on using business drivers to guide cybersecurity activities and considering cybersecurity risks as part of an organization's risk management process.
Nationally Recognized Statistical Rating Organization (NRSRO)	Credit rating agency registered with and regulated by the SEC.
Net asset value (NAV)	The value of an entity's assets minus its liabilities. For example, a mutual fund calculates its NAV daily by dividing the fund's net value by the number of outstanding shares.
Network model	A model consisting of a set of nodes, or financial institutions, and a set of payment obligations linking them, to show how financial interconnections can amplify market movements.

Non-investment-grade debt	Instruments rated below investment grade that pay a higher interest rate than investment-grade securities because of the perceived credit risk; also known as speculative or high-yield debt.
Notional derivatives exposure	The reference amount from which contractual payments will be derived on a derivatives contract; generally not an amount at risk.
Off balance sheet	Assets or entities that are not tracked on a company's balance sheet. Rather, they are explained only in notes to financial statements.
Operational risk	The risk of loss from internal inadequacies or failures — problems of lapses by people, processes, or systems — or from external events.
Option	A financial contract granting the holder the right, but not the obligation, to engage in a future transaction on an underlying security or real asset. For example, an equity call option provides the right, but not the obligation, for a fixed period to buy a block of shares at a fixed price. A put option provides the right, but not the obligation, to sell an asset for a fixed period at a fixed price.
Orderly liquidation authority (OLA)	Provision in Dodd-Frank Act that allows the Federal Deposit Insurance Corporation to unwind a large, complex financial institution. An OLA serves as a backup to bankruptcy court proceedings.
Originate	To extend credit after processing a loan application. Banks, for example, originate mortgage loans and either hold them until maturity or distribute them to other financial market participants. The distribution can include a direct sale or a securitization of a portion of the credit at the time of origination or later.
Over-the-counter (OTC) derivatives	Deals negotiated privately between two parties, rather than traded on a formal securities exchange. Unlike standard exchange-traded products, OTC derivatives can be tailored to fit specific needs, such as the effect of a foreign exchange rate or commodity price over a given period.
Own Risk and Solvency Assessment (ORSA)	An internal process undertaken by an insurer or insurance group to assess the adequacy of its risk management and current and prospective solvency positions under normal and severe stress scenarios.

Passporting	Legal arrangement that allows firms from European Union nations to sell their services across the Union without having to comply with each country's separate regulations.
Pension funded ratio	The ratio of a pension plan's assets to the present value of its obligations.
Pension risk transfer	The transfer of pension risk from a pension plan to another party, usually through insurance or annuity contracts, longevity swaps, or other contractual arrangements.
Price discovery	The process of determining the prices of assets in the market-place through the interactions of buyers and sellers.
Primary dealer	Banks and securities broker-dealers designated by the Federal Reserve Bank of New York (FRBNY) to serve as trading counterparties when it carries out U.S. monetary policy. Among other things, primary dealers are required to participate in all auctions of U.S. government debt and to make markets for the FRBNY when it transacts on behalf of its foreign official accountholders. A primary dealer buys government securities directly and can sell them to other market participants.
Prime broker	Companies that provide hedge funds and other investors with services such as lending cash and securities.
Qualifying hedge fund	Hedge fund advised by a large hedge fund adviser and with a net asset value (individually or in combination with any feeder funds, parallel funds, and/or dependent parallel managed accounts) of at least \$500 million as of the last day of any month in the fiscal quarter immediately preceding the adviser's most recently completed fiscal quarter. Large hedge fund advisers are advisers that have at least \$1.5 billion in hedge fund assets under management.
Regulation SCI	A regulation adopted by the Securities and Exchange Commission in November 2014. The regulation applies to entities that directly support six key securities market functions: (1) trading, (2) clearance and settlement, (3) order routing, (4) market data, (5) market regulation, and (6) market surveillance. The rules in Regulation SCI are designed to reduce the occurrence of systems issues, improve resiliency when systems problems occur, and enhance SEC oversight and enforcement of securities market technology infrastructure.

Reinsurance	The risk management practice of insurers to transfer some of their policy risk to other insurers. A second insurer, for example, could assume the portion of liability in return for a proportional amount of the premium income.
Repo	See repurchase agreement.
Repurchase agreement (repo)	A transaction in which one party sells a security to another party and agrees to repurchase it at a certain date in the future at an agreed price. Banks often do this on an overnight basis as a form of liquidity that is similar to a collateralized loan.
Residential mortgage-backed securities (RMBS)	A security that is collateralized by a pool of residential mortgage loans and makes payments derived from the interest and principal payments on the underlying mortgage loans.
Resilience	Ability of the financial system or parts of the system to absorb shocks and continue to provide basic functions.
Resolution plans	Plans required of U.S. banks with \$50 billion or more in total consolidated assets and nonbank financial companies designated by the Financial Stability Oversight Council for supervision by the Federal Reserve. Each plan, or living will, must describe how the company could be resolved in a rapid, orderly way in the event of failure.
Risk assets	Assets that carry risk, usually risk of price changes. Such assets include equities, bonds, commodities, and most other investment vehicles, in contrast with U.S. Treasury securities, which are generally considered safe.
Risk management	The business and regulatory practice of identifying and measuring risks and developing strategies and procedures to limit them. Categories of risk include credit, market, liquidity, operations, model, and regulatory.
Risk retention	Under the Dodd-Frank Act, a requirement that issuers of asset-backed securities must retain at least 5 percent of the credit risk of the assets collateralizing the securities. The regulation also prohibits a securitizer from directly or indirectly hedging the credit risk.
Risk-based capital	Amount of capital a financial institution holds to protect against losses. It is based on the risk weighting of different asset categories.
Risk-weighted assets	Bank assets or off-balance-sheet exposures weighted according to risk. This asset measure is used to determine a bank's regulatory capital requirements.

Runnable funding	Funds that can be withdrawn from a financial institution on short notice. Uninsured bank deposits, money market fund holdings, commercial paper, and repurchase agreements are among runnable sources of funding.
Run risk	The risk that investors lose confidence in a market participant because of concerns about counterparties, collateral, solvency, or related issues and respond by pulling back their funding or demanding more margin or collateral.
Sarbanes-Oxley Act of 2002	Law aimed at curbing corporate fraud exposed in several financial scandals, including those at Enron and WorldCom. The law laid out numerous accounting and accountability requirements for companies, managers, and accountants.
Search for yield (reach for yield)	The practice of accepting greater risks in hopes of earning higher than average returns.
Secured Overnight Financing Rate (SOFR)	Interest rate benchmark used as an alternative to LIBOR to set rates on financial products such as mortgages. The SOFR, which is based on repurchase agreement (repo) rates, reflects the general cost of large banks' borrowing that is not backed by collateral. The OFR's repo data collection supports the production of the SOFR.
Securities financing	The transfer or lending of securities from one party to another. A borrower of securities puts up collateral in the form of shares, bonds, or cash and is obliged to return the securities on demand. These transactions provide liquidity in the market.
Securities lending/borrowing	The temporary transfer of securities from one party to another for a specified fee and time period in exchange for collateral in the form of cash or securities.
Securitization	A financial transaction in which assets such as mortgage loans are pooled, securities representing interests in the pool are issued, and proceeds from the underlying pooled assets are used to service and repay the securities.
Settlement	The process of transferring securities and settling by book entry according to a set of exchange rules. Some settlement systems can include institutional arrangements for confirmation, clearance, and settlement of securities trades and safekeeping of securities.
Shadow banking	Credit intermediation performed by nonbank companies or financed by runnable liabilities without a government guarantee.

Shock	A sudden change in the financial system or economy that can stress the financial system.
Skin in the game	The risk of monetary loss from an activity to an individual or organization because its own money funded the activity. For example, a central counterparty has skin in the game because it contributes to its default waterfall.
Special-purpose entity (SPE)	Off-balance-sheet legal and accounting entity; also known as a variable-interest entity.
Speculative-grade debt	See high-yield debt.
Spread	The difference in yields between private debt instruments and government securities of comparable maturity. The spread can be used as one of many indicators of financial stability.
SRISK	A systemic risk indicator based on the capital that a firm is expected to need if there is another financial crisis; short for "systemic risk."
Stable net asset value	A characteristic of some money market funds in which the value of a single share remains the same, usually \$1, even when the value of the underlying assets shifts.
Stablecoin	Variety of cryptocurrency that seeks to maintain a fixed value backed by reserves.
Stress test	An exercise that shocks asset prices by a prespecified amount, sometimes along with other financial and economic variables, to observe the effect on financial institutions or markets. Under the Dodd-Frank Act, banking regulators run annual stress tests of the biggest U.S. bank holding companies.
Supplementary leverage ratio	Under Basel III, the ratio of a bank's Tier 1 (high-quality) capital to its total leverage exposure, which includes all on-balance-sheet assets and many off-balance-sheet exposures. U.S. regulators require a 3 percent ratio for most banks with \$250 billion or more in consolidated assets or \$10 billion or more in foreign exposures. The eight large U.S. banks designated as global systemically important banks by the Financial Stability Board must maintain a ratio of 5 percent.
Swap	An exchange of cash flows agreed by two parties with defined terms over a fixed period.
Swap Data Repository (SDR)	A central recordkeeping facility that collects and maintains a database of swap transaction terms, conditions, and other information. In some countries, SDRs are referred to as trade repositories.

Swap execution facility	Under the Dodd-Frank Act, a trading platform market participants use to execute and trade swaps by accepting bids and offers made by other participants.
Society for Worldwide Interbank Financial Telecommunications (SWIFT)	Provides messaging services and interface software between wholesale financial institutions. SWIFT is organized as a cooperative owned by its members.
Syndicated loans	Financing provided by a group of lenders.
Systemic risk	Risk to systemwide financial stability.
Systemic risk indicators	Cross-sectional measures of the risks financial firms may pose to the financial system.
Tail risk	The low-probability risk of an extreme event moving an asset price.
TED spread	Difference between three-month U.S. dollar LIBOR and Treasury bill rates.
Tier 1 Capital Ratio and Common Equity Tier 1 Capital Ratio	Two measurements comparing a bank's capital to its risk-weighted assets to show its ability to absorb unexpected losses. Tier 1 capital includes common stock, preferred stock, and retained earnings. Common Equity Tier 1 capital excludes preferred stock.
Total Loss-Absorbing Capacity (TLAC)	A mix of long-term debt and equity that global systemically important bank holding companies would be required under recent proposals to hold sufficient to absorb losses and implement an orderly resolution without resorting to taxpayer-funded bailouts or extraordinary government measures.
Tranche	From the French "slice," a portion of a securitized asset pool.
Triparty repo	A repurchase agreement in which a third party, such as a clearing bank, acts as an intermediary for the exchange of cash and collateral between two counterparties. In addition to providing operational services to participants, agents in the U.S. triparty repo market extend intraday credit to facilitate settlement of triparty repos.
Value-at-Risk (VaR)	A tool for market risk management that measures the risk of loss of a portfolio. The VaR projects the maximum expected loss for a given time horizon and probability. For example, the VaR over 10 days and with 99 percent certainty measures the most one would expect to lose over a 10-day period, 99 percent of the time.

Variable annuity	A tax-deferred insurance company contract where the owner can choose investment options whose values fluctuate with the underlying securities, much like mutual funds. Variable annuities may also include minimum guarantees, which may exceed the value of the investment accounts.
Variable-interest entity	See special-purpose entity.
Variation margin	Payment made by clearing members to the clearinghouse based on price movements of the contracts these members hold.
VIX	Chicago Board Option Exchange (CBOE) Volatility Index, a measure of 30-day expected volatility in the U.S. stock market.
Volcker Rule	Provision of Dodd-Frank Act that bans proprietary trading of corporate bonds and other types of securities by commercial banks and their affiliates, with some exceptions.
Vulnerabilities	Underlying weaknesses that can disrupt the financial system in the future.
Wholesale funding	Funding provided by federal funds borrowing, repurchase agreements, foreign deposits, brokered deposits, and other short-term borrowing. Wholesale funding is considered less stable than funding provided by core deposits.
Yield curve	Graphical representation of the relationship between bond yields and their respective maturities. Generally, the curve slants up because longer-term bonds have higher yields than short-term debt securities. When that relationship does not hold, the yield curve is said to be inverted.

Endnotes

- ¹ Office of Financial Research, "Financial System Vulnerabilities Monitor," Online content, revised quarterly. <https://www.financialresearch.gov/financial-vulnerabilities/#/>.
- ² Jan Hatzius, Sven Jari Stehn, Nicholas Fawcett, and Manav Chaudhary, "Gauging the China Spillover Threat," Goldman Sachs Economics Research report, Sept. 24, 2018.
- ³ International Monetary Fund (IMF), *World Economic Outlook, April 2019: Growth Slowdown, Precarious Recovery* (Washington: IMF, April 2, 2019), Table A4. <https://www.imf.org/en/Publications/WEO/Issues/2019/03/28/world-economic-outlook-april-2019>; Office of Financial Research staff analysis of data from International Monetary Fund World Economic Outlook Database, April 2019. <https://www.imf.org/en/Publications/SPROLLs/world-economic-outlook-databases#sort=%40imfdate%20descending>.
- ⁴ Congressional Budget Office (CBO), *An Update to the Budget and Economic Outlook: 2019 to 2029* (Washington: CBO, August 2019). https://www.cbo.gov/system/files/2019-08/55551-CBO-outlook-update_0.pdf.
- ⁵ Office of Financial Research (OFR), *2018 Annual Report to Congress* (Washington: OFR, Nov. 15, 2018), 38-42. <https://www.financialresearch.gov/annual-reports/2018-annual-report>.
- ⁶ Moody's Investors Service, "Sector Update – Q2 2019: Slight Improvements Across Credit Metrics for CMBS We Rate," Aug. 19, 2019.
- ⁷ Catherine Liu, "Retailers at Risk: How Long Will the Retailpocalypse Continue?," Trepp, Aug. 13, 2019. <https://info.trepp.com/trepp-talk/retailers-at-risk-how-long-will-retailpocalypse-continue>.
- ⁸ Freddie Mac Multifamily Research Center, "2019 Midyear Outlook," August 2019. https://mf.freddiemac.com/docs/multifamily_2019_midyear_outlook.pdf.
- ⁹ CreditSights, "REITs/CRE 1Q19: How Are Property Types Performing?," May 28, 2019. <https://www.creditsights.com/articles/237628?resultIndex=0&ssid=1565880881445>.
- ¹⁰ Trepp CMBS Research, "CMBS Delinquency Rate Sets Another New Post-Crisis Low in August," August 2019. <https://info.trepp.com/hubfs/August%202019%20CMBS%20Delinquency%20Report-1.pdf>.
- ¹¹ Moody's Baa rating is equivalent to S&P's and Fitch's BBB ratings.
- ¹² Office of Financial Research (OFR), *2018 Annual Report to Congress* (Washington: OFR, Nov. 15, 2018), 44-45. <https://www.financialresearch.gov/annual-reports/2018-annual-report/>.
- ¹³ The institutional leveraged loan market is defined as par amount outstanding of loans included in the S&P/LSTA Leveraged Loan Index. All loans in the index are institutional leveraged loans. Index eligibility factors are available at <https://us.spindices.com/documents/methodologies/methodology-sp-global-leveraged-loan.pdf>.
- ¹⁴ Office of Financial Research staff analysis of data from S&P Leveraged Commentary and Data.
- ¹⁵ Office of Financial Research staff analysis of data from S&P Leveraged Commentary and Data.
- ¹⁶ Office of Financial Research staff analysis of data from S&P Leveraged Commentary and Data.
- ¹⁷ Moody's Investors Service, "Leveraged Finance — US: Convergence of Bonds and Loans Sets Stage for Worse Recoveries in the Next Downturn," Sector In-depth, Aug. 16, 2018. http://www.moody's.com/researchdocumentcontentpage.aspx?docid=PBC_1128748.
- ¹⁸ Office of Financial Research (OFR), *2013 Annual Report* (Washington: OFR, Dec. 17, 2013). <https://www.financialresearch.gov/annual-reports/2013-annual-report/>.
- ¹⁹ Office of Financial Research (OFR) Financial Research Advisory Committee (FRAC), "OFR FRAC Working Group: Leveraged Lending & CLOs," Presentation to FRAC meeting, New York, July 11, 2019. https://www.financialresearch.gov/frac/files/OFR_FRAC-meeting_Leveraged_Lending_CLOs_07_09_2019.pdf.

- ²⁰ Financial Crisis Inquiry Commission (FCIC), *The Financial Crisis Inquiry Report* (Washington: FCIC, January 2011), 138. <http://fcic.law.stanford.edu/report>.
- ²¹ Jim Akin, "What Are the Different Credit Scoring Ranges?," Experian, July 12, 2019. <https://www.experian.com/blogs/ask-experian/infographic-what-are-the-different-scoring-ranges>.
- ²² Federal Deposit Insurance Corporation, "Quarterly Banking Profile, Second Quarter 2019," Sept. 5, 2019. <https://www.fdic.gov/bank/analytical/qbp/2019jun/qbp.pdf>.
- ²³ Office of the Comptroller of the Currency, Board of Governors of the Federal Reserve System, and Federal Deposit Insurance Corporation, "Changes to Applicability Thresholds for Regulatory Capital and Liquidity Requirements," Final Rule, Oct. 10, 2019. <https://www.federalreserve.gov/aboutthefed/boardmeetings/files/tailoring-rule-fr-notice-20191010a1.pdf>.
- ²⁴ Board of Governors of the Federal Reserve System, "Prudential Standards for Large Bank Holding Companies, Savings and Loan Holding Companies, and Foreign Banking Organizations," Final rule, Federal Register 84, no. 212 (Nov. 1, 2019): 59032-59123. <https://www.govinfo.gov/content/pkg/FR-2019-11-01/pdf/2019-23662.pdf>.
- ²⁵ See, for example, Jihad Dagher, Giovanni Dell'Ariccia, Luc Laeven, Lev Ratnovski, and Hui Tong, "Benefits and Costs of Bank Capital," International Monetary Fund Staff Discussion Note, March 2016. <https://www.imf.org/external/pubs/ft/sdn/2016/sdn1604.pdf> (Oct. 9, 2019); Simon Firestone, Amy Lorenc, and Ben Ranish, "An Empirical Economic Assessment of the Costs and Benefits of Bank Capital in the U.S.," Finance and Economics Discussion Series 2017-034, Board of Governors of the Federal Reserve System, March 31, 2017. <https://www.federalreserve.gov/econres/feds/files/2017034pap.pdf>.
- ²⁶ Office of Financial Research (OFR), "Size Alone is Not Sufficient to Identify Systemically Important Banks," OFR Viewpoint Paper no. 17-04, Oct. 26, 2017. <https://www.financialresearch.gov/viewpoint-papers/2017/10/26/size-not-sufficient-to-identify-systemically-important-banks/>.
- ²⁷ Board of Governors of the Federal Reserve System, "Comprehensive Capital Analysis and Review 2019: Assessment Framework and Results," June 2019. <https://www.federalreserve.gov/publications/files/2019-ccar-assessment-framework-results-20190627.pdf>.
- ²⁸ National Association of Insurance Commissioners, "Risk-based Capital," Online content, updated May 23, 2019. https://www.naic.org/cipr_topics/topic_risk_based_capital.htm.
- ²⁹ A.M. Best, "Favorable 2018 Statutory Results for Life/Annuity Segment," Best's Special Report, June 17, 2019, 10. <http://www3.ambest.com/bestweekpdfs/sr507453119175afull.pdf>.
- ³⁰ Board of Governors of the Federal Reserve System, "Regulatory Capital Rules: Risk-based Capital Requirements for Depository Institution Holding Companies Significantly Engaged in Insurance Activities," Notice of proposed rulemaking, *Federal Register* 84, no. 206 (Oct. 24, 2019): 57240-57301. <https://www.govinfo.gov/content/pkg/FR-2019-10-24/pdf/2019-21978.pdf>.
- ³¹ Office of Financial Research (OFR), *2018 Annual Report to Congress* (Washington: OFR, Nov. 15, 2018), 42-49. <https://www.financialresearch.gov/annual-reports/2018-annual-report>.
- ³² Office of Financial Research Financial Research Advisory Committee (FRAC), "U.S. Corporate Bond Market Liquidity and Potential Financial Stability Consequences," Presentation to FRAC meeting, Washington, Feb. 28, 2019. https://www.financialresearch.gov/frac/files/OFR_FRAC-meeting_working-group_marketliquidity_02-28-2019.pdf.
- ³³ Office of Financial Research (OFR), *2018 Annual Report to Congress* (Washington: OFR, Nov. 15, 2018), 42-49. <https://www.financialresearch.gov/annual-reports/2018-annual-report>.
- ³⁴ Meraj Allahrakha, Jill Cetina, Benjamin Munyan, and Sumudu Watugala, "The Effects of the Volcker Rule on Corporate Bond Trading: Evidence from the Underwriting Exemption," Office of Financial Research Working Paper no. 19-02, Aug. 6, 2019. <https://www.financialresearch.gov/working-papers/2019/08/06/the-effects-of-the-volcker-rule-on-corporate-bond-trading/>.
- ³⁵ Federal Deposit Insurance Corporation, "Identifying, Accepting, and Reporting Brokered Deposits: Frequently Asked Questions," revised July 14, 2016, <https://www.fdic.gov/news/news/financial/2016/fil16042b.pdf>.
- ³⁶ Office of Financial Research staff analysis of FDIC Statistics on Banking Quarterly Banking Profile data in Haver Analytics. Quarterly cost of funding earning assets (series USACA@FDIC), 2Q2018-2Q2019. Quarterly yield on earning assets (series USAYA@FDIC), 2Q2018-2Q2019. Quarterly net interest margin (series USANT@FDIC), 2Q2018 – 2Q2019).
- ³⁷ Federal Home Loan Bank System, "Lending and Collateral Q&A," Aug. 13, 2019. http://www.fhfb-of.com/ofweb_userWeb/resources/lendingqanda.pdf.

³⁸ Federal Housing Finance Agency, "Federal Home Loan Bank Liquidity Guidance," Advisory Bulletin AB 2018-07, Aug. 27, 2018. <https://www.fhfa.gov/SupervisionRegulation/AdvisoryBulletins/Pages/Federal-Home-Loan-Bank-Liquidity-Guidance.aspx>.

³⁹ Jack Bao, Josh David, and Song Han, "The Runnables," FEDS Notes, Board of Governors of the Federal Reserve System, Sept. 3, 2015. <https://www.federalreserve.gov/econresdata/notes/feds-notes/2015/the-runnables-20150903.html>.

⁴⁰ Calculated by Volatility Laboratory of the NYU Stern Volatility Institute, <https://vlab.stern.nyu.edu>.

⁴¹ Paul Glasserman and H. Peyton Young, "Contagion in Financial Networks," *Journal of Economic Literature* 54, no. 3 (September 2016): 779-831. <https://www.aeaweb.org/articles?id=10.1257/jel.20151228>; also published as Office of Financial Research Working Paper no. 15-21, Oct. 20, 2015, 34-35. <https://www.financialresearch.gov/working-papers/2015/10/20/contagion-in-financial-networks/>. The index formula can also be written as Contagion Index = Connectivity X (Outside assets - Net worth).

⁴² Liabilities include net derivatives liabilities.

⁴³ Christian T. Brownlees and Robert F. Engle, "SRISK: A Conditional Capital Shortfall Measure of Systemic Risk," *Review of Financial Studies* 30, no. 1 (January 2017): 48-79. <https://academic.oup.com/rfs/article/30/1/48/2669965>.

⁴⁴ Allen N. Berger, Filippo Curti, Atanas Mihov, and John Sedunov, "Operational Risk Is More Systemic than You Think: Evidence from U.S. Bank Holding Companies," Sept. 15, 2018, revised June 11, 2019, available via SSRN. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3210808.

⁴⁵ Depository Trust & Clearing Corporation, "Systemic Risk Barometer Surveys," Online content, updated Dec. 11, 2018. <http://www.dtcc.com/systemic-risk/systemic-risk-barometer-surveys>.

⁴⁶ Jerome Powell, "Federal Reserve Chairman Jerome Powell: The 60 Minutes Interview," Interview by Scott Pelley, *60 Minutes*, CBS, June 2, 2019. <https://www.cbsnews.com/news/jerome-powell-federal-reserve-chairman-60-minutes-interview-2019-06-02>.

⁴⁷ Office of Financial Research (OFR), *2016 Financial Stability Report* (Washington: OFR, Dec. 13, 2016), 38-48. <https://www.financialresearch.gov/financial-stability-reports/2016-financial-stability-report/>; OFR, "Cybersecurity and Financial Stability: Risks and Resilience," OFR Viewpoint Paper no. 17-01, Feb. 15, 2017. <https://www.financialresearch.gov/viewpoint-papers/2017/02/15/cybersecurity-and-financial-stability/>; OFR, *2017 Financial Stability Report* (Washington: OFR, Dec. 5, 2017), 7-10. <https://www.financialresearch.gov/financial-stability-reports/2017-financial-stability-report/>; see also Financial Stability Oversight Council (FSOC), *2018 Annual Report* (Washington: FSOC, revised June 20, 2019), 107. <https://home.treasury.gov/system/files/261/FSOC2018AnnualReport.pdf>.

⁴⁸ Francesco Canepa, "ECB Shuts Down One of Its Websites After Hacker Attack," Reuters, Aug. 15, 2019. <https://www.reuters.com/article/us-ecb-cyber/ecb-shuts-down-one-of-its-websites-after-hacker-attack-idUSKCN1V51N0>.

⁴⁹ Department of Justice, U.S. Attorney's Office, Western District of Washington, "Seattle Tech Worker Arrested for Data Theft Involving Large Financial Services Company," News release, July 29, 2019. <https://www.justice.gov/usao-wdwa/pr/seattle-tech-worker-arrested-data-theft-involving-large-financial-services-company>.

⁵⁰ Emily Fitter and Karen Weise, "Capital One Data Breach Compromises Data of Over 100 Million," *The New York Times*, July 29, 2019. <https://www.nytimes.com/2019/07/29/business/capital-one-data-breach-hacked.html>; Robert McMillan, "How the Accused Capital One Hacker Stole Reams of Data from the Cloud," *The Wall Street Journal*, Aug. 4, 2019. <https://www.wsj.com/articles/how-the-accused-capital-one-hacker-stole-reams-of-data-from-the-cloud-11564911001>.

⁵¹ Renae Merle, "Prosecutors Say Accused Capital One Hacker Had Stolen Data from 30 Other Companies in Her Bedroom," *The Washington Post*, Aug. 14, 2019. <https://www.washingtonpost.com/business/2019/08/14/prosecutors-say-capital-one-hacker-had-stolen-data-other-companies-her-bedroom/>.

⁵² Federal Trade Commission, "Equifax to Pay \$575 Million as Part of Settlement with FTC, CFPB, and States Related to 2017 Data Breach," News release, July 22, 2019. <https://www.ftc.gov/news-events/press-releases/2019/07/equifax-pay-575-million-part-settlement-ftc-cfpb-states-related>.

⁵³ Council of Economic Advisers (CEA), *The Cost of Malicious Cyber Activity to the U.S. Economy* (Washington: CEA, February 2018), 14-15. <https://www.whitehouse.gov/wp-content/uploads/2018/02/The-Cost-of-Malicious-Cyber-Activity-to-the-U.S.-Economy.pdf>.

⁵⁴ Council of Economic Advisers (CEA), *The Cost of Malicious Cyber Activity to the U.S. Economy* (Washington: CEA, February 2018), 21-23. <https://www.whitehouse.gov/wp-content/uploads/2018/02/The-Cost-of-Malicious-Cyber-Activity-to-the-U.S.-Economy.pdf>.

- ⁵⁵ Verizon, "2019 Data Breach Investigations Report," Online content, 2019. <https://enterprise.verizon.com/resources/reports/dbir/>.
- ⁵⁶ CreditSights, "P&C Insurance: Cyber Security Market Grows Again," June 5, 2019.
- ⁵⁷ Her Majesty's Government, "Operation Yellowhammer: HMG Reasonable Worst Case Planning Assumptions," As released by the U.K. government under order of Parliament, Aug. 2, 2019. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/831199/20190802_Latest_Yellowhammer_Planning_assumptions_CDL.pdf; Megan Specia, "Britain Outlined the Impact of a No-Deal Brexit. It's Not Pretty," *The New York Times*, Sept. 12, 2019. <https://www.nytimes.com/2019/09/12/world/europe/no-deal-brex-it-impact.html>.
- ⁵⁸ Financial Conduct Authority (FCA), *EU Withdrawal Impact Assessment* (London: FCA, November 2018), 11-16. <https://www.fca.org.uk/publication/impact-assessments/eu-withdrawal-impact-assessment.pdf>.
- ⁵⁹ International Swaps and Derivatives Association (ISDA), *Contractual Continuity in OTC Derivatives: Challenges with Transfers* (New York: ISDA, July 2018), 4-5. <https://www.isda.org/a/EEJEE/Contractual-Continuity-in-OTC-Derivatives-Challenges-with-Transfers.pdf>.
- ⁶⁰ Bank of England, "Regulatory Framework in a No-deal Scenario," Online content, updated July 25, 2019. <https://www.bankofengland.co.uk/eu-withdrawal/transitioning-to-post-exit-rules-and-standards>; European Central Bank, "Brexit: Stepping up Preparations," Supervision Newsletter, Aug. 14, 2019. <https://www.bankingsupervision.europa.eu/press/publications/newsletter/2019/html/ssm.nl190814.en.html>.
- ⁶¹ Accenture, "2019 LIBOR Survey: Are You Ready to Transition?," Sept. 16, 2019. <https://www.accenture.com/us-en/insights/financial-services/libor-transition-survey>.
- ⁶² CME Group, "Secured Overnight Financing Rate (SOFR) Futures," Online content, updated daily. <https://www.cmegroup.com/trading/interest-rates/secured-overnight-financing-rate-futures.html>.
- ⁶³ Glenn D. Rudebusch, "Climate Change and the Federal Reserve," *FRBSF Economic Letter* 2019-09, March 25, 2019. <https://www.frbsf.org/economic-research/publications/economic-letter/2019/march/climate-change-and-federal-reserve/>; Margherita Giuzio, Dejan Krusec, Anouk Levels, Ana Sofia Melo, Katri Mikkonen, and Petya Radulova, "Climate Change and Financial Stability," European Central Bank, *Financial Stability Review*, May 2019. https://www.ecb.europa.eu/pub/financial-stability/fsr/special/html/ecb.fsrart201905_1~47cf778cc1.en.html; Sandra Batten, Rhiannon Sowerbutts, and Misa Tanaka, "Let's Talk About the Weather: The Impact of Climate Change on Central Banks," Bank of England Staff Working Paper no. 603, May 2016. <https://www.bankofengland.co.uk/-/media/boe/files/working-paper/2016/lets-talk-about-the-weather-the-impact-of-climate-change-on-central-banks.pdf>.
- ⁶⁴ Office of Financial Research (OFR), *2018 Annual Report to Congress* (Washington: OFR, Nov. 15, 2018), 25. <https://www.financialresearch.gov/annual-reports/2018-annual-report/>.
- ⁶⁵ Office of Financial Research (OFR), *2018 Annual Report to Congress* (Washington: OFR, Nov. 15, 2018), 35-36. <https://www.financialresearch.gov/annual-reports/2018-annual-report/>.
- ⁶⁶ Financial Stability Board (FSB), *Crypto-asset Markets: Potential Channels for Future Financial Stability Implications* (Basel: FSB, Oct. 10, 2018). <http://www.fsb.org/wp-content/uploads/P101018.pdf>.
- ⁶⁷ Department of the Treasury, "White House Press Briefing by Treasury Secretary Steven Mnuchin on Regulatory Issues Associated with Cryptocurrency," July 15, 2019. <https://home.treasury.gov/news/featured-stories/white-house-press-briefing-by-treasury-secretary-steven-mnuchin-on-regulatory-issues-associated-with-cryptocurrency>; Financial Stability Oversight Council, "Minutes of the Financial Stability Oversight Council," Dec. 19, 2018, 4. https://home.treasury.gov/system/files/261/December192018_minutes.pdf.
- ⁶⁸ Matthew Leising, "Fidelity Will Offer Cryptocurrency Trading Within a Few Weeks," Bloomberg, May 6, 2019. <https://www.bloomberg.com/news/articles/2019-05-06/fidelity-said-to-offer-cryptocurrency-trading-within-a-few-weeks>.
- ⁶⁹ Ciphertrace, *Cryptocurrency Anti-Money Laundering Report*, 2019 Q1 (Menlo Park, Calif.: Ciphertrace, April 2019). <https://ciphertrace.com/wp-content/uploads/2019/05/ciphertrace-q1-2019-cryptocurrency-anti-money-laundering-report.pdf>.
- ⁷⁰ Daniel Sangeap to Bill Shihara, "Letter re: Application of Bittrex Inc. for a License to Engage in Virtual Currency Business Activity, etc.," New York State Department of Financial Services, April 10, 2019. <https://www.dfs.ny.gov/system/files/documents/2019/04/dfs-bittrex-letter-41019.pdf>.

⁷¹ Mike Isaac and Nathaniel Popper, "Facebook Plans Global Financial System Based on Cryptocurrency," *The New York Times*, June 18, 2019. <https://www.nytimes.com/2019/06/18/technology/facebook-cryptocurrency-libra.html>.

⁷² AnnaMaria Andriotis and Peter Rudegeair, "Mastercard, Visa, eBay Drop Out of Facebook's Libra Payments Network," *The Wall Street Journal*, Oct. 11, 2019. <https://www.wsj.com/articles/mastercard-drops-out-of-facebook-s-libra-payments-network-11570824139>.

⁷³ Bank for International Settlements (BIS), "Big Tech in Finance: Opportunities and Risks," in *BIS Annual Economic Report 2019* (Basel: BIS, June 23, 2019). <https://www.bis.org/publ/arpdf/ar2019e3.htm>.

Bibliography

- Accenture. "2019 LIBOR Survey: Are You Ready to Transition?" Sept. 16, 2019. <https://www.accenture.com/us-en/insights/financial-services/libor-transition-survey>.
- Akin, Jim. "What Are the Different Credit Scoring Ranges?" Experian, July 12, 2019. <https://www.experian.com/blogs/ask-experian/infographic-what-are-the-different-scoring-ranges>.
- Allahrakha, Meraj, Jill Cetina, Benjamin Munyan, and Sumudu Watugala. "The Effects of the Volcker Rule on Corporate Bond Trading: Evidence from the Underwriting Exemption." Office of Financial Research Working Paper no. 19-02, Aug. 6, 2019. <https://www.financialresearch.gov/working-papers/2019/08/06/the-effects-of-the-volcker-rule-on-corporate-bond-trading/>.
- A.M. Best. "Favorable 2018 Statutory Results for Life/Annuity Segment." Best's Special Report, June 17, 2019. <http://www3.ambest.com/bestweekpdfs/sr507453119175afull.pdf>.
- Andriotis, AnnaMaria, and Peter Rudegeair. "Mastercard, Visa, eBay Drop Out of Facebook's Libra Payments Network." *The Wall Street Journal*, Oct. 11, 2019. <https://www.wsj.com/articles/mastercard-drops-out-of-facebook-s-libra-payments-network-11570824139>.
- Bank for International Settlements (BIS). "Big Tech in Finance: Opportunities and Risks," in *BIS Annual Economic Report 2019*. Basel: BIS, June 23, 2019. <https://www.bis.org/publ/arpdf/ar2019e3.htm>.
- Bank of England. "Regulatory Framework in a No-deal Scenario." Online content, updated July 25, 2019. <https://www.bankofengland.co.uk/eu-withdrawal/transitioning-to-post-exit-rules-and-standards>.
- Bao, Jack, Josh David, and Song Han. "The Runnables." FEDS Notes, Board of Governors of the Federal Reserve System, Sept. 3, 2015. <https://www.federalreserve.gov/econresdata/notes/feds-notes/2015/the-runnables-20150903.html>.
- Barnett, William A. *Getting it Wrong: How Faulty Monetary Statistics Undermine the Fed, the Financial System, and the Economy*. Cambridge, Mass.: The MIT Press, 2012.
- Batten, Sandra, Rhiannon Sowerbutts, and Misa Tanaka. "Let's Talk About the Weather: The Impact of Climate Change on Central Banks." Bank of England Staff Working Paper no. 603, May 2016. <https://www.bankofengland.co.uk/-/media/boe/files/working-paper/2016/lets-talk-about-the-weather-the-impact-of-climate-change-on-central-banks.pdf>.
- Berger, Allen N., Filippo Curti, Atanas Mihov, and John Sedunov. "Operational Risk Is More Systemic than You Think: Evidence from U.S. Bank Holding Companies." Sept. 15, 2018, revised June 11, 2019, available via SSRN. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3210808.

Blanchard, Olivier. "The Perfect Storm." *Finance and Development*, June 2009. <https://www.imf.org/external/pubs/ft/fandd/2009/06/pdf/blanchard.pdf>.

Board of Governors of the Federal Reserve System. "Comprehensive Capital Analysis and Review 2019: Assessment Framework and Results." June 2019. <https://www.federalreserve.gov/publications/files/2019-ccar-assessment-framework-results-20190627.pdf>.

Board of Governors of the Federal Reserve System. "Regulatory Capital Rules: Risk-based Capital Requirements for Depository Institution Holding Companies Significantly Engaged in Insurance Activities." Notice of proposed rulemaking, *Federal Register* 84, no. 206 (Oct. 24, 2019): 57240-57301. <https://www.govinfo.gov/content/pkg/FR-2019-10-24/pdf/2019-21978.pdf>.

Board of Governors of the Federal Reserve System. "Prudential Standards for Large Bank Holding Companies, Savings and Loan Holding Companies, and Foreign Banking Organizations," Final rule, *Federal Register* 84, no. 212 (Nov. 1, 2019): 59032-59123. <https://www.govinfo.gov/content/pkg/FR-2019-11-01/pdf/2019-23662.pdf>.

Brownlees, Christian T., and Robert F. Engle. "SRISK: A Conditional Capital Shortfall Measure of Systemic Risk." *Review of Financial Studies* 30, no. 1 (January 2017): 48-79. <https://academic.oup.com/rfs/article/30/1/48/2669965>.

Canepa, Francesco. "ECB Shuts Down One of Its Websites After Hacker Attack." Reuters, Aug. 15, 2019. <https://www.reuters.com/article/us-ecb-cyber/ecb-shuts-down-one-of-its-websites-after-hacker-attack-idUSKCN1V51N0>.

Calomiris, Charles W., and Stephen H. Haber. *Fragile by Design: The Political Origins of Banking Crises & Scarce Credit*. Princeton, N.J.: Princeton University Press, 2014.

Catanach, Anthony H., Jr., and Julie Anne Ragatz. "2008 Market Crisis: Black Swan, Perfect Storm or Tipping Point? Buzzwords Make It Possible to Deflect Responsibility for Financial Cataclysm." *Bank Accounting and Finance* 23, no. 3 (April-May 2010): 20. <https://go.gale.com/ps/anonymouse?id=GALE%7CA225580490&sid=googleScholar&v=2.1&it=r&linkaccess=abs&issn=08943958&p=AONE&sw=w>.

Ciphertrace. *Cryptocurrency Anti-Money Laundering Report, 2019 Q1*. Menlo Park, Calif.: Ciphertrace, April 2019. <https://ciphertrace.com/wp-content/uploads/2019/05/ciphertrace-q1-2019-cryptocurrency-anti-money-laundering-report.pdf>.

CME Group. "Secured Overnight Financing Rate (SOFR) Futures." Online content, updated daily. <https://www.cmegroup.com/trading/interest-rates/secured-overnight-financing-rate-futures.html>.

Congressional Budget Office (CBO). *An Update to the Budget and Economic Outlook: 2019 to 2029*. Washington: CBO, August 2019. https://www.cbo.gov/system/files/2019-08/55551-CBO-outlook-update_0.pdf.

Council of Economic Advisers (CEA). *The Cost of Malicious Cyber Activity to the U.S. Economy*. Washington: CEA, February 2018. <https://www.whitehouse.gov/wp-content/uploads/2018/02/The-Cost-of-Malicious-Cyber-Activity-to-the-U.S.-Economy.pdf>.

CreditSights, "P&C Insurance: Cyber Security Market Grows Again," June 5, 2019.

CreditSights. "REITs/CRE 1Q19: How Are Property Types Performing?" May 28, 2019. <https://www.creditsights.com/articles/237628?resultIndex=0&ssid=1565880881445>.

Dagher, Jihad, Giovanni Dell'Ariccia, Luc Laeven, Lev Ratnovski, and Hui Tong. "Benefits and Costs of Bank Capital." International Monetary Fund Staff Discussion Note, March 2016. <https://www.imf.org/external/pubs/ft/sdn/2016/sdn1604.pdf>.

Department of Justice, U.S. Attorney's Office, Western District of Washington. "Seattle Tech Worker Arrested for Data Theft Involving Large Financial Services Company." News release, July 29, 2019. <https://www.justice.gov/usao-wdwa/pr/seattle-tech-worker-arrested-data-theft-involving-large-financial-services-company>.

Department of the Treasury. "White House Press Briefing by Treasury Secretary Steven Mnuchin on Regulatory Issues Associated with Cryptocurrency." July 15, 2019. <https://home.treasury.gov/news/featured-stories/white-house-press-briefing-by-treasury-secretary-steven-mnuchin-on-regulatory-issues-associated-with-cryptocurrency>.

Depository Trust & Clearing Corporation. "Systemic Risk Barometer Surveys." Online content, updated Dec. 11, 2018. <http://www.dtcc.com/systemic-risk/systemic-risk-barometer-surveys>.

Dodd-Frank Wall Street Reform and Consumer Protection Act. Public Law 111-203. Washington: U.S. Government Printing Office, July 21, 2010. <https://www.gpo.gov/fdsys/pkg/PLAW-111publ203/pdf/PLAW-111publ203.pdf>.

Federal Deposit Insurance Corporation. "Identifying, Accepting, and Reporting Brokered Deposits: Frequently Asked Questions." June 30 2016, revised July 14, 2016. <https://www.fdic.gov/news/news/financial/2016/fil16042b.pdf>.

Federal Deposit Insurance Corporation. "Quarterly Banking Profile, Second Quarter 2019." Sept. 5, 2019. <https://www.fdic.gov/bank/analytical/qbp/2019jun/qbp.pdf>.

Federal Home Loan Bank System. "Lending and Collateral Q&A." Aug. 13, 2019. http://www.fhlb-of.com/ofweb_userWeb/resources/lendingqanda.pdf.

Federal Housing Finance Agency. "Federal Home Loan Bank Liquidity Guidance." Advisory Bulletin AB 2018-07, Aug. 27, 2018. <https://www.fhfa.gov/SupervisionRegulation/AdvisoryBulletins/Pages/Federal-Home-Loan-Bank-Liquidity-Guidance.aspx>.

Federal Trade Commission. "Equifax to Pay \$575 Million as Part of Settlement with FTC, CFPB, and States Related to 2017 Data Breach." News release, July 22, 2019. <https://www.ftc.gov/news-events/press-releases/2019/07/equifax-pay-575-million-part-settlement-ftc-cfpb-states-related>.

Financial Conduct Authority (FCA). *EU Withdrawal Impact Assessment*. London: FCA, November 2018. <https://www.fca.org.uk/publication/impact-assessments/eu-withdrawal-impact-assessment.pdf>.

Financial Crisis Inquiry Commission (FCIC). *The Financial Crisis Inquiry Report*. Washington: FCIC, January 2011. <http://fcic.law.stanford.edu/report>.

Financial Stability Board (FSB). *Crypto-asset Markets: Potential Channels for Future Financial Stability Implications*. Basel: FSB, Oct. 10, 2018. <http://www.fsb.org/wp-content/uploads/P101018.pdf>.

Financial Stability Oversight Council (FSOC). *2016 Annual Report*. Washington: FSOC, June 21, 2016, revised June 20, 2019. <https://www.treasury.gov/initiatives/fsoc/studies-reports/Documents/FSOC%202016%20Annual%20Report.pdf>.

Financial Stability Oversight Council (FSOC). *2017 Annual Report*. Washington: FSOC, Dec. 14, 2017, revised June 20, 2019. https://www.treasury.gov/initiatives/fsoc/studies-reports/Documents/FSOC_2017_Annual_Report.pdf.

Financial Stability Oversight Council (FSOC). *2018 Annual Report*. Washington: FSOC, Dec. 19, 2018, revised June 20, 2019. <https://home.treasury.gov/system/files/261/FSOC2018AnnualReport.pdf>.

Financial Stability Oversight Council. "Minutes of the Financial Stability Oversight Council Meeting." Dec. 19, 2018. https://home.treasury.gov/system/files/261/December192018_minutes.pdf.

Firestone, Simon, Amy Lorenc, and Ben Ranish. "An Empirical Economic Assessment of the Costs and Benefits of Bank Capital in the US." Finance and Economics Discussion Series 2017-034, Board of Governors of the Federal Reserve System, March 31, 2017. <https://www.federalreserve.gov/econres/feds/files/2017034pap.pdf>.

Fitter, Emily, and Karen Weise. "Capital One Data Breach Compromises Data of Over 100 Million." *The New York Times*, July 29, 2019. <https://www.nytimes.com/2019/07/29/business/capital-one-data-breach-hacked.html>.

Freddie Mac Multifamily Research Center. "2019 Midyear Outlook." August 2019. https://mf.freddiemac.com/docs/multifamily_2019_midyear_outlook.pdf.

Giuzio, Margherita, Dejan Krusec, Anouk Levels, Ana Sofia Melo, Katri Mikkonen, and Petya Radulova. "Climate Change and Financial Stability." *Financial Stability Review*, European Central Bank, May 2019. https://www.ecb.europa.eu/pub/financial-stability/fsr/special/html/ecb.fsrart201905_1~47cf778cc1.en.html.

Glasserman, Paul, and H. Peyton Young. "Contagion in Financial Networks." *Journal of Economic Literature* 54, no. 3 (September 2016): 779-831. <https://www.aeaweb.org/articles?id=10.1257/jel.20151228>; also published as Office of Financial Research Working Paper no. 15-21, Oct. 20, 2015. <https://www.financialresearch.gov/working-papers/2015/10/20/contagion-in-financial-networks/>.

Hatzius, Jan, Sven Jari Stehn, Nicholas Fawcett, and Manav Chaudhary. "Gauging the China Spillover Threat." Goldman Sachs Economics Research report, Sept. 24, 2018.

Her Majesty's Government. "Operation Yellowhammer: HMG Reasonable Worst Case Planning Assumptions." As released by the U.K. government under order of Parliament, Aug. 2, 2019. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/831199/20190802_Latest_Yellowhammer_Planning_assumptions_CDL.pdf.

International Monetary Fund (IMF). *World Economic Outlook, April 2019: Growth Slowdown, Precarious Recovery*. Washington: IMF, April 2, 2019. <https://www.imf.org/en/Publications/WEO/Issues/2019/03/28/world-economic-outlook-april-2019>.

International Swaps and Derivatives Association (ISDA). *Contractual Continuity in OTC Derivatives: Challenges with Transfers*. New York: ISDA, July 2018. <https://www.isda.org/a/EEjEE/Contractual-Continuity-in-OTC-Derivatives-Challenges-with-Transfers.pdf>.

Isaac, Mike, and Nathaniel Popper. "Facebook Plans Global Financial System Based on Cryptocurrency." *The New York Times*, June 18, 2019. <https://www.nytimes.com/2019/06/18/technology/facebook-cryptocurrency-libra.html>.

Lahart, Justin. "Mr. Rajan Was Unpopular (But Prescient) at Greenspan Party." *The Wall Street Journal*, Jan. 2, 2009. <https://www.wsj.com/articles/SB123086154114948151>.

Leising, Matthew. "Fidelity Will Offer Cryptocurrency Trading Within a Few Weeks." Bloomberg, May 6, 2019. <https://www.bloomberg.com/news/articles/2019-05-06/fidelity-said-to-offer-cryptocurrency-trading-within-a-few-weeks>.

Liu, Catherine. "Retailers at Risk: How Long Will the Retailpocalypse Continue?" Trepp, Aug. 13, 2019. <https://info.trepp.com/trepptalk/retailers-at-risk-how-long-will-retailpocalypse-continue>.

McMillan, Robert. "How the Accused Capital One Hacker Stole Reams of Data from the Cloud." *The Wall Street Journal*, Aug. 4, 2019. <https://www.wsj.com/articles/how-the-accused-capital-one-hacker-stole-reams-of-data-from-the-cloud-11564911001>.

Merle, Renae. "Prosecutors Say Accused Capital One Hacker Had Stolen Data from 30 Other Companies in Her Bedroom." *The Washington Post*, Aug. 14, 2019. <https://www.washingtonpost.com/business/2019/08/14/prosecutors-say-capital-one-hacker-had-stolen-data-other-companies-her-bedroom/>.

Moody's Investors Service. "Leveraged Finance — US: Convergence of Bonds and Loans Sets Stage for Worse Recoveries in the Next Downturn." Sector In-depth, Aug. 16, 2018. http://www.moody's.com/researchdocumentcontentpage.aspx?docid=PBC_1128748.

Moody's Investors Service. "Sector Update – Q2 2019: Slight Improvements Across Credit Metrics for CMBS We Rate." Aug. 19, 2019

National Association of Insurance Commissioners. "Risk-based Capital." Online content, updated May 23, 2019. https://www.naic.org/cipr_topics/topic_risk_based_capital.htm.

Office of Financial Research (OFR). *2013 Annual Report to Congress*. Washington: OFR, Dec. 17, 2013. <https://www.financialresearch.gov/annual-reports/2013-annual-report/>.

Office of Financial Research (OFR). *2016 Financial Stability Report*. Washington: OFR, Dec. 13, 2016. <https://www.financialresearch.gov/financial-stability-reports/2016-financial-stability-report/>.

Office of Financial Research (OFR). *2017 Financial Stability Report*. Washington: OFR, Dec. 5, 2017. <https://www.financialresearch.gov/financial-stability-reports/2017-financial-stability-report/>.

Office of Financial Research (OFR). *2018 Annual Report to Congress*. Washington: OFR, Nov. 15, 2018. <https://www.financialresearch.gov/annual-reports/2018-annual-report/>.

Office of Financial Research (OFR). "Cybersecurity and Financial Stability: Risks and Resilience." OFR Viewpoint Paper no. 17-01, Feb. 15, 2017. <https://www.financialresearch.gov/viewpoint-papers/2017/02/15/cybersecurity-and-financial-stability/>.

Office of Financial Research. "Financial System Vulnerabilities Monitor." Online content, revised quarterly. <https://www.financialresearch.gov/financial-vulnerabilities/#/>.

Office of Financial Research (OFR). "Size Alone Is Not Sufficient to Identify Systemically Important Banks." OFR Viewpoint Paper no. 17-04, Oct. 26, 2017. <https://www.financialresearch.gov/viewpoint-papers/2017/10/26/size-not-sufficient-to-identify-systemically-important-banks/>.

Office of Financial Research. "Ongoing Data Collection of Centrally Cleared Transactions in the U.S. Repurchase Agreement Market." Notice of proposed rulemaking, *Federal Register* 83, no. 132 (July 10, 2018): 31896-31911. <https://www.govinfo.gov/content/pkg/FR-2018-07-10/pdf/2018-14706.pdf>.

Office of Financial Research. "Ongoing Data Collection of Centrally Cleared Transactions in the U.S. Repurchase Agreement Market." Final Rule, *Federal Register* 84, no. 34 (Feb. 20, 2019): 4975-4987. <https://www.federalregister.gov/documents/2019/02/20/2019-02639/ongoing-data-collection-of-centrally-cleared-transactions-in-the-us-repurchase-agreement-market>.

Office of Financial Research Financial Research Advisory Committee (OFR FRAC). "OFR FRAC Working Group: Leveraged Lending & CLOs." Presentation to FRAC meeting, New York, July 11, 2019. https://www.financialresearch.gov/frac/files/OFR_FRAC-meeting_Leveraged_Lending_CLOs_07_09_2019.pdf.

Office of Financial Research Financial Research Advisory Committee (OFR FRAC). "U.S. Corporate Bond Market Liquidity and Potential Financial Stability Consequences." Presentation to FRAC meeting, Washington, Feb. 28, 2019. https://www.financialresearch.gov/frac/files/OFR_FRAC-meeting_working-group_marketliquidity_02-28-2019.pdf.

Office of the Comptroller of the Currency, Board of Governors of the Federal Reserve System, and Federal Deposit Insurance Corporation. "Changes to Applicability Thresholds for Regulatory Capital and Liquidity Requirements." Final rule, *Federal Register* 84, no. 212 (Nov. 1, 2019): 59230-59283. <https://www.govinfo.gov/content/pkg/FR-2019-11-01/pdf/2019-23800.pdf>

Powell, Jerome. "Federal Reserve Chairman Jerome Powell: The 60 Minutes Interview." Interview by Scott Pelley, *60 Minutes*, CBS, June 2, 2019. <https://www.cbsnews.com/news/jerome-powell-federal-reserve-chairman-60-minutes-interview-2019-06-02>.

Rajan, Raghuram G. *Fault Lines: How Hidden Fractures Still Threaten the World Economy*. Princeton, N.J.: Princeton University Press, 2010.

Rudebusch, Glenn D. "Climate Change and the Federal Reserve." *FRBSF Economic Letter* 2019-09, March 25, 2019. <https://www.frbsf.org/economic-research/publications/economic-letter/2019/march/climate-change-and-federal-reserve/>.

Sangeap, Daniel, to Bill Shihara. "Letter re: Application of Bittrex Inc. for a License to Engage in Virtual Currency Business Activity, etc." New York State Department of Financial Services, April 10, 2019. <https://www.dfs.ny.gov/system/files/documents/2019/04/dfs-bittrex-letter-41019.pdf>.

Specia, Megan. "Britain Outlined the Impact of a No-Deal Brexit. It's Not Pretty." *The New York Times*, Sept. 12, 2019. <https://www.nytimes.com/2019/09/12/world/europe/no-deal-brex-it-impact.html>.

Stern, Gary H., and Ron J. Feldman. *Too Big to Fail: The Hazards of Bank Bailouts*. Washington: Brookings Institution Press, 2004.

Trepp CMBS Research. "CMBS Delinquency Rate Sets Another New Post-Crisis Low in August." August 2019. <https://info.trepp.com/hubfs/August%202019%20CMBS%20Delinquency%20Report-1.pdf>.

Verizon. "2019 Data Breach Investigations Report." Online content, 2019. <https://enterprise.verizon.com/resources/reports/dbir/>.

White House. *Economic Report of the President, Transmitted to the Congress February 2006, Together with the Annual Report of the Council of Economic Advisers*. Washington: Government Printing Office, 2006. <https://www.govinfo.gov/content/pkg/ERP-2006/pdf/ERP-2006.pdf>.

