OFR
OFFICE OF FINANCIAL RESEARCH

ANNUAL REPORT TO CONGRESS 2016

FROM THE DIRECTOR

I am pleased to present this *2016 Annual Report to Congress*, our fifth annual report. Like the previous four, this report fulfills our statutory requirements to assess the U.S. financial system, including potential threats to financial stability; document our progress in meeting our mission; and report on key research findings.

Our overall risk assessment is unchanged from last year. Threats to financial stability remain in a medium range, but the sources of those threats have shifted as disruptions have affected the global economy and the U.S. financial system has evolved.

We assess threats by weighing vulnerabilities in the financial system against its resilience. We judge that the system's resilience has improved over the past year, even as new threats have arisen.

As we did last year, we are reporting to Congress and the public in two installments. Our *2016 Financial Stability Report* focuses exclusively on threat assessment and monitoring. The stability report complements the annual report with a deeper analytical assessment of threats to financial stability.

As in the past, this year's annual report covers the three requirements in the statute. Its three chapters contain:

- a summary of the financial stability threats discussed in the financial stability report;
- key findings and insights, including a discussion of the programmatic framework for achieving our data-and-research agenda; and
- the status of our efforts to meet our mission, including our support of the Financial Stability Oversight Council (FSOC) and its member agencies.

The report closes with a description of our priorities for fiscal year (FY) 2017 and beyond.

Taken together, I hope the two reports will help us communicate with a wide range of stakeholders while ensuring that we are transparent and accountable in our work and in the ways we pursue it. These two reports, like those we published previously, reflect the views of the OFR. However, we continue to benefit from collaboration with the member organizations of the FSOC.

Collaboration is a critical ingredient in fostering what we call a virtual research-and-data community — one that extends the reach and impact of what our staff can accomplish alone. This collaboration includes interaction with our Financial Research Advisory Committee and our domestic and global counterparts.

In FY 2016, the OFR made further progress toward meeting its mission. In particular, we made significant progress on our mandates to improve the scope, quality, and accessibility of financial data. These data mandates are what make the OFR unique; they are designed to provide the high-quality, comprehensive data essential for good decisionmaking.

For example, we completed important pilot projects to expand the scope of data describing bilateral repurchase agreements and securities lending transactions, and we plan permanent collections for these same data in the coming year and beyond. Likewise, we report substantial progress in data standards and data catalogs — critical tools to promote improved data quality and accessibility.

Our research mission is also critical. First, it is needed to fulfill our data mandates. To identify, prioritize, and fill data gaps with high-quality financial information, we first need to frame how we assess and monitor threats to financial stability.

In addition, our mandates put us in a unique position to look across the financial system to complement the work of others in the FSOC by filling gaps in analysis, developing new tools, and assessing resilience.

Finally, as an office that does not make policy, we have an objective perspective to fulfill our mandates to study financial stability policies, including evaluating and reporting on stress tests. We report here the significant progress we've made in meeting these analytical aspects of our mission.

To communicate our agenda, be transparent and accountable to the public, and advance and sustain the pursuit of our mission in coming years, we continue to build on our programmatic approach to our work. This approach identifies core areas of concentration that align our priorities with our mission.

Our eight initial programs focus on improving the accessibility, quality, and scope of financial data; assessing and monitoring vulnerabilities in the financial system; evaluating policies intended to mitigate financial stability risks; and developing tools to monitor emerging risks. We report here on the progress we have made in these areas.

During nearly four years as Director of the OFR, I have had the honor of leading an extraordinary group of public servants, united in their passion for our mission and their shared commitment to succeed. I am extraordinarily proud of the OFR team and grateful for the privilege of working with this diverse group of dedicated and talented professionals.

In the coming year, we will keep that passion burning and strive as "One OFR" to build on the progress we have achieved together. This year's accomplishments demonstrate that teamwork brings success, and we will continue to work together to produce outstanding results.

Richard Berner
Director, Office of Financial Research

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2016 Annual Report to Congress

The Office of Financial Research (OFR) 2016 *Annual Report to Congress* takes the same approach as our report last year. This report meets the statutory requirement to prepare and submit a report to Congress within 120 days after the end of each fiscal year to assess the state of the United States financial system.

The main chapters contain the required content, as defined by the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010:

1 Analysis of Threats to the Financial Stability of the United States

2 Key Findings from the OFR's Research and Analysis of the Financial System

3 Status of the Efforts of the OFR in Meeting Its Mission

1 Analysis of Threats to the Financial Stability of the United States

Threats to financial stability are in a medium range. This overall assessment has not changed since our report last year, but global events and the evolution of the financial system have shifted the underlying factors.

This chapter discusses four themes in our assessment, the interplay among them, and seven threats that apply to them. The chapter also weighs our assessment against the resilience of the financial system and describes our latest Financial Stability Monitor, which informs our assessment along with our research, analysis, and ongoing surveillance.

The resilience of the financial system continues to build after the financial crisis of 2007-09, but important vulnerabilities remain and new ones have emerged.

The high-level themes are:

1. Disruptions in the global economy
2. Risk-taking amid low long-term interest rates
3. Risks facing U.S. financial institutions
4. Challenges in improving financial data

The specific threats under those themes are:

1. Potential spillovers from Europe
2. Credit risks in U.S. nonfinancial corporations
3. Cybersecurity incidents
4. Central counterparties (CCPs) as contagion channels
5. Pressure on U.S. life insurance companies
6. Systemic footprints of the largest U.S. banks
7. Deficiencies in data and data management

2 Key Findings from OFR's Research and Analysis of the Financial System

This chapter describes our key findings and insights — what works and what does not for the most effective pursuit of our mission — based on lessons we have learned since the OFR's inception in 2010.

We have found that interagency memorandums of understanding are essential tools for overcoming obstacles to the appropriate sharing of data envisioned in the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010. These memorandums set the terms for timely and appropriate access to nonpublic data. We have signed more

than 50 of them in the last several years with federal regulators, state regulators, overseas regulators, and others.

We are concerned that, although clearing swaps transactions through central counterparties reduces the risk from the other party defaulting in two-way swap transactions, it also concentrates risk in the CCP itself.

After the key findings and insights, this chapter discusses our eight initial programs, which align our priorities with our mission. These programs focus on:

- improving the accessibility, quality, and scope of financial data;
- assessing and monitoring vulnerabilities in the financial system; and
- evaluating policies intended to mitigate financial stability risks and developing tools to monitor emerging risks.

The discussion of the programs includes findings from the OFR briefs and working papers in fiscal year 2016 that relate to the programs.

The chapter also describes our work on shadow banking, which is not part of any single OFR program but cuts across the programs, and the OFR's role in a public-private project to explore possible alternatives to the London Interbank Offered Rate, a set of interest rate benchmarks known as LIBOR.

3 Status of the Efforts of the OFR in Meeting Its Mission

This chapter relates how we are working to achieve our mission, including our support of the Financial Stability Oversight Council — a primary purpose of the OFR under the Dodd-Frank Act — and through our wide-ranging collaboration in the United States and internationally. Through this collaboration, we foster a virtual research-and-data community to extend the reach and impact of what our staff can accomplish alone.

The collaboration includes valuable interaction with our Financial Research Advisory Committee, made up of 29 members who are experts and practitioners in fields related to the OFR mission.

This chapter also cites ways we ensure we are transparent and accountable, the governance of our programmatic approach, the continued execution of our strategic plan, and our initiatives to nurture and build our workforce.

The chapter concludes with a summary of our budget and highlights of the information technology infrastructure and safeguards critical to our work.

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Analysis of Threats to the Financial Stability of the United States

This chapter discusses the OFR's assessment of potential threats to the financial stability of the United States, weighed against our evaluation of resilience in the financial system.

Threats to financial stability remain in a medium range. Although the financial system is significantly more resilient than during the financial crisis of 2007-09, some important vulnerabilities persist, and new ones have emerged.

Our financial stability assessment contains four high-level themes:

1. **Disruptions in the global economy** — Potential impacts on the United States from shocks in Europe, such as weaknesses in European banks, or from emerging market economies.
2. **Risk-taking amid low long-term interest rates** — Ongoing "reaching for yield" behavior could threaten financial stability if rates rise.
3. **Risks facing U.S. financial institutions** — Despite improvements in the resilience of U.S. financial institutions, risks remain.
4. **Challenges in improving financial data** — Continued deficiencies in scope, quality, and accessibility of data for financial stability assessment, with new challenges emerging.

We unpack those themes into seven key threats:

1. Potential spillovers from Europe
2. Credit risks in U.S. nonfinancial corporations
3. Cybersecurity incidents
4. Central counterparties as contagion channels
5. Pressure on U.S. life insurance companies
6. Systemic footprints of the largest U.S. banks
7. Deficiencies in data and data management

This chapter analyzes the seven key threats and discusses how the thematic interplay among them can originate, transmit, or amplify risks to financial stability.

Finally, we describe the categories of risk that form the framework for our Financial Stability Monitor.

For a deeper analysis and assessment of these threats to financial stability and an assessment of current financial system vulnerabilities, see the OFR's *2016 Financial Stability Report*.

Key Threats to Financial Stability

Our overall assessment that threats to financial stability are in a medium range has not changed since our report last year, but the underlying factors have shifted because of global events and the evolution of the financial system.

This section contains an analysis of the seven threats, which we chose based on the following criteria: potential impact, probability, immediacy, and readiness of policymakers and market participants to deal with them.

We base our overall financial stability assessment of current vulnerabilities on an evaluation of the five categories of risk in our Financial Stability Monitor, as well as our research, analysis, and ongoing surveillance of the financial system.

Potential Spillovers from Europe

Policymakers, economists, and market participants were already raising concerns about weak global growth when the United Kingdom voted in June to leave the European Union (EU).

Markets recovered quickly from the "Brexit" shock, increasing market confidence in the resilience of the global financial system and the responses of policymakers, but the vote began a period of uncertainty that could last for years as Brexit details unfold.

Events in Europe will not necessarily have an impact on the United States. For example, the eurozone, the group of countries that use the euro as their currency, had a financial crisis from 2010-12. This crisis did not destabilize the U.S. financial system, despite the dense network of financial interconnections between the United States and Europe.

However, the past does not necessarily mean spillovers will not occur in the future. The uncertainty and potential instability in Europe could be transmitted to the United States through at least three paths.

First, risks are increasing for some large interconnected European banks, including ones identified as global systemically important banks, or G-SIBs. A legacy of nonperforming loans, slow growth, and low or negative interest rates is straining their profitability (see **Figure 1**).

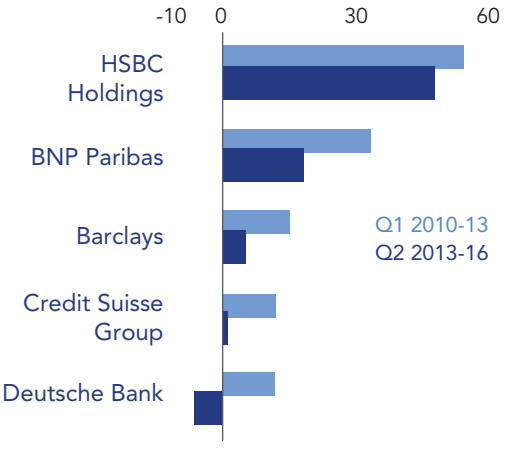
Second, many European banks also have U.S. operations. If they curtailed these operations under stress, the U.S. financial system could suffer, at least temporarily, through reduced availability of credit.

Third, a recession in Europe could decrease the demand for U.S. goods and services, a potential drag on U.S. economic growth.

The interplay among three of the four themes — global economic disruptions, persistently low interest rates, and risks facing financial institutions — could compound risks to financial stability:

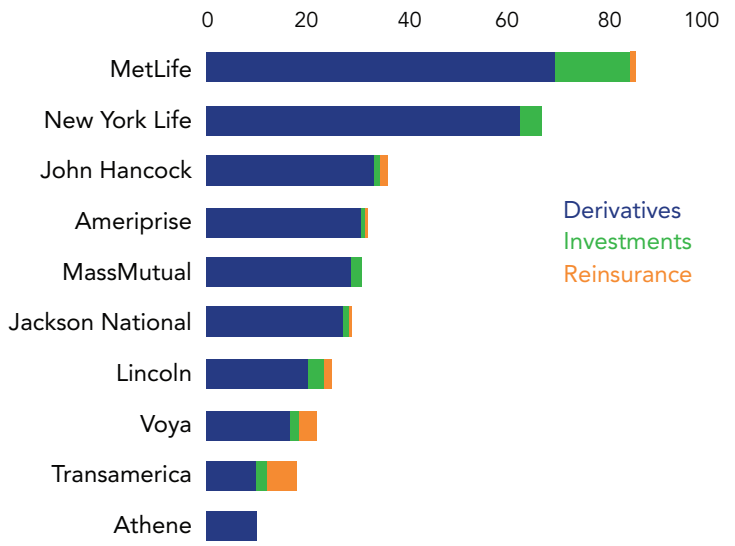
- The combination of low inflation, soft economic growth, and monetary stimulus has pushed European interest rates well below those in the United States. Investors seeking higher returns have pushed up the dollar and U.S. bond prices, depressing U.S. rates.
- Global economic disruptions could spill over to heighten vulnerabilities in U.S. life insurance companies. The top 10 U.S. life insurers have

Figure 1. Net Income of Select European G-SIBs ($ billions)



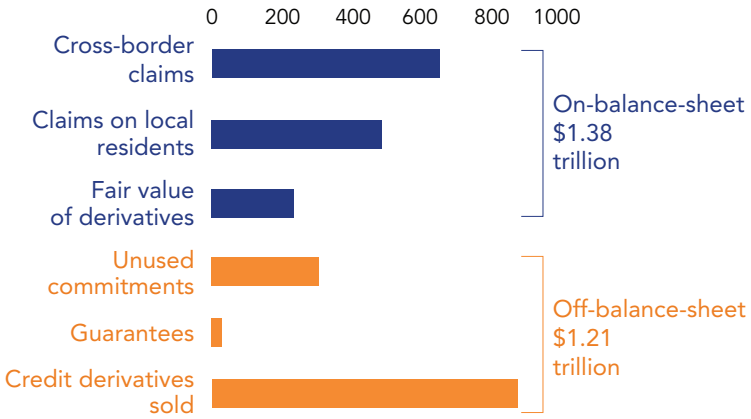
Note: G-SIB stands for global systemically important bank.
Sources: SNL Financial LC, OFR analysis

Figure 2. Top 10 U.S. Life Insurers' Exposure to the European Union ($ billions)



Note: Data as of Dec. 31, 2015. United Kingdom not included.
Sources: SNL Financial LC, OFR analysis

Figure 3. Total Exposures of U.S. G-SIBs to the European Union ($ billions)



Note: Data as of June 30, 2016. G-SIB stands for global systemically important bank. Claims are on an ultimate risk basis and include the reallocation of claims such as risk transfers. Croatia, Estonia, Latvia, Lithuania, Malta, and Slovenia are not represented.
Sources: Federal Financial Institutions Examination Council, OFR analysis

$32 billion of investment exposure to Europe, excluding the United Kingdom, and much more in indirect exposures.

Although direct exposures of U.S. life insurers to the EU are small relative to their $4 trillion in general account assets, U.S. insurers are also exposed to European banks through derivatives transactions and reinsurance (see **Figure 2**).

- Global disruptions and the threat of spillovers from abroad relate to the threat from the systemic footprints of the largest U.S. banks. Direct exposures of U.S. G-SIBs to the EU are high — more than $2 trillion on and off their balance sheets (see **Figure 3**).

One way to evaluate the potential impact of disruptions in the global economy, including the potential failure of a large European bank, is to include such disruptions in the scenarios of stress tests on large U.S. banks and insurance companies.

Credit Risks in U.S. Nonfinancial Corporations

In our report last year, we cited the threat from high levels of debt among nonfinancial companies. This debt has continued to grow at a rapid rate since our report last year. In fact, the ratio of debt to gross domestic product (GDP) for these companies is near an all-time high, growing at a much faster rate than debt levels among financial businesses and households (see **Figure 4**).

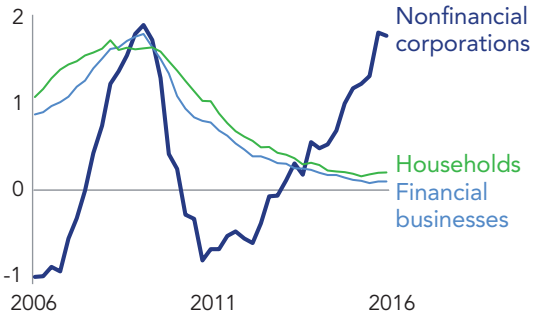
This escalating debt, fueled in part by risk-taking amid low long-term interest rates, raises the potential for default and losses by investors. The impact of such a shock to financial stability would depend on the scope of the defaults, potential contagion to other markets, and the resilience of investors in managing the damage.

U.S. banks, mutual funds, life insurers, and pension funds have provided the most credit to nonfinancial companies, so they are most exposed to the threat from potential defaults and shocks to confidence (see **Figure 5**).

In light of the vulnerabilities, stress testing of these creditors should include scenarios of severe losses in nonfinancial corporate debt, coupled with ripple effects from strained liquidity and eroded confidence. Such stress testing should also include downturns in U.S. stock markets and commercial real estate prices, which have coincided with corporate default cycles in the United States in the past.

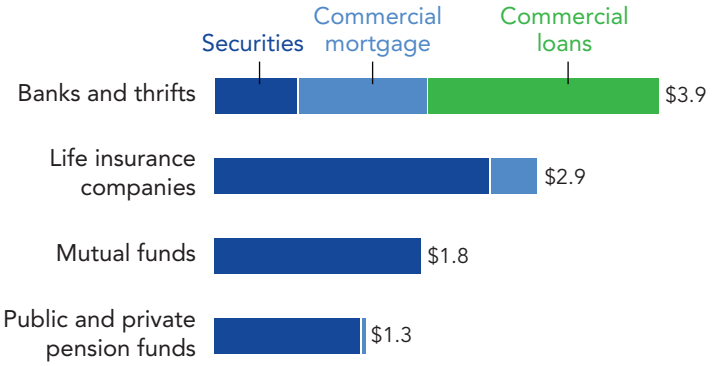
The ratio of debt to GDP among nonfinancial companies is now 45 percent, near its peak of 46 percent during the crisis in 2009 — the highest since the data series began in 1945.

Figure 4. U.S. Private Sector Debt-to-Gross Domestic Product Ratios (Z-scores)



Note: Data as of June 30, 2016. Z-score represents distance from the first quarter 1990 to second quarter 2016 average, expressed in standard deviations.
Sources: Haver Analytics, OFR analysis

Figure 5. Financial Institutions' Holdings of U.S. Nonfinancial Business Debt ($ trillions)



Note: Data as of June 31, 2016. Mortgages and commercial and industrial loans include debt of nonfinancial businesses, corporate and noncorporate.
Sources: Haver Analytics, Mortgage Bankers Association, OFR analysis

Cybersecurity Incidents

Cybersecurity incidents pose a clear threat to financial stability because financial institutions exist within complex networks and rely on electronic transactions that often occur on a rapid, just-in-time basis.

The unique roles that some institutions, such as certain central counterparties (CCPs), play in the financial system magnify the threat. A successful attack on their technology systems could disrupt payment systems or markets and trigger a cascade of losses.

The magnitude of the risk facing financial institutions and the firms' resilience in responding to this threat are difficult to quantify because detailed public data on cybersecurity incidents are scarce.

The U.S. government has made substantial progress in sharing information about emerging cybersecurity risks, and U.S. regulators have introduced tools to assess the readiness of financial institutions to meet them.

Regulators can build on this progress by collaborating on a broader approach focused on key links among financial institutions. This collaboration should include regulators and financial firms across different parts of the financial system. Financial regulators and the financial industry would benefit across the board from a shared vocabulary, strategy, enhanced standards, and risk-based approach for combating cybersecurity risks.

In FY 2017, the OFR will continue to expand its analytical capability and tools for assessing such threats.

Categories of Cybersecurity Incidents that Threaten Financial Stability

- **Lack of substitutability.** In many information technology networks that complete transactions or move payments in the financial services industry, a few firms or utilities serve as hubs. Examples of these hubs are custodian banks and systems for payment, clearing, settlement, and messaging. A cybersecurity incident could heighten concerns about substitutability — the ability of the financial system to replace lost services — by damaging a key hub and triggering ripple effects through financial institutions and markets.
- **Loss of confidence**. A broad cyber theft targeting customer account information could cause a loss of confidence in financial institutions. For example, in South Korea in 2014 cyber thieves stole customer names, credit card information, and telephone numbers from a consumer credit rating firm. News of the theft triggered a run on the country's banks and many customers canceled their credit cards.
- **Data integrity**. Data integrity is critical. Financial institutions need to recover backup data soon after a cybersecurity incident without compounding risks. Data corruption could disrupt such a recovery effort.

Central Counterparties as Contagion Channels

After the financial crisis, regulators across the world started moving the trading of derivatives from two-way, or bilateral, swap transactions to central clearing through central counterparties (CCPs).

In this country, the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 requires central clearing of all standardized swaps transactions. Central clearing reduces the risk to each party in the transaction from the other party defaulting, but it also concentrates risk in the CCP itself.

CCPs are vulnerable to defaults by their clearing members, typically large and interconnected banks acting as dealers and clearing agents for clients. This vulnerability is heightened by risk concentration, when a handful of large clearing members account for an outsized share of exposures. At most clearing services the five largest clearing members in CCPs account for about half of the outstanding exposures, according to data that CCPs began to disclose this year.

CCPs submit the new data in line with international principles embraced by regulators. These data contain valuable information about the financial condition and risks of CCPs (see **Figure 6**). However, data are reported voluntarily in various formats and at different levels of detail. More consistent data are needed to fully evaluate CCP risks.

Stress testing is a valuable tool for evaluating the resilience of CCPs. In April 2016, European regulators released results of stress tests that evaluated scenarios in which counterparties defaulted among multiple CCPs simultaneously.

In the United States, the Securities and Exchange Commission (SEC) and Commodity Futures Trading Commission (CFTC) are the regulators responsible for CCP oversight. In November 2016, the CFTC released results of a stress test of the five largest CCPs registered with the commission. The test included the 15 largest clearing members and their affiliates at each CCP. The stress scenarios for the test were based on days of extreme volatility, including the day Lehman Brothers collapsed during the financial crisis and the day after the Brexit vote. The stress test showed that the CCPs had sufficient funds to withstand losses to the two clearing members with the biggest exposures in every scenario.

Figure 6. Central Counterparty Resources Available for Defaults from the Five Largest Clearing Members ($ billions)

Required customer initial margin	$187.74
Required house initial margin	$107.04
Total initial margin held less required initial margin	$54.46
CCP "skin in the game"	$0.68
Required prepaid guarantee fund	$20.41
Guarantee fund held in excess of requirement	$1.01
Assessment power	$24.70
TOTAL	**$396.03**

Data as of June 30, 2016.

Sources: Individual central counterparty responses to the Committee on Payments and Market Infrastructures-International Organization of Securities Commissions (CPMI-IOSCO) Principles for Financial Market Infrastructures Quantitative Disclosure Standards for Central Counterparties

Pressure on U.S. Life Insurance Companies

U.S. life insurers face an array of threats, including downward pressure on earnings from low long-term interest rates and sensitivity to stock prices.

Life insurers receive premiums from customers and invest them to generate income for paying claims. Interest rate spreads — the difference between rates earned and rates required to pay claims — are a key component of insurers' earnings. When interest rates fall, actual yields from these investments also fall, reducing insurers' interest rate spreads (see **Figure 7**).

Like banks, insurance companies are locked into the costs of long-term liabilities, so declining yields from their assets reduce their earnings.

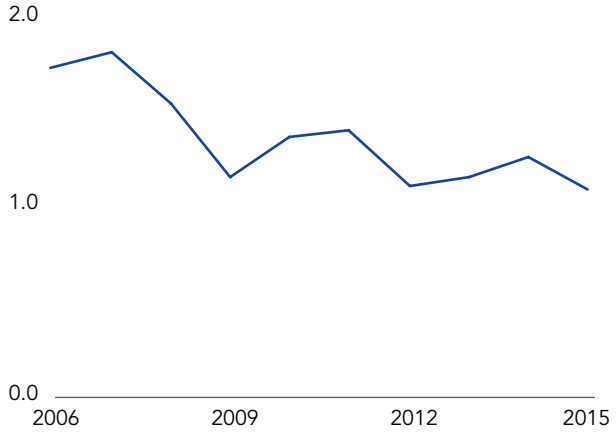
Some firms also have growing exposures to retirement products — including variable annuities and private pension obligations — that are sensitive to these risks.

Life insurers are interconnected with G-SIBs and other financial institutions of all sizes, so significant distress at a large life insurer could result in contagion, impairing other financial firms and markets (see **Figure 8**).

The framework for resolving failed U.S. insurance companies is designed for individual firms and has not been tested for multiple large failures.

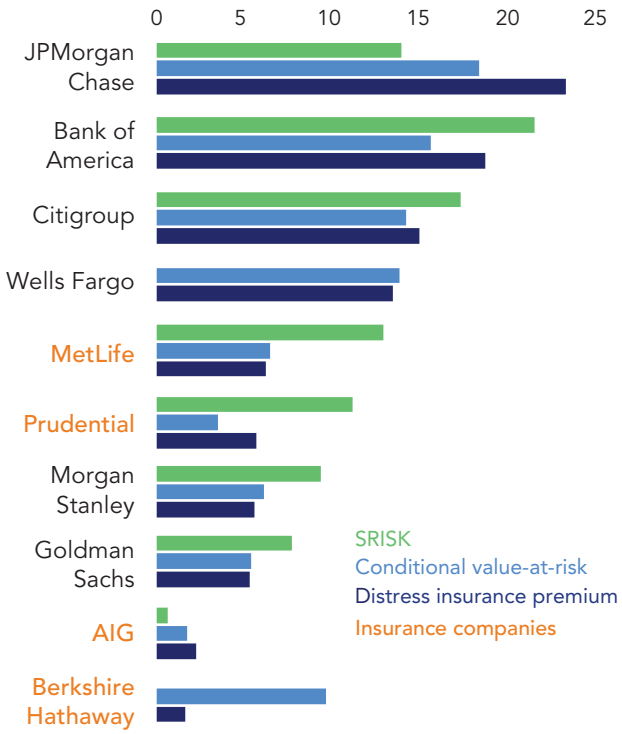
In addition, the resolution framework for a failing insurer relies largely on state guarantee funds. If an insurance company failed, state guarantee funds

Figure 7. Interest Rate Spread for U.S. Insurer Portfolios (percent)



Source: National Association of Insurance Commissioners

Figure 8. Normalized Systemic Risk Measures (percent of systemic risk)



Note: Data as of June 30, 2016. SRISK is a widely cited measure of a financial firm's contribution to systemic risk, and is an estimate of the capital a firm would need in a severe market decline. Distress insurance premium is the hypothetical contribution a financial institution would make to an "insurance premium" that would protect the whole financial system from distress.

Sources: Bloomberg Finance L.P., Markit Group Ltd., the Volatility Laboratory of the NYU Stern Volatility Institute (https://vlab.stern.nyu.edu), OFR analysis

would rely on surviving firms in that state to cover shortfalls to policyholders. This state-based guarantee fund system has not faced an industry-wide solvency crisis; past failures have been small and limited to individual firms.

Systemic Footprints of the Largest U.S. Banks

Reforms after the financial crisis have made the largest banks significantly more resilient. They require these banks to hold more capital as a buffer against losses and other shocks and more liquid assets to meet sudden demands for cash. They also require banks to conduct rigorous stress tests.

Although these requirements have reduced the likelihood of a large bank failing, the potential impact of a large bank failure remains substantial. The "systemic footprint" of the largest banks — their size, complexity, and interconnectedness — constitutes a key threat to financial stability.

The eight U.S. banks identified as G-SIBs hold almost three-fourths of all assets of U.S. bank holding companies.

Substitutability — the ability of the financial system to replace services previously provided by a firm that has failed or otherwise left a line of business — is also a concern.

In July, one of the largest U.S. banks announced it is closing its government securities settlement business by the end of 2017. This decision could concentrate this type of business in another firm. More concentration could raise financial stability concerns.

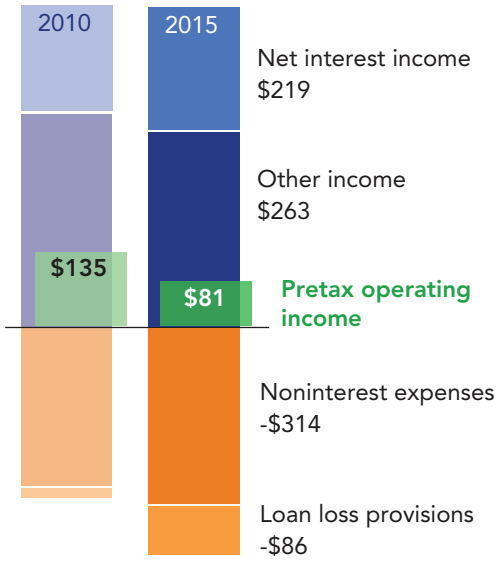
U.S. interest rates remain at or near historic lows, and rates in other advanced economies have fallen below zero. Low long-term interest rates promote economic expansion, but among large banks, the low rates also encourage risk-taking because investors make increasingly risky investments to increase their returns.

Sustained low rates have also combined with growing competition from shadow banks and other factors to undermine profits from the traditional bank services of accepting deposits and making loans. Shadow banking is the extension of credit by nonbank companies or credit funded by liabilities susceptible to runs because they are payable on demand and lack a government backstop.

U.S. G-SIBs' income from the difference between the interest earned on loans and the interest paid on deposits fell $29 billion from 2010 to 2015, with little offset from increases in other sources of net interest income (see **Figure 9**).

Government regulators must ensure that monitoring and stress testing of these institutions take into account the firms' changing business models. They should also continue to require G-SIBs to improve "living

Figure 9. Components of U.S. G-SIBs' Operating Income ($ billions)



Note: Other income includes noninterest income and securities gains or losses. G-SIB stands for global systemically important bank.
Sources: SNL Financial LC, OFR analysis

wills," or resolution plans, by simplifying their structures, ensuring that critical operations could continue even after failure, reducing interconnectedness and providing more transparency about progress in improving their resolution planning.

Deficiencies in Data and Data Management

During the height of the financial crisis, government regulators and financial companies' risk managers lacked timely access to the data they needed to assess exposures and the health of markets. The crisis taught the world that, to measure and monitor risks in the financial system, regulators, financial institutions, researchers, and policymakers need financial data that is

- accurate,
- timely,
- high-quality,
- comprehensive,
- detailed, and
- accessible.

The amount of data available to regulators and the public about banks and mortgage markets has increased since the crisis, but major deficiencies remain.

A fundamental element of the OFR mission is to improve financial data to support the Financial Stability Oversight Council (FSOC) and promote financial stability. Three of the eight core programs of the OFR center on threats from deficiencies in data and data management. These programs focus on data accessibility, quality, and scope.

At the OFR, we have taken a particular interest in data related to shadow banking. Bank-like activities that take place outside the banking industry often face less oversight and transparency.

Since the crisis, the OFR and financial regulators have gained more access to detailed information about shadow banking activities that were largely opaque a decade ago, including data on hedge funds, money market funds, and securities financing transactions.

Projects are underway to expand the scope of information about shadow banking. The OFR is planning permanent data collections on repurchase agreements and securities lending — important sources of short-term funding in the financial industry.

Regulators from around the world are also collaborating on initiatives to improve data quality. Following recommendations by the Group of 20 (G-20) for greater transparency of derivatives markets, its member nations are working through the Committee on Payments and Market Infrastructures-International Organization of Securities Commissions (CPMI-IOSCO) to develop global standards to make derivatives data more consistent, usable, and comparable. The G-20 is a forum of finance ministers and heads of central banks from 19 countries and the EU.

Additional work is taking place through the Financial Stability Board on cross-border harmonization of securities financing data collections.

These standards initiatives and new data collections since the crisis represent

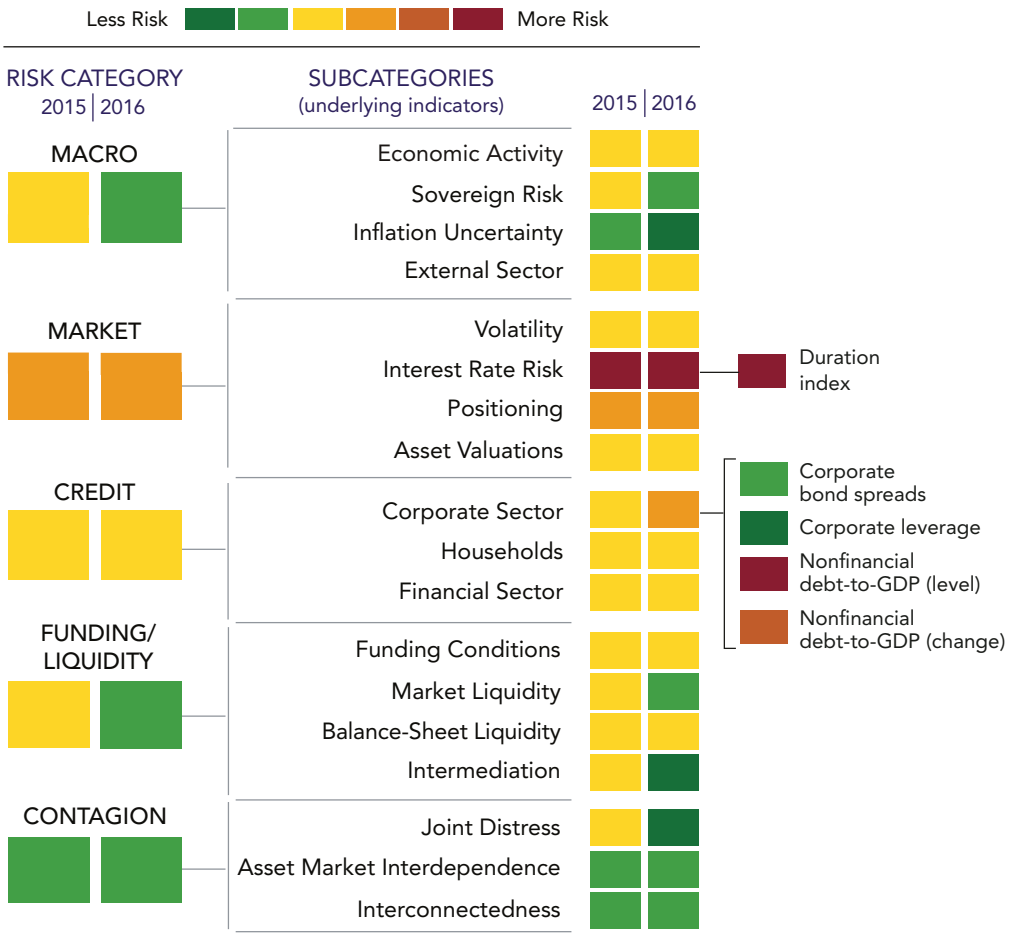
major progress, but there is more work to do. With the quick pace of financial innovation, markets change and new data needs emerge.

Impediments to data sharing are a complication. No single regulator or segment of the industry or market has all of the data required for a complete picture of the financial system and its health. That's why sharing — with appropriate safeguards — is so important.

Financial Stability Monitor

Our Financial Stability Monitor contains the five categories of risk we monitor regularly: (1) macroeconomic, (2) market, (3) credit, (4) funding and liquidity, and (5) contagion. The monitor, a heat map of key risk indicators, contributes to our overall assessment of financial stability (see **Figure 10**).

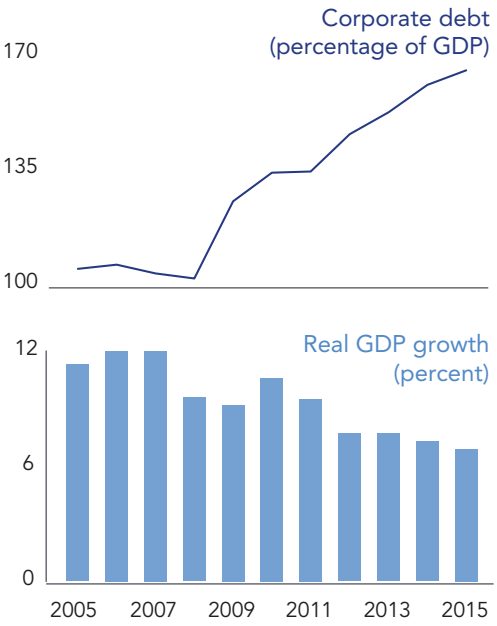
Figure 10. OFR Financial Stability Monitor



Note: Data available as of Oct. 4, 2016. Third quarter 2015 results reflect data not previously available. The colors reported here and in past editions are subject to change because of newly reported data, data revisions, or changes in the historical range due to new observations. GDP stands for gross domestic product.

Sources: Bloomberg Finance L.P., Haver Analytics, SNL Financial LC, OFR analysis

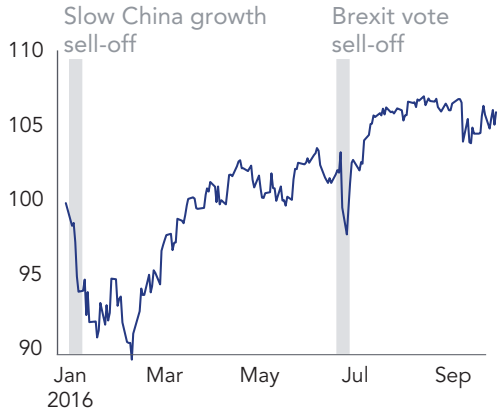
Figure 11. China's Corporate Debt and Real GDP Growth



GDP stands for gross domestic product

Source: Bloomberg Finance L.P.

Figure 12. U.S. Equity Prices (index)



Note: S&P 500 indexed to 100 on Dec. 31, 2015.

Sources: Bloomberg Finance L.P., Haver Analytics, OFR analysis

Since we developed the monitor in 2013, we have continued to refine it. We release updated versions twice each year on our website, as well as in each of our annual reports and financial stability reports.

Macroeconomic

Low oil prices have pushed inflation lower, but the Federal Reserve expects inflation to return to a normal range in coming years.

The slow global growth and strong dollar will continue to put pressure on the earnings of U.S. companies, which may curtail investment and hiring.

The effects of Brexit threaten to spill over into the U.S. economy by creating continued uncertainty about European cohesion that could prompt businesses to postpone investment as Brexit details unfold.

A related threat is spillover to U.S. financial institutions and markets from weaknesses in interconnected EU banks.

Outside of Europe, the risks in emerging markets that we cited in our report last year continue to cause concern. These risks stem from a buildup of debt since the financial crisis and a slowdown in growth that has now lasted for five years.

China is the largest emerging market. Market stress and investment flight from late 2014 to early 2016 have eased in recent quarters, leading to more stability in financial markets and the Chinese economy.

Vulnerabilities remain. China's corporate debt has surged as economic growth has slowed (see **Figure 11**).

Market

The category of market risk remains elevated and its impact cuts across financial stability themes and vulnerabilities. Market risk is the risk of financial losses when asset prices change.

Events in Europe, China, and elsewhere overseas have contributed to the volatility in market prices in 2016. Anxiety about slowing growth in China and globally helped spark a major sell-off in risky assets in January 2016. The Brexit vote triggered another sell-off in June. In both cases, markets rebounded quickly (see **Figure 12**).

Market prices have formed a pattern in recent years of occasional bouts of turbulence interrupting periods of calm.

Low long-term interest rates have also come into play by supporting economic expansion while stoking risk-taking by investors and spurring nonfinancial corporations to pile up debt.

Long-term interest rates have been declining along with inflation for decades in the United States. They have risen since mid-2016 but remain near all-time lows.

For investors in U.S. bonds, low rates have increased risks of heavy losses if interest rates rise, even moderately.

In addition, insurance companies are exposed to mounting market risks. For example, insurers are offering more retirement products that guarantee policyholders certain returns. Some of these products can expose insurers to changes in stock markets because the benefits they guarantee to policyholders are typically payable when market values decline below agreed-to minimums.

Credit

Credit risk — the risk of borrowers or counterparties not meeting their financial obligations — is also elevated because of the rising debt of nonfinancial companies.

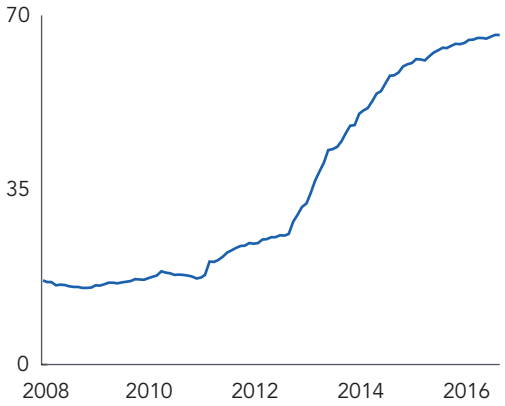
As discussed earlier, the ratio of U.S. nonfinancial corporate debt to GDP is near an all-time high. Measures of firms' debt-to-earnings and debt-to-assets are also high.

"Covenant lite" loans, which lack strict legal covenants, have become much more prevalent and now account for two-thirds of leveraged loans to corporations — loans to companies or individuals already carrying significant loads of debt (see **Figure 13**). Such loans pose an elevated risk of default.

Excessive borrowing by households and financial firms was a key factor underpinning the financial crisis. Debt in these sectors has dropped sharply since the crisis but has risen in other parts of the economy.

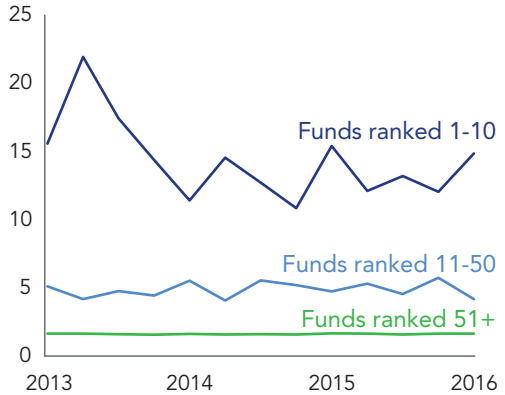
Among some large hedge funds, the use of borrowed money for investments or activities is high (see **Figure 14**). Much of that leverage results from short-term borrowing.

Figure 13. Covenant-Lite Share of Leveraged Loans (percent)



Source: Standard and Poor's Leveraged Commentary & Data

Figure 14. Qualifying Hedge Fund Leverage Ranking by Gross Fund Assets (gross to net assets)



Sources: Securities Exchange Commission Form PF, OFR analysis

Funding and Liquidity

Funding and liquidity risks persist in the U.S. financial system. These types of risk are slow to change.

Funding liquidity relates to run risk — the risk that investors will lose confidence and pull their funding from an institution or market. Market liquidity relates to the risk of fire sales of assets — the risk that market participants won't be able to sell securities quickly without pushing down prices.

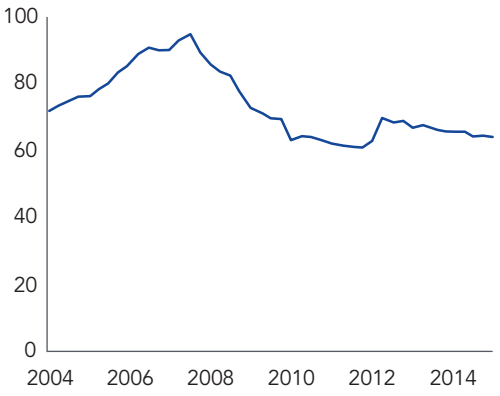
Liabilities payable on demand and not backed by government backstops are susceptible to run risk. The volume of "runnable" liabilities has decreased since the crisis when they were hit by runs and fire sales. Such liabilities include repurchase agreements, securities loans, commercial paper, money market funds, and uninsured bank deposits. Post-crisis reforms partly account for the decrease (see **Figure 15**). The sharp increase in 2013 coincides with the end of temporary unlimited deposit insurance under the Dodd-Frank Act.

Open-ended mutual funds are a type of fund that may face difficulty paying investors on demand during times of stress in financial markets. These funds, which have no restrictions on the amount of shares they can issue, had almost $16 trillion in assets under management in June 2016, nearly double the amount at the end of 2008.

This risk is greatest for funds with limited buffers of cash and investments in high-yield bonds, bank loans, municipal bonds, and other illiquid assets that cannot be converted quickly to cash. During times of market stress, these funds could struggle to meet redemption demands from investors (see **Figure 16**).

Concentrations in some asset classes with few fund managers may also make these markets more vulnerable to stress. For example, only three asset management firms manage nearly 40 percent of municipal bond funds and bank loan funds. The SEC finalized rules in October 2016 to require mutual funds

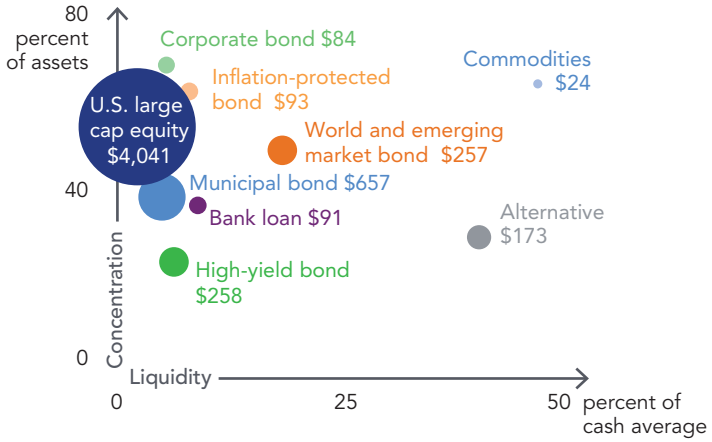
Figure 15. Runnable Liabilities in the U.S. Financial System (percent of GDP)



Note: Data as of Dec. 31, 2015. GDP stands for gross domestic product.

Sources: Federal Reserve Board of Governors, Financial Stability Oversight Council, Haver Analytics, OFR analysis

Figure 16. Size, Liquidity, and Concentration of U.S. Open-Ended Funds in Select Asset Classes ($ billions)



Note: Data as of July 31, 2016. Liquidity is defined as the average percentage of cash and cash equivalents for all funds in each category. Concentration is defined as the top three managers' share of category assets, in percent.

Sources: Morningstar, OFR analysis

and exchange-traded funds that redeem shares in cash to hold more liquid assets so they can accommodate larger-scale redemptions.

Contagion

Contagion risk is the risk of stress spreading through the financial system across markets, institutions, and other entities.

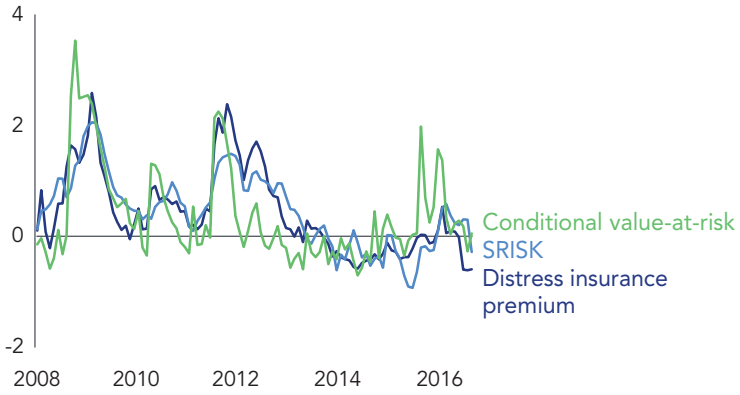
At the OFR, our research emphasizes finding new ways to measure and assess contagion risk.

Three current metrics for gauging contagion risk evaluate the contribution an individual firm makes to financial stability risk, and they can help compare risks posed by individual firms. But the metrics are less reliable in measuring changes in those risks over time and tend to rise only when stress hits.

The three metrics jumped for the six largest bank holding companies during market sell-offs in early 2016, then reverted to long-term average levels when markets recovered. These risk measures generally register lower today than during the financial crisis (see **Figure 17**).

The OFR takes another perspective on contagion risk by gauging the connectivity of financial institutions. An OFR working paper in 2013 proposed such a connectivity index for banks (see **Figure 18**). The index measures the percentage of a bank's liabilities held by other financial institutions. If a bank with a high connectivity rank defaulted, the impact could spill over to other financial institutions.

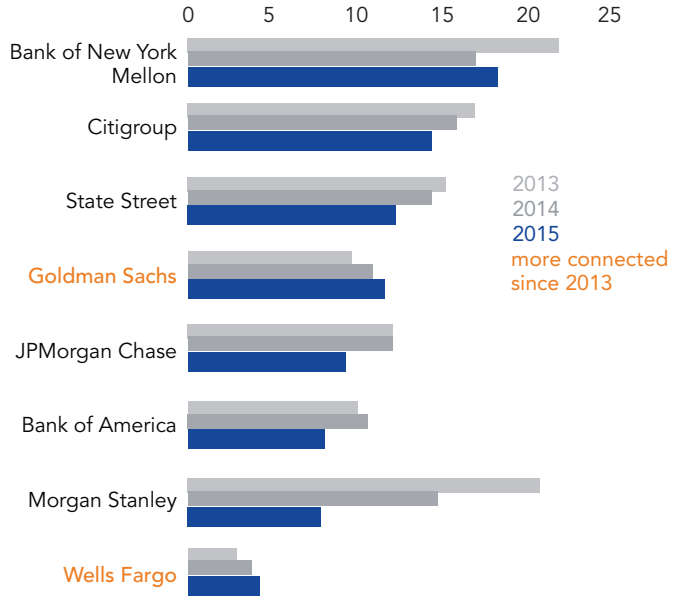
Figure 17. Measures of Joint Distress for the Six Largest U.S. Bank Holding Companies (Z-scores)



Note: Equal-weighted average. The six large bank holding companies are Bank of America, Citigroup, Goldman Sachs, JPMorgan Chase, Morgan Stanley, and Wells Fargo. Z-score represents the distance from the average expressed in standard deviations. SRISK is a widely cited measure of a financial firm's contribution to systemic risk, and is an estimate of the capital a firm would need in a severe market decline. Distress insurance premium is the hypothetical contribution a financial institution would make to an "insurance premium" that would protect the whole financial system from distress.

Sources: Bloomberg Finance L.P., Markit Group Ltd., the Volatility Laboratory of the NYU Stern Volatility Institute (https://vlab.stern.nyu.edu), OFR analysis

Figure 18. OFR Financial Connectivity Index (percent)



Note: G-SIB is global systemically important bank. The OFR Financial Connectivity Index measures the fraction of a bank's liabilities held by other financial institutions.

Sources: Federal Reserve Form Y-15, OFR analysis


Central Counterparties Data Accessibility Data Quality
Data Scope Market Structure Monitors Risks in Financial
Institutions Stress Tests Data Accessibility Data Quality
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Key Findings from the OFR's Research and Analysis of the Financial System

We have learned a great deal since the OFR's inception in 2010 about what works and what does not for the most effective pursuit of the OFR mission.

This chapter describes findings and insights that arise from our work and lead us toward important conclusions. This chapter also describes OFR programs; significant work outside of programs; and key OFR initiatives, projects, and products.

Under the programs, we discuss the findings in OFR working papers and briefs in fiscal year (FY) 2016. All OFR papers are on our website at financialresearch.gov.

Data Findings and Insights

The OFR has a unique mandate and broad authority to gather financial data from across the financial system, including by collaborating with federal financial regulators and collecting data directly from financial companies. Under that mandate, we have a responsibility to rely on data already submitted to authorities before requiring financial companies to submit similar information.

We also have a mandate to standardize the types and formats of financial data, foster appropriate data sharing, and make data accessible while protecting its security.

Indicates an OFR key finding or insight

Of the eight initial programs that closely align our work to our mission, three are related to financial data. The data-related findings and insights in this section draw from our efforts to improve the accessibility, quality, and scope of financial data.

Data Accessibility

At the OFR, we are learning how to overcome obstacles to the appropriate data sharing envisioned in the Dodd-Frank Act.

Examples of OFR Memorandums of Understanding

Federal Reserve	Share data on triparty repurchase agreements
Securities and Exchange Commission	Share data about hedge funds and other private funds that firms submit on Form PF
Bank of England	Share information related to financial stability, including threats and risks, metrics, analysis, data, and information on data standards
FSOC and more than 30 state insurance commissioners	Share data collected by state insurance supervisors on insurance activities, including 18 MOUs in FY 2016
Financial Industry Regulatory Authority	Share data about investment advisers and transactions in corporate bonds and other securities
Federal Reserve (FY 2016)	Share stress testing data that large banks submit on Form Y-14 Share data about financial institutions' exposures in particular countries

We have found that interagency memorandums of understanding (MOUs) are essential tools for overcoming such obstacles by setting the terms for timely and appropriate access to nonpublic data.

In the last several years, we have signed more than 50 MOUs with federal, state, and overseas regulators and others to facilitate data sharing that fosters research and analysis to promote financial stability.

To streamline the process of developing and approving MOUs, we are leading an interagency team of representatives from FSOC member agencies to develop a set of common MOU provisions to decrease the time agency attorneys spend negotiating MOU terms.

We will continue to collaborate to complete this reference set and facilitate its use.

Another important lesson we have learned is that metadata repositories are key building blocks for making data accessible.

Metadata are data about data. By building and linking repositories, we can develop a common understanding among financial regulators about what datasets exist and what datasets are missing — the data gaps that inhibit a fuller grasp of threats to financial stability.

These initiatives are not limited to the United States. The European Central Bank has expressed interest in sharing and linking its metadata. This interest reflects a developing international consensus that global metadata sharing makes metadata more useful in understanding the complex nature of interrelated financial domains and transactions.

During FY 2016, in forums such as the Regulatory Data Workshop and the FSOC's Data Committee, U.S. federal financial regulators discussed how to align efforts to improve metadata management and identify best practices for defining and using metadata.

FSOC member agencies are recognizing that their data management must facilitate information accessibility so authorized users can find needed data and gain easy access. For example, search tools for accessing data must use search terms familiar to end users.

The OFR will continue to champion better metadata use by agencies and facilitate collaboration between agencies to integrate disparate metadata repositories into one comprehensive tool.

Data Quality

The OFR has played a central role in the international public-private partnership that developed the Legal Entity Identifier, or LEI, which is like a bar code for identifying parties in financial transactions. Our work on the LEI laid the foundation for an array of other OFR initiatives on financial data quality standards.

The process used to develop the global LEI system is a blueprint for public-private collaboration that will be the key to success in establishing global data standards.

Standards are essential for using, comparing, and sharing the data necessary for monitoring the stability of the financial system and assessing the impact of systemic shocks.

Data standards benefit market participants and regulators by reducing the cost of data provision and collection and facilitating the exchange, assessment, and aggregation of data for analysis and risk management.

The financial crisis revealed fundamental deficiencies in the ability of market participants to manage and analyze data. The lack of consistent standards prevented institutions from identifying and measuring risks building within and across business lines.

Shortfalls in data standards have lessened some of the benefits of reforms after the crisis. For example, the Dodd-Frank Act required that data on over-the counter derivatives trades be reported to swap data repositories, but data quality has been low.

As a result, work is underway — including in international forums — to harmonize swap data reporting and develop standards.

In July 2016, the SEC announced its adoption of amendments and guidance on regulatory reporting and public dissemination of some swap

transactions. Also in July, CFTC issued a new rule on requirements for reporting data to swap data repositories. The rule goes into effect in late December.

However, better alignment between U.S. regulators is needed. The CFTC and the SEC each ask the industry for different data about swap transactions. They should align their reporting standards for settlement methods, valuation dates, and notional amounts for a more comprehensive view of derivatives transactions.

Another major OFR project on data quality involves the creation of a financial instrument reference database, as required by the Dodd-Frank Act.

The core components of the financial instrument reference database will help the public better understand financial instruments. This deeper understanding will promote financial stability.

A financial instrument reference database is an authoritative source of data describing a financial instrument.

The lack of consistent standards for defining financial instruments was a factor in preventing institutions from assessing and measuring their risks.

Similarly, regulators and supervisors were unable to assess risks comprehensively from firm to firm, among firms, or among other parts of the financial system. The effects trickled down to individual investors who lacked the transparency to assess the crisis' impacts on their portfolios.

To meet the financial instrument reference database mandate requires collaboration between the private and public sectors.

Success in developing data standards depends on stakeholder engagement and a thorough understanding of the industry's underlying business processes and requirements. Without this engagement and understanding, standards may be ineffective, with significantly reduced potential for widespread adoption.

Public-private partnership is also critical when broadening data standards development from the national to the global level. Organizations playing key roles in international standards development include the International Organization for Standardization; the Committee on Payments and Market Infrastructures-International Organization of Securities Commissions, known collectively as CPMI-IOSCO; and the Global Legal Entity Identifier Foundation.

As data standards evolve and business requirements change, public-private partnerships will continue to support financial stability.

Data Scope

Analysis of threats to financial stability requires financial data that are comprehensive and detailed.

Current financial regulatory data collection efforts are fragmented. They also may be duplicative and, in many cases, depend on expensive and antiquated legacy technology. These deficiencies hinder efforts to keep pace with market

innovations and impede creation of a more efficient regulatory environment.

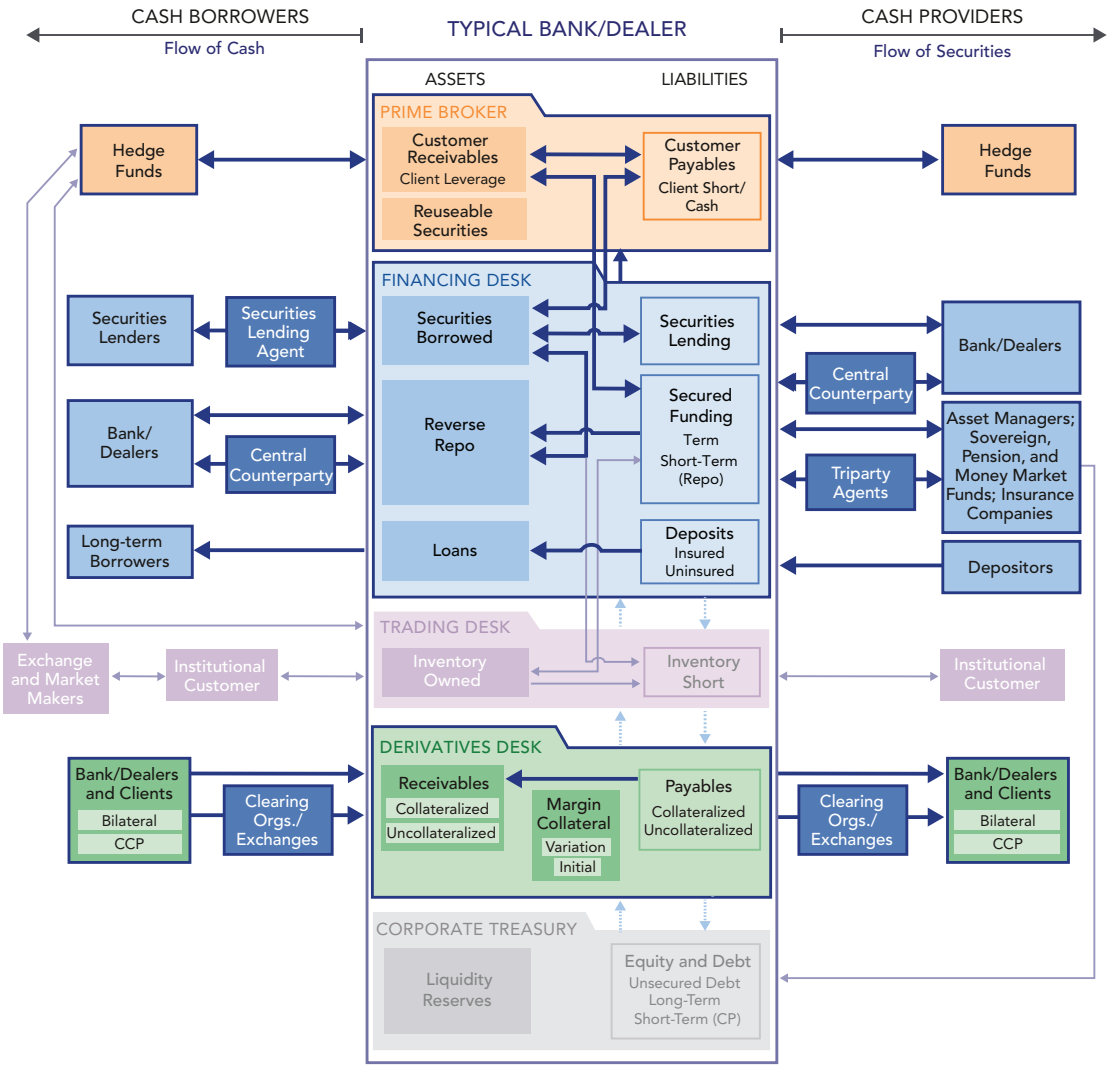
Data mapping is one important tool for improving the scope of financial data while minimizing reporting burdens on the financial industry.

Data mapping can show how a common set of data collected once from a specific industry participant can serve similar needs of several regulators.

An OFR brief and several working papers have introduced and analyzed financial maps that inform our work. We are already seeing the practical benefits of these maps.

For example, a working paper in 2014 used a funding map to illustrate the flow of funding from initial providers through banks and dealers to end users. The funding map was valuable when we planned the interagency data collection pilot on repurchase (repo) agreements; it will support our future efforts in

Figure 19. Detailed Collateral Map



Source: OFR analysis

developing an efficient permanent data collection.

In FY 2016, we published a working paper introducing a collateral map and a brief that brought the funding and collateral maps together with an asset map to form a multilayer map (see **Figure 19**).

In the future, we could use maps to assess the relationship between financial data repositories and transactions. A financial data map could describe the physical characteristics of the data, their boundaries, and the connections between them. We would use the information to define classes of metadata in the metadata repository.

Research Findings and Insights

Our research findings and insights in the briefs and working papers we produced in FY 2016 stem from our ongoing monitoring and analysis of potential vulnerabilities that can threaten the stability of the financial system. They also arise from the research initiatives underway and our ongoing evaluation of financial stability policies.

Stress Testing

The Dodd-Frank Act requires financial companies with more than $10 billion in total assets and regulated by a primary federal financial regulator to conduct annual stress tests. The requirement extends to banks and nonbank financial firms.

Stress tests can support the regulation of these firms by identifying risks that are not fully addressed by standards requiring the firms to hold certain levels of capital or liquidity to make them more resilient.

The tests can also be useful for evaluating risks in financial firms not subject to supervision by federal financial regulators.

Stress tests could be valuable to regulators for probing broad vulnerabilities throughout the U.S. financial system and could be improved by increasing the number of scenarios and types of shocks.

The OFR has a mandate under the Dodd-Frank Act to evaluate and report on stress tests, and stress testing is one of the OFR's eight core programs.

Since 2012, the OFR has published eight papers on the subject. One paper published in 2016 considers how the Federal Reserve's annual stress testing — the Comprehensive Capital Analysis and Review — evaluates the risk that a bank's counterparties will default. It found higher loss concentrations for the banking system than for individual firms and the potential for large indirect losses when a major counterparty defaults.

Regulators could use stress tests to analyze current threats to financial stability, such as the potential impacts of a sharp increase in defaults of nonfinancial firms, paired with sharp drops in prices of stocks and commercial real estate.

Stress tests of banks and nonbanks could identify critical thresholds of weakness and the levels of capital and liquidity needed to reduce potential risks to financial stability. Such tests should be tailored to the business models of different types of firms.

In addition, stress testing could be a valuable tool in assessing the resilience of central counterparties and insurance companies.

Central Counterparties

The Dodd-Frank Act requires central clearing of all standardized swaps transactions. Central counterparties assume each side of a swap contract by becoming a buyer to every seller and a seller to every buyer. This arrangement reduces the risk in two-way swap transactions in which each party bears the risk of the other party defaulting.

New public data and stress tests in 2016 shed light on the potential for a distressed CCP to transmit financial instability.

One of the OFR's eight core programs focuses on CCPs. The OFR has published four papers on the subject, including one in FY 2016.

Life Insurance Industry

Vulnerabilities are rising for life insurance companies and their potential for impact on financial stability.

Sustained low long-term interest rates put pressure on life insurers' earnings because life insurers invest the funds that clients pay in premiums. When interest rates drop, the income that insurers derive from these investments decreases and the pool of funds available to pay claims shrinks.

Potential declines in the value of life insurers' stock holdings and other assets could put pressure on their solvency.

Japan's life insurers faced challenges in the late 1990s amid sustained low interest rates and stock prices.

In 2014, European regulators conducted a stress test of their insurers that included a scenario of low long-term interest rates. The results showed that under this scenario, about a quarter of insurers in the EU would have difficulty meeting their obligations to policyholders in 8 to 11 years. The scenario assumed interest rates well above the rates in Europe in 2016. The stress test also included a more severe scenario that assumed low rates and falling asset prices. In that scenario, 44 percent of these insurers would not have sufficient capital.

In January 2016, large and medium-sized U.S. insurers began submitting to state regulators their results from the Own Risk and Solvency Assessment. These assessments are a good start but need to be more robust. For example, the tests do not use a consistent set of stress scenarios and no template exists for reporting test results.

A large shock to all life insurers or the failure of a single large and highly connected life insurer could affect U.S. financial stability.

Some insurance firms are connected to global systemically important banks (G-SIBs) and other financial firms around the world. For example, data show nine large U.S. and European banks are direct counterparties to about 60 percent of U.S. life insurers' $2 trillion in notional derivatives.

Large Banks

Reforms after the financial crisis brought new and more rigorous regulatory standards for banks. Large banks must hold more capital as a buffer against the impact of losses and shocks, and they must have liquidity readily available to meet sudden demands for cash.

Financial reform also brought a major emphasis on bank stress tests. These tests, and the actions they have required individual companies to take, have helped increase the resilience of the U.S. banking sector.

G-SIBs' business models and risk profiles are evolving in response to earnings held back by low long-term interest rates, competition from shadow banks, and added regulatory requirements. These pressures could spur the banks to seek sources of income with higher potential returns, but also higher risk.

The largest U.S. banks remain a potential source of systemic risk due to their size, complexity, and interconnectedness.

Regulators have also criticized U.S. G-SIBs' resolution plans, or living wills. The need for credible living wills for the largest banks and other financial firms designated as systemically important remains critical unfinished business for financial reform.

Cybersecurity

Cybersecurity incidents pose a clear potential risk to financial stability. The magnitude of the risk and the resilience of financial institutions in responding to these threats are difficult to measure and quantify. Detailed public data on cybersecurity incidents are scarce. However, cybersecurity risks are a growing source of concern for financial institutions.

Cybersecurity incidents can pose a broader risk to financial stability because financial institutions exist within complex networks and rely on electronic transactions that often occur on a rapid, just-in-time basis.

The U.S. government has made substantial progress in sharing information about emerging cybersecurity risks, and U.S. regulators have introduced tools to assess the readiness of financial institutions to meet them.

Regulators can build on this progress by collaborating on a broader approach focused on key links among financial institutions. This collaboration should include regulators and financial firms across different parts of the financial system. Financial regulators and the financial industry would benefit across the board from a shared vocabulary, strategy, enhanced standards, and risk-based approach for combating cybersecurity risks.

Shadow Banking

We define shadow banking as the extension of credit by nonbank companies, or credit funded by liabilities susceptible to runs because they are payable on demand and lack a government backstop.

OFR Shadow Banking Focus Areas

- Run risks in money market funds and similar funds and investment pools
- Run risks and fire sale risks in secured funding markets, such as repurchase agreements and securities lending transactions
- Credit risks for nonbanks that extend credit

Shadow banking is not part of any single OFR program but instead cuts across all of our programs.

Decades before the crisis, financial activities began migrating to new institutions and markets. In some cases, these activities were affiliated with banks but were less transparent and not covered by existing regulations. One reason the crisis was so devastating was that investors and regulators did not recognize the risks this migration created.

Shadow banking is a major provider of financial services in the United States. To understand the risks these activities pose to financial stability, we need to understand the incentives that drive them. These inquiries are central to the OFR's work.

Money Market Funds and Similar Funds and Investment Pools

Runs on prime money market funds accelerated the financial crisis in September 2008 after the Reserve Primary Fund "broke the buck," falling below a net asset value of $1 per share by more than half a cent.

To curb this risk, a recent SEC rule requires prime and tax-exempt money market funds with institutional investors to let their net asset values float with the value of underlying assets.

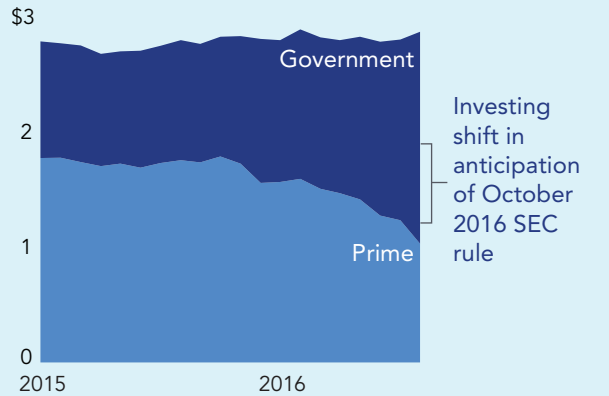
Prime and tax-exempt funds with retail investors may continue to offer a stable net asset value; they may be sold and redeemed at $1 per share but must report the market value of their share prices.

Under the rule, both types of funds must adopt restrictions on redemptions and impose "liquidity fees," fees on redemptions that may rise as a fund's liquidity falls below certain levels. However, each fund's board has the power to suspend these requirements.

In anticipation of this rule, which took effect on Oct. 14, 2016, $1 trillion shifted from prime funds to government funds (see **Figure 20**).

Other funds and pools, some of which report a stable net asset value and have no government backstop, can also be vulnerable to run risk. These vehicles include some short-term investment funds

Figure 20. Assets Under Management in Money Market Funds ($ trillions)



Note: Tax-exempt funds are excluded.
Sources: Securities and Exchange Commission Form N-MFP, OFR analysis

sponsored by banks, local government investment pools, and private liquidity funds.

The OFR recently obtained data that the Office of the Comptroller of the Currency collects from national banks about their short-term investment funds. We also have data that the SEC collects from private liquidity funds. Combined, private liquidity funds and short-term investment funds had more than $500 billion under management at the end of June 2016, according to these data. State-regulated banks and local government investment pools do not report this information.

In July, we launched a U.S. Money Market Fund Monitor. Regulators and others can easily explore fund information by using this interactive online tool, which relies on fund data from the SEC's Form N-MFP.

Secured Funding Markets

Runs and fire sales in secured funding markets also amplified the financial crisis. We are working with other FSOC agencies to fill data gaps in these markets.

We will soon announce details of our proposed permanent bilateral repo data collection, which we plan to follow with a securities lending collection.

Nonbank Credit Providers

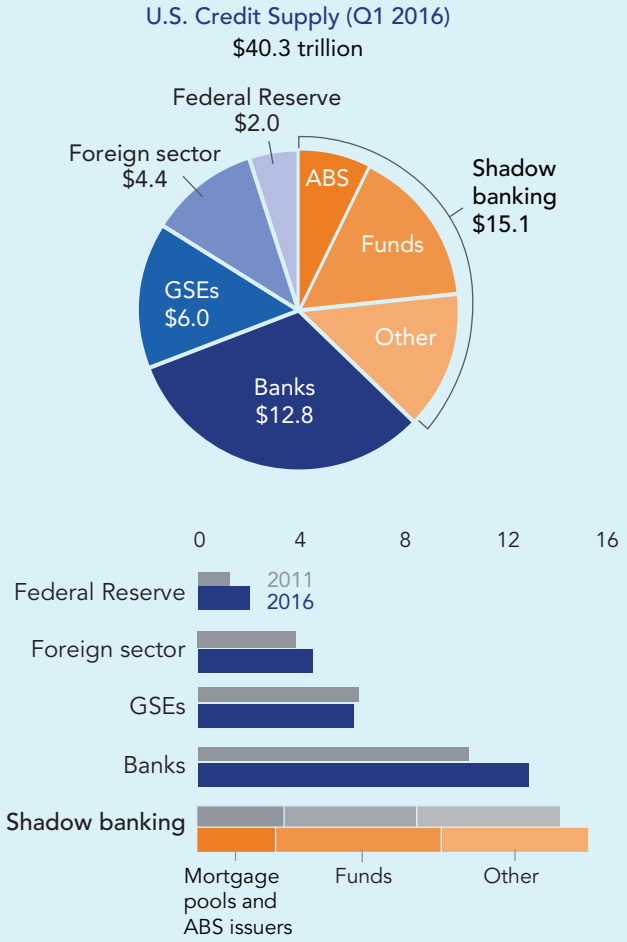
Before the financial crisis, subprime mortgages were packaged together as securities and sold to investors. The collapse of the market for these mortgage-backed securities was a defining event of the financial crisis.

Although asset-backed securities have declined by almost $1 trillion since 2011, shadow banking remains the major source of credit to U.S. businesses and households, providing 38 percent of credit, compared with 32 percent provided by banks (see **Figure 21**).

Overall, shadow banking credit has risen more than $1.2 trillion since 2011, mostly due to growth in mutual funds, hedge funds, and other asset managers.

The SEC's Form PF shows that total investments by hedge funds in loans were $138 billion as of June 2016. Their total investments in corporate loans and fixed-income securities were $662 billion, excluding sovereigns. However, Form PF does not identify borrowers or provide other information to help analyze risks.

Figure 21. Shadow Banking Share of U.S. Credit Supply ($ trillions)



ABS stands for asset-backed securities. GSEs stands for government-sponsored enterprises. "Funds" includes pensions funds, money market funds, mutual funds, exchange-traded funds, real estate investments trusts, and private funds. "Other" includes insurance companies, finance companies, and broker-dealers.

Sources: Haver Analytics, OFR analysis

OFR Programs

In late 2015, we began a major initiative that extends from our strategic planning process and identifies core areas of concentration, or programs, that align our priorities with our mission.

Data Programs

The global financial crisis of 2007-09 reinforced the need to make high-quality financial data available for policymaking and surveillance. The fragmented regulatory environment, domestically and internationally, makes sharing financial data essential to seeing broad risks in the financial system.

Financial data must have three attributes to be useful for policymakers and market participants and to support financial measurement, risk management, and reporting:

- **Accessibility.** Stakeholders must have access to data. Information must be securely and appropriately shared among stakeholders who need it, taking into account privacy and confidentiality concerns.
- **Quality.** Data must be complete, accurate, timely, and easily usable by stakeholders through different systems. Data also must be supported by adequate information technology.
- **Scope.** Data must cover all financial activities that may pose threats to financial stability with sufficient detail to facilitate monitoring and risk assessment.

OFR Programs Focus on Meeting Our Mission

- Improve the accessibility, quality, and scope of financial data.
- Assess and monitor vulnerabilities in the financial system.
- Evaluate policies intended to mitigate financial stability risks and developing tools to monitor emerging risks.

Data Accessibility

Policymakers, regulators, industry participants, and other data users need access to consistent and comparable data to understand, monitor, and manage macroprudential risks — risks that affect financial stability.

Although regulators need to be able to see all information relevant to their areas of responsibility, questions remain about what data have been collected, who has collected data, where data reside, and how data can be accessed securely and confidentially. These questions continue to hinder data sharing among authorities and with the financial services industry.

Many financial data are not currently shared among regulators, industry participants, and the public. Significant concerns about sharing include confidentiality and protecting data from security breaches.

Other significant impediments to sharing financial data include:

Data Accessibility Program Objectives

- Make data understandable to those who need them.
- Provide easy access to the data needed for monitoring, analysis, and risk management.
- Ensure the ability to share and compare financial data.
- Secure financial data to ensure they are kept confidential.
- Collect data only once to address the many needs of all users.

- **Maintaining commercial value of proprietary data**. Data sold or licensed as part of a business have commercial value for the owners. The value could be diminished if unauthorized parties have access to the data.
- **Protecting personally identifiable information**. Data that include personally identifiable information are particularly sensitive because exposure could reveal the identity of individuals.
- **Securing market-sensitive data**. If exposed, market-sensitive data could cause shifts or volatility in financial markets or frustrate competitive dynamics that help markets function.
- **Navigating statutory and other legal constraints.** In the United States, the fragmented regulatory landscape determines who can access certain types of financial data. Confidentiality concerns are heightened with international data sharing because of limited cross-border authority to enforce agreements, resolve disputes, and remedy breaches.
- **Managing data and information security.** Security of data and information requires specific types of controls for organizations that hold data and for organizations that need access to data, such as regulatory agencies. For agencies that hold or seek access to data, security controls need to align to ensure that information and data security are uniform between agencies.

The OFR has a unique mandate to resolve these issues. In pursuing this mandate, we work closely with regulatory organizations whose missions center on other goals. In addition, the OFR is a source of expertise in metadata management and other technological, legal, and research areas needed to establish data sharing infrastructure and best practices.

To address the obstacles that impede data sharing and foster an environment that allows data to be shared, our data accessibility program is building tools that encourage wider data access. In addition, the program is working toward improving memorandums of understanding between regulators and standardizing data security categories.

Metadata Repository

One of the main objectives of the data accessibility program is to build an OFR metadata repository and link it to counterparts at other regulatory agencies.

This approach will position the OFR metadata repository as the premier catalog of financial data, where users

can locate and request access to needed financial data for regulation and policymaking.

The OFR currently maintains a knowledge catalog that serves as the beginning of a metadata repository. The knowledge catalog captures information on OFR datasets and its physical library assets, such as periodicals and books.

The knowledge catalog stores metadata generated when we bring data into the OFR from external sources. We need the ability to add new metadata to new content types, such as new datasets derived from other data.

Another program objective is to develop a data dictionary that ensures internal consistency and transparency of the metadata and the data that the OFR securely brings in, stores, and produces.

The program team also plans to develop a metadata registry as part of the OFR metadata repository. Similar to library catalogs that register all the bibliographic items found in a library, metadata registries categorize and store information about the items in the metadata repository.

The registry must have cross references to similar datasets so data users can locate, request access to, and integrate relevant data from the OFR's stored data.

Initially, the metadata registry will include the data and metadata for the datasets the OFR brings in, stores, and produces. Later, the registry may be extended to include external stakeholder metadata, subject to resolution of any licensing or other legal requirements.

When the repository is complete, we plan to link it to other organizations' metadata repositories, which would help authorized stakeholders find data elsewhere. For example, we will build on the existing Interagency Data Inventory and help other organizations link their metadata catalogs or create catalogs as needed. The current inventory, now on the OFR website, catalogs basic information describing data collected by FSOC member agencies. Although linked metadata repositories will aid stakeholders in locating data, control over the access to the data will always remain with the custodians who hold the data.

The ability to link metadata with corresponding data will mean the OFR maintains the central library of financial data for multiple stakeholders, giving authorized users a single, secure place to find the source of data. At its most advanced stage, the OFR metadata repository is expected to facilitate international data sharing among financial regulators.

The repository is also useful for identifying data gaps to expand the scope of useful data — the aim of our data scope program. In addition, we plan to help stakeholders who need similar capabilities by providing expertise, lessons learned, and best practices to assist in building other repositories.

Data Security Categorization

Definitions of security controls may be different from one organization to another. Tracing data handling categories from one entity to another is more difficult when no consistent framework exists between the organizations

sharing data. For example, the Federal Information Security Management Act of 2002 applies to U.S. federal agencies, but industry participants and foreign regulators use other security categories. Because custodians of data must ensure that data shared will be handled securely, such a mismatch can prevent agencies and entities from sharing data.

Our data accessibility program will develop a single data categorization framework to map data sensitivity levels to security controls. All organizations would be able to map their data security categories and controls to this framework, no matter which framework they had historically used. By mapping to this common framework, entities would be able to compare their own data security categories and controls to those of entities seeking access to data. An entity could then negotiate data access with a clear understanding of how its own security concerns would mesh with the capabilities of another organization seeking to share data.

Data Quality

Improving the quality of financial data and the methods for ensuring data quality will make data more usable, comparable, and sharable.

During the financial crisis, the lack of consistent standards for identifying financial entities and defining financial instruments hindered firms from assessing and measuring risks. Financial regulators and supervisors also struggled to assess risks in the financial system.

In addition, the crisis highlighted the need to improve the internal risk management and reporting capabilities of firms. These deficiencies included the lack of clear data about the ownership structures of firms and the lack of standardized data about over-the-counter derivatives.

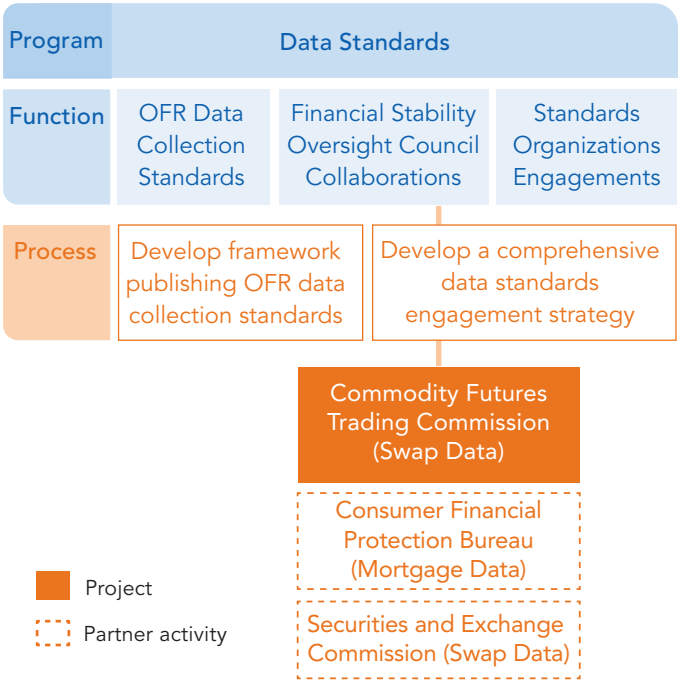
The Dodd-Frank Act requires the OFR to set standards for the types and formats of data the OFR collects for itself and on behalf of the FSOC. Under this authority, and in consultation with other FSOC agencies, we will set standards for the types and formats of the OFR permanent collection of repo and securities lending data.

The Act also calls for the OFR to assist member agencies in developing standards for the data they collect. The OFR has assisted the CFTC through a memorandum of understanding to help improve data quality in swap data repositories, advised the SEC on swap data,

Challenges to Data Quality

- Lack of standard terms and definitions — a common data dictionary — employed throughout the financial and regulatory sectors
- Lack of requirements in regulations for using data standards, such as the Legal Entity Identifier (LEI) and the International Securities Identification Number
- Absence of a free, open-source central utility for the public to research financial instruments and conduct risk analysis

Figure 22. Data Standardization Process



Source: OFR analysis

and advised the Consumer Financial Protection Bureau on mortgage data standards (see Figure 22).

The OFR's data quality program focuses on improving the quality of data available for analysis through application and development of data standards, providing a common reference for industry data and establishing operational excellence in data management.

Some regulators continue to use legacy processes that rely on inadequate standards or proprietary data definitions. These processes often do not allow for effective validation or conformance to structures needed for data sharing. Additionally, as financial markets continue to evolve, the challenge of maintaining data quality will similarly evolve for firms and regulators.

The OFR can identify gaps in data quality and standards, influence development of voluntary data standards by standards organizations around the world, and use rulemaking authority to require that firms adopt consistent standards.

Unlike in other industries, participants in the financial services markets and U.S. regulatory agencies have been slow to adopt best practices for data quality and to define and implement consistent data standards and formats to support risk analysis, management, and reporting. Without shared meaning throughout systems and databases, the industry and the regulatory community will continue to face challenges and operational risks because data cannot be well understood.

Work and planning are underway at the OFR on several data quality projects.

Financial Instrument Reference Database

No widely adopted, free standard currently exists for financial instrument identification or encoding terms and conditions for broad classes of instruments. Section 154 of the Dodd-Frank Act requires the OFR Data Center to "prepare and publish, in a manner easily accessible to the public … a financial instrument reference database."

We have received input from multiple sources, including members of the OFR's Financial Research Advisory Committee, about developing a financial instrument reference database that will serve as a resource for all U.S. market participants and investors.

Instrument Database Core Components

- **Reference Data.** This component will consist of financial instrument reference data provided by commercial data providers included on an authoritative list of providers that conform to the data dictionary and data standards. The reference data will contain a unique identifier and comprehensive descriptive data for each financial instrument within each provider's scope.
- **Data Dictionary.** The data dictionary will list widely used financial terms with consistent definitions. To support the database's capability, reference data providers will use the same data dictionary to ensure consistency. For example, data definitions used in interagency data collection pilots about bilateral repo and securities lending were largely aligned with similar terms in existing regulatory reports.
- **Data Standards.** This component supplements the data dictionary with the definition or identification of data standards to document the formats (the structure and syntax) of financial instrument reference data. Establishing the formats and the common terms and definitions is essential for sharing, comparing, aggregating, and exchanging data.

Essential components for reference data about a financial instrument include identification and descriptions of attributes related to terms and conditions.

A financial instrument reference database will allow cheaper and more efficient analyses for interested parties. Such a database will help define a common language for all securities and financial contracts (conventional or complex) to improve information sharing throughout the financial system.

When we make the database available for public use, a range of market participants may access it to cross-check a reference identifier or an FSOC member agency may use it to align an internal data definition with one at another FSOC member agency.

The OFR financial instrument reference database will bring multiple datasets and tools together in one location, providing common definitions and open-source data for cross-industry data harmonization, that is, removing inconsistencies among datasets to make them compatible.

In 2017, we expect to collaborate with the private sector to validate and prioritize the core components of the instrument database.

We believe this effort will foster consensus among market participants about creating common data terms and definitions, and establishing best practices. The result would be OFR-led public-private partnerships to identify, implement, and share voluntary industry data standards based on consensus.

Data Stewardship

The OFR's data stewardship approach encompasses an internal data quality framework for financial datasets within the OFR. For example, the OFR has developed a process of data quality checking and data enrichment that we apply to money market fund data we receive from the SEC. These data are the

basis for the OFR's U.S. Money Market Fund Monitor.

The main objective of data stewardship is to manage the organization's data assets to improve reusability, accessibility, and quality. Data stewardship, which includes definition of security requirements, is the most important component of a broader initiative to establish best practices in data management throughout the OFR.

The data steward has responsibility for approving business naming standards, developing consistent data definitions, determining data aliases, developing standard calculations and derivations, documenting the business rules of the organization, monitoring the quality of the data in the OFR environment, and defining security requirements.

Through the data quality program, we vet and adopt best practices for data stewardship, ensuring that data obtained and used by the OFR are complete, accurate, timely, and usable. A longer-term goal is for best practices to be adopted by regulators and industry, which will improve data quality throughout the financial system.

The data stewardship project includes data created by the OFR for permanent storage and sharing with external stakeholders, and it will also help other organizations improve their in-house data quality programs.

Data that we purchase under contract from commercial vendors require the lightest touch because of the data quality assurance processes the providers use. Data collected directly from market participants following OFR-specified formats and standards require the most intensive cleansing because the OFR must validate these raw data. Noncommercial datasets acquired from government agencies or financial companies fall in between, depending on the standards and business rules applied.

Financial Entity Identification and Information Integration Challenge

In November 2015, the OFR and the National Institute of Standards and Technology (NIST) announced a challenge for research teams to link four disparate financial datasets.

The goal of the Financial Entity Identification and Information Integration Challenge was for information specialists to develop technologies that automatically align diverse financial entity identification schemes. In July 2016, eight teams shared their results at an industry conference.

NIST issued a grant to the University of Maryland to run the challenge. The organizations worked with subject matter experts from federal regulatory agencies, academia, and the financial industry, including computer and information scientists.

The techniques should enhance the toolkit for researchers, industry participants, and regulators who regularly bring together and align data from a broad array of sources, including financial firms' internal systems, regulatory collections, and public websites. Tools to improve the efficiency and accuracy of these data alignments will be important building blocks for a more resilient financial system.

The Legal Entity Identifier

The Legal Entity Identifier, or LEI, is a data standard for precisely identifying parties to financial transactions. Similar to a bar code, this 20-character reference code uniquely identifies legally distinct entities and includes associated reference data. Two fundamental principles of the LEI code are:

1. **Uniqueness**. Each LEI is assigned to a unique entity.
2. **Exclusivity.** Once a legal entity has an LEI, it cannot ever be issued another.

The LEI can help the financial industry, regulators, and policymakers trace exposures and connections across the financial system. It also generates efficiencies for financial companies in internal reporting, risk management, and in collecting, cleaning, and combining data. In addition, the LEI is expected to ease companies' regulatory reporting burdens by reducing overlap and duplication of the multiple identifiers reporting firms must manage.

The worldwide LEI system reached significant milestones in 2015 when work began on designing the system to capture ownership information. But only some aspects of financial reporting in the United States and abroad require use of the LEI and these, in substantial part, rely on voluntary implementation.

The global effort to establish the LEI is a model for other standards-setting initiatives. Government regulators and private financial firms recognized the tremendous benefit the LEI could bring. Industry provided the technical expertise and officials solved the "collective action" problems that were impeding adoption.

The OFR has led the global LEI initiative as it has progressed from conception to full-fledged operational system in just a few years. Until 2016, the OFR's Chief Counsel chaired the LEI Regulatory Oversight Committee, which oversees the global system.

So far, recognition of the need for the standard has driven LEI adoption across the globe. Like any network, the LEI system has benefits that will grow as the system grows. Universal adoption is necessary to bring efficiencies to reporting entities and useful information to the FSOC, its member agencies, and other policymakers.

To accelerate adoption, the OFR has been calling for regulators to require broader use of the LEI in regulatory reporting. Regulators have begun to respond but more progress is needed.

Data Scope

Gaps in regulatory financial data limit the ability of the FSOC and its member agencies to identify and respond to risks to U.S. financial stability. Currently, the financial community lacks the scope of data needed to understand the financial landscape in sufficient detail.

For example, without access to the information relevant to financial risk oversight, agencies may be hindered in developing regulatory rules to increase market stability or effectively enforce rules already in place.

In addition, global market innovations may result in new data gaps that increase the risk of financial shocks before market participants and regulatory agencies can identify them and take appropriate action.

The Dodd-Frank Act requires the OFR to address problems of data scope.

We have the ability to look across the financial system and collect essential financial data from regulators and market participants. As a result, we can foster greater transparency for regulators, industry, and the public in markets where more comprehensive, detailed data are needed.

Our data scope program is designed to collect new datasets and find new methods for identifying data gaps and new market activities. This work will help make data collecting and reporting more efficient, and reduce the reporting burden on financial institutions and markets.

Improving data scope begins with understanding and documenting the flows of cash and collateral through the financial system, as well as creating an inventory of available financial data. Making such information available to regulators, industry, and the public will help create a more transparent system.

Together, a map of the cash and collateral flows and an inventory can show connections among existing datasets, reveal where data gaps lie, and expose data collections that may need to be eliminated because of duplication. The process also entails regular reviews of existing data, including data collected by other agencies, to promote improvements in current collections and evaluate whether data collections required by regulation will be useful for research.

The OFR's Steps for Improving Data Scope

1. Identify financial stability data needs.
2. Determine gaps and weaknesses.
3. Prioritize and fill the gaps by better organizing existing data, promoting data standards, and sourcing new data when necessary.

Data Scope Program Projects

Global Financial Data Inventory

We will expand the current Interagency Data Inventory to include data available under international regulatory reporting requirements, forming a global financial data inventory. The organizational framework will be based on financial and nonfinancial industry participants, existing and new financial instruments, and trading venues.

The data scope program information will be cross-referenced against the standards and definitions available in the OFR's metadata repository. Financial industry metadata tie together financial activities, the related business records and processes that create data, and the origins of those data.

This integrated metadata catalog content should advance our understanding of activities and corresponding flows in the financial system, allowing us to create additional maps of funding and liquidity, collateral flows, and the "plumbing" of the financial system — the payments, clearing, and settlement systems.

The OFR's Direct Data Collections

Under the data scope program, we plan to deliver a data collection capability

with 21st century technology, security, and processes. We are positioning the OFR to serve as a leader in regulatory collections management and benefit our stakeholders by employing new methods that increase collection efficiency, which in turn can reduce reporting burdens.

Our data collection strategy will outline the framework and elements — people, process, and systems — necessary to stand up an innovative and flexible collection capability. Our goal is for the OFR's collection management practices to set the standard for the global regulatory community.

Bilateral Repo Data and Securities Lending Data Collections

In collaboration with FSOC member agencies, the OFR initiated two voluntary pilot projects to collect samples of data about bilateral repo and securities lending transactions. The OFR conducted the pilots in partnership with the Federal Reserve and the SEC to fill these important data gaps.

Short-term funding markets are instrumental in providing liquidity — the lubrication that helps to keep the global financial system operating — but they remain vulnerable to runs and asset fire sales, posing potential risks to financial stability.

The U.S. repo market provides more than $3 trillion in funding to securities dealers every day.

Industry and regulators need high-quality data about bilateral repos. Information and data on the triparty and GCF repo markets are published regularly, but information about bilateral repos is scant.

Collecting these data on a permanent basis could help regulators identify potential vulnerabilities in a key component of the U.S. financial system.

The projects marked the first time the OFR went directly to industry to collect financial market information. Participation in the pilot projects was voluntary, and participating companies gave input on what data should be gathered.

The first pilot project focused on the bilateral repo market, which represents half of the total repo market.

Securities lending makes financial markets more liquid and allows investors who believe that a security is overvalued to borrow the security and sell it short, hoping to buy it back later at a lower price.

During the financial crisis, some securities lenders had large losses on cash collateral reinvested in other securities. These losses were one of the main reasons the government prevented the bankruptcy of the insurance company, American International Group. The data gaps that prevented regulators from

Two Parts of Repurchase (Repo) Market

Triparty repo market	Transactions are centrally settled by two large clearing banks. This market also includes the general collateral financing (GCF) repo market in which participants' transactions are settled through a central counterparty.
Bilateral repo market	Transactions are cleared and settled privately between two firms.

identifying and addressing risks in these markets during the crisis persist.

The FSOC's *2016 Annual Report* recommended developing a permanent data collection on bilateral repo and securities lending. The OFR plans to address this critical need through a rulemaking to launch ongoing data collections. The collections would include key types of data useful in assessing a range of financial stability risks, such as the buildup of debt in the financial system.

These permanent collections will build on our experiences with the pilots. We will make the collections available to FSOC agencies, and in aggregated form, to the public. These data would also be available for potential inclusion in developing a secured funding rate as an alternative to the London Interbank Offered Rate, or LIBOR.

Reference Rate Project - Alternatives to LIBOR

LIBOR, formerly known as the London Interbank Offered Rate, is a set of interest rate benchmarks calculated based on submissions from contributing banks to indicate the average rate at which they can obtain unsecured funding. U.S. dollar LIBOR is referenced by at least $10 trillion in loans and an estimated $160 trillion of derivatives contracts.

Concerns over manipulation of LIBOR rates and the possibility that the continued production of LIBOR could be in question have led to reform efforts, including an effort to identify alternative reference rates.

To explore possible LIBOR alternatives, the Federal Reserve Board and the Federal Reserve Bank of New York convened the Alternative Reference Rates Committee (ARRC), composed primarily of large swaps dealers. The U.S. Department of the Treasury and the OFR participate in the ARRC as ex-officio members.

The ARRC is considering two rates as possible alternatives:

1. An unsecured funding rate, which would be the Overnight Bank Funding Rate published by the Federal Reserve Bank of New York.
2. A secured funding rate, which is being developed by the Federal Reserve, in cooperation with the OFR.

The ARRC is targeting the second quarter of 2017 for a decision on whether to use an unsecured or a secured rate as a potential LIBOR replacement. The Federal Reserve, in cooperation with the OFR, intends to begin production of a secured rate based on overnight, Treasury-backed repo transactions in the first half of 2018. This rate could potentially serve as a reference rate.

After the ARRC decides on a potential replacement, it will implement a transition strategy, a process that will likely take a period of some years.

U.S. dollar LIBOR is referenced by at least $10 trillion in loans and an estimated $160 trillion of derivatives contracts.

FY 2016 Data Scope Published Works

Developing Best Practices for Regulatory Data Collections

This paper, the OFR's first published nondisclaimed work in the new Viewpoint Paper Series, contained insights about the approaches that deliver the best results in collecting regulatory data. The paper offered guidelines for collecting comprehensive, high quality, and interoperable data for financial stability analysis, market monitoring, and policymaking. The paper also identified pitfalls that financial regulators may encounter.

The paper found that if regulators use current best practices of industry and government, they can collect financial data to answer questions about financial stability. In addition, the paper found that regulators should pay attention to details in each step of the collection process.

These improvements would make regulatory data collection more effective. For example, regulators will be in a better position to evaluate, understand, and work to remove obstacles to collaboration and data sharing and find ways to glean more value from current data collections to draw a more complete picture of the financial system.

We are continuing to work with FSOC member agencies to improve the scope, quality, and accessibility of financial data, especially related to new and emerging sources of potential vulnerabilities. We plan to refine the best practices described in this paper as we learn from our experiences collaborating with financial regulators in conducting data collections from financial market participants. (Viewpoint Paper no. 16-01, May 10, 2016)

The U.S. Bilateral Repo Market: Lessons from a New Survey (Viktoria Baklanova, Cecilia Caglio, Marco Cipriani, and Adam Copeland)

This brief provided aggregate statistics on U.S. dealers' bilateral repurchase, or repo, agreements and economically equivalent securities lending activities. The data were collected from the U.S.-affiliated securities dealers of nine bank holding companies under a voluntary pilot program run by the OFR and the Federal Reserve System with input from the SEC.

The pilot collected valuable quantitative information and laid a foundation for a permanent data collection by identifying challenges of collecting this type of market data. Because this pilot included a limited number of major U.S. broker-dealers, leaving out smaller market participants, we found that the collection did not provide a full picture of the market. The brief cited the need for a larger scope in collecting data on the repo market and the need for better data quality.

The permanent collection that the OFR and financial regulators are now developing builds on the lessons learned from this pilot data collection. (Brief no. 16-01, Jan. 13, 2016)

A Pilot Survey of Agent Securities Lending Activity (Viktoria Baklanova, Cecilia Caglio, Frank Keane, and Burt Porter)

This paper reported aggregate statistics on securities lending activity from a pilot data collection by the OFR, the Federal Reserve System, and the SEC.

This collection found that on average, lending agents reported $9.4 trillion in securities available for lending. Investment firms held nearly $3 trillion of the securities available for lending, while pension funds and endowments had $2.5 trillion available. The dataset also reported lending activity, lending fees, rebate rates, and collateral management.

Filling gaps in data about securities lending is important because, although securities lending makes financial markets more liquid, it may also pose risks to financial stability. The paper cited the need for a permanent collection. (Working Paper no. 16-08, Aug. 23, 2016)

Research Programs

The OFR has had a robust research program and agenda since its inception. Under our programmatic approach, we are focusing our research, analysis, and monitoring on specific financial stability issues central to our mission.

The OFR has several publication series — reports, briefs, working papers, discussion papers, and viewpoint papers — designed to advance understanding of issues related to financial stability. These works elicit discussion among policymakers, researchers, industry representatives, market participants, regulators, academia, and the public.

This section describes our research-related programs and work during FY 2016.

Central Counterparties

The Dodd-Frank Act requires that all standardized swaps be centrally cleared. Clearing financial transactions through central counterparties promises significant benefits in reducing risks from exposure to the default of a counterparty, as long as the CCP has sufficient resources to meet its payment obligations.

The increased use of central clearing and CCPs in the derivatives markets also increases transparency and improves risk management, but central clearing creates a single point of vulnerability for the failure of the system — the CCP. Credit risks, liquidity risks, operational risks, and legal risks are concentrated in the CCP itself.

Trust in the risk management, creditworthiness, and resilience of central counterparties is paramount. Although CCPs individually release information to the public through their rulebooks and to regulators through safety-and-soundness examinations, CCPs also have an interest in evaluating and demonstrating their resilience collectively. Large enough shocks to one CCP could spread to others through clearing members they have in common.

A clearer understanding of the risks posed by CCPs would help clearing members in assessing the risks they face and put regulators and policymakers in a better position to develop appropriate responses to those risks. Potential responses include capital and liquidity requirements for CCPs, resolution and recovery plans, and more robust tools and practices for risk measurement and management for CCPs and their clearing members, typically large and interconnected banks.

Central Counterparties Program Core Components

- **Conduct and publish research** on CCP design, risks, risk management practices, and potential systemic impacts.
- **Collaborate with domestic regulators and international authorities** to assess current data gaps related to CCPs.
- **Develop monitors and other tools** to assess CCP risks.
- **Evaluate domestic and international policies** designed to mitigate CCP risk, including CCP stress testing.

CCPs are supervised by multiple regulators. Although the OFR does not have a supervisory role, we can develop monitoring tools and improve the data available to regulators and market participants. We started our work evaluating vulnerabilities in central clearing and CCPs before we set up the CCP program, producing a number of significant papers exploring issues affecting CCPs.

FY 2016 CCPs Published Work

Does Over-the-Counter Derivatives Reform Incentivize Central Clearing? (Samim Ghamami and Paul Glasserman)

Reforms for the over-the-counter derivatives market sought to reduce risk in the financial system by requiring that standardized over-the-counter derivatives be cleared through CCPs. This paper explored whether reforms introduced in 2009, including higher capital and collateral requirements for derivatives not centrally cleared, created the intended cost incentives to encourage central clearing. The authors compared the total capital and collateral costs between bilateral and central clearing. The paper found that central clearing is sometimes more expensive. When cost favors central clearing, the benefit may be due to insufficient guarantee funds paid by banks to protect CCPs from members' defaults. This situation puts cost incentives that favor central clearing at odds with efforts to maintain sufficient levels of guarantee funds. The paper cited data gaps that would need to be filled for a better understanding of the impact of reforms for the over-the-counter derivatives. (Working Paper no. 16-07, July 26, 2016)

Market Structure

This program follows our mandate in the Dodd-Frank Act "to investigate disruptions and failures in the financial markets, report findings, and make recommendations to the Council based on those findings."

Well-functioning financial markets are essential for the operation of the U.S. financial system. Trading volumes across major asset classes exceed $10 trillion on most trading days. This activity is spread through a wide range of financial instruments that trade in markets with widely varying structures.

A thorough understanding of financial markets' structures is essential to supporting and improving regulation of financial markets and to understanding the causes of disruptions.

A market's structure is determined by whom and how many entities participate; how easy entry is; participants' information, influence over pricing, and business models; how business models are evolving; how prices are formed and trades are executed; and what regulations are in force.

Market structure emerges through a complex interaction of historical precedent, participant incentives, environmental circumstances, and regulation.

Many financial markets have fundamentally changed in the past decade, evolving from human-centric trading with large counterparties matching buyers and sellers to machine-centric trading with multiple smaller counterparties that specialize in providing limited-time liquidity between immediate buyers and

sellers. These new middlemen are often not the ultimate buyer or seller. This environment has created new risks, as shown by the Flash Crash of May 2010 and the Flash Rally of October 2014.

Changes in capital charges for large middlemen, coupled with the phase of the business cycle, have contributed to a perceived reluctance to commit capital to dealing in markets that have historically been less liquid. These changes and other more gradual structural changes in the trading landscape warrant vigilance to avoid the potential systemic risk that would result from a market disruption.

The current regulatory environment for financial markets is split among regulators, such as the SEC, CFTC, and the Federal Reserve. Objectives such as protecting investors and preventing market manipulation generally receive more attention than financial stability.

In this regulatory environment, similar products may have different regulators and trade under different rules. S&P 500 exchange-traded funds and S&P E-mini Financial Index Futures are good examples of assets that have a close fundamental relationship and are simultaneously traded by the same participants but are regulated by different agencies.

We have published a significant body of research on market structure topics since our inception. That research includes mapping of funding and collateral markets, analyzing causes of contagion and interconnectedness in financial markets, and using agent-based models to analyze financial market phenomena.

Market Structure Program Core Components

- **Identify changes in market structure** for key financial instruments and the impact of these changes on risk.
- **Study the links between innovation, regulation, and incentives** on market structures.
- **Identify data gaps** that prevent effective understanding of risks in markets.
- **Develop monitoring tools for insight into market risk** and evaluate policies designed to mitigate these risks.

Monitors Program

The Dodd-Frank Act requires the OFR to develop tools for risk measurement and monitoring. We are fulfilling this requirement by developing and launching a suite of interactive online monitors to assess, measure, and monitor risks throughout the financial system.

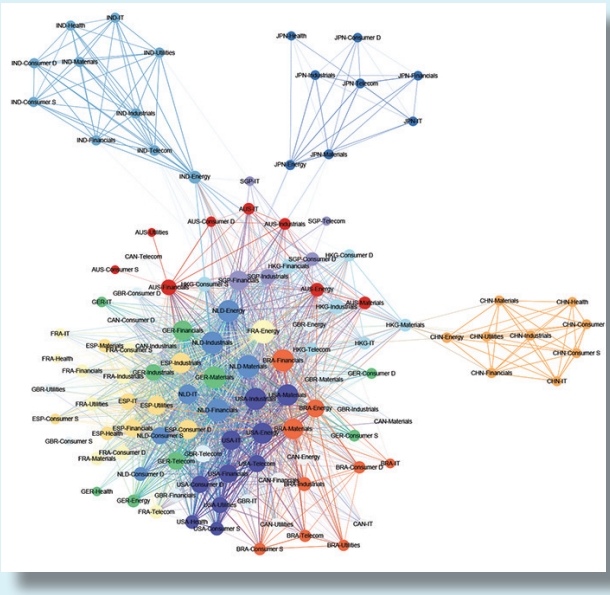
Some OFR monitors are already available to the public. In late July 2016, we launched our interactive U.S. Money Market Fund Monitor. The monitor converts data from the SEC's Form N-MFP into a user-friendly format on the OFR website. Users are able to examine individual funds and the industry as a whole on the basis of credit, interest rate, and liquidity risks. The monitor also helps the OFR and other users understand industry trends and activities in new ways. The monitor analyzes each risk category based on portfolio statistics and holdings.

FY 2016 Market Structure Published Works

Interconnectedness in the Global Financial Market (Matthias Raddant and Dror Y. Kenett)

The global financial system is complex, with many cross-border connections among companies and markets. This working paper found that returns of stocks move together within regions in times of stability but move in sync globally in times of crisis.

The authors analyzed daily and weekly closing prices of nearly 4,000 stocks in 15 countries from 2006 to 2013. Using these data, the authors normalized stock returns and estimated relationships across stocks. They found that countries like the United States and Germany are core nodes that typically have more interconnections among stocks. Analysis of weekly closing prices showed that financial services stocks have the most links. When daily closing prices were analyzed, energy and materials stocks showed the most links. This result may indicate that fast-moving commodity prices influence stocks in their sectors, and movement in the financial services and industrial sectors is influenced by factors that move more slowly. (Working Paper no. 16-09, Sept. 27, 2016)



Looking Deeper, Seeing More: A Multilayer Map of the Financial System (Richard Bookstaber and Dror Y. Kenett)

This brief introduced a three-layer map to illustrate how the circulation of short-term funding, collateral, and assets may spread financial stability risks throughout the U.S. financial system. Potential vulnerabilities and contagion paths emerge as large banks, hedge funds, central clearinghouses, and other market participants become increasingly interconnected.

The brief used the example of Bear Stearns, a New York investment bank that collapsed during the financial crisis and was sold to another bank, to illustrate through a multilayer map how risks begin and spread through the financial system. A single-layer map cannot fully capture the array of activities in the financial system or how different nodes are affected by shocks or disruptions.

The crisis demonstrated the need for a more sophisticated way to monitor the financial system, because risks emerged and spread in unanticipated ways. The multilayer map is a new tool that can prove valuable in tracking contagion in the system, identifying points of vulnerability, and assessing threats to financial stability. (Brief no. 16-06, July 14, 2016)

Map of Collateral Uses and Flows (Andrea Aguiar, Richard Bookstaber, Dror Y. Kenett, and Thomas Wipf)

This working paper mapped the flow of collateral in financial markets. Market participants exchange collateral to support financial activities, including secured funding, securities lending, securities exchanges, margin lending, derivatives, and clearing. This paper showed how collateral can spread stress through the financial system. The paper also explored the effects of new regulations on collateral, including higher demand for high quality liquid assets and lower demand for illiquid collateral. The paper identified several data gaps. For example, existing regulatory and public data exclude derivatives transactions, only report aggregate data from primary dealers, and often lack detail. The collateral map suggests that more detailed, complete data broken out by functional area are needed for better evaluation of the examples. (Working Paper no. 16-06, May 26, 2016)

Monitors Program Core Components

- **Research and development.** Review proof-of-concept ideas for new monitors, build prototypes, and identify gaps in monitoring and data. Incorporate research and feedback as we go.
- **Production process.** Move prototype monitors into production and set standards for data collection and quality, user interface design, data sharing, access, and availability.
- **Web portal.** Securely share the monitors and their data with authorized users through an interactive Web portal.
- **Communication.** Engage with stakeholders to share new releases of monitors, solicit feedback, disseminate analysis, share research results, and help identify risk areas.

The OFR also previously released its biannual Financial Stability Monitor and a quarterly Financial Markets Monitor, which reviews themes and developments in financial markets. In addition, the OFR has a "G-SIB Scores Interactive Chart" on our website, showing systemic importance scores and score components for global systemically important banks.

We are planning public release of additional monitors in coming years.

We envision our monitors program to be a source of high-quality monitoring tools used by key stakeholders, such as the FSOC and its member agencies, members of Congress, financial industry participants, academics, the news media, and the public. The monitors will show emerging trends in the financial system and continue to establish the OFR as a

FY 2016 Monitors Published Works

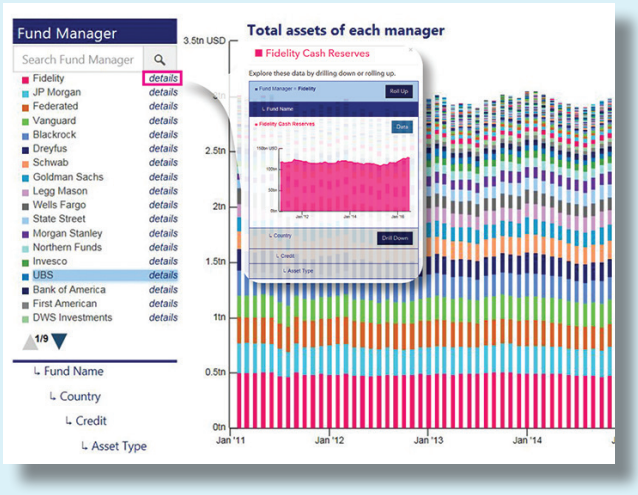
Reference Guide to the OFR's U.S. Money Market Fund Monitor (Viktoria Baklanova and Daniel Stemp)

This brief described the U.S. Money Market Fund Monitor, the online charting tool the OFR launched on July 20, 2016, to help users take a closer look at the portfolios of U.S. money market funds. To develop the tool, the OFR analyzed more than 4 million records of data on the holdings of about 500 funds.

The financial crisis illustrated the vulnerability of money market funds to runs and prompted regulators to implement reforms in this market. Improving transparency was an important component of these reforms.

The OFR used data from the SEC about money market funds to build an interactive set of online charts to analyze key investments and drill down to detailed information. The U.S. MMF Monitor helps regulators and other users track portfolios and risk profiles of funds. The monitor also examines investment trends in the industry. These interactive charts make the analysis of complex data more intuitive and accessible.

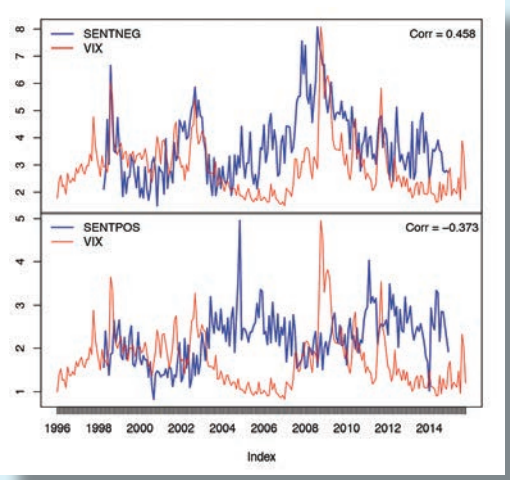
This monitor is part of a suite of monitor products that we are planning as part of our monitors program, including the Financial Stability Monitor introduced in 2013. (Brief no. 16-07, July 20, 2016)



FY 2016 Monitors Published Works, continued

Does Unusual News Forecast Market Stress? (Harry Mamaysky and Paul Glasserman)

This paper investigated the use of automated text analysis by computers to determine whether negative news predicts increased volatility in stock markets. The authors developed a methodology to analyze the text of articles to determine the overall sentiment of an article and classify its degree of "unusualness." They found negative sentiment extracted from more than 360,000 news articles about 50 large financial services companies to be useful in forecasting market volatility. When "unusual" news with negative sentiment increases, stock market volatility also increases. Markets appear to respond to unusual news gradually. This new methodology may be useful in a monitoring tool to help anticipate stress in the financial system. (Working Paper no. 16-04, April 20, 2016)



leader in the field of financial stability monitoring and analysis.

The monitors program also gives the OFR opportunities to collaborate with regulators on new ways to present and analyze their data. The program will not duplicate work by other financial regulators. We plan to create analytical tools that take advantage of other agencies' expertise and develop comprehensive tools that complement existing ones.

Risks in Financial Institutions

The OFR investigates risks arising from the activities of financial institutions as part of our mission to promote financial stability.

The current U.S. regulatory structure fragments supervision and regulation of different types of financial institutions. This fragmentation can make the risk landscape difficult to view and can impede assessment of the impact of government regulations. In addition, recent regulations have added to the complexity of financial institution risk analysis and supervision.

The OFR does not set regulatory policies but instead takes a bird's eye view of the U.S. financial system to track the movement of risks.

The OFR assesses financial stability risks arising from the activities of financial institutions in a dynamic business and regulatory environment. Banks operate under a complex new set of regulatory requirements related to liquidity, capital, and other areas. These requirements are not fully phased in yet. Nonbanks operate in an environment of less prescriptive regulation. All types of financial institutions operate in a business environment characterized by rapid innovation.

For banks, we are primarily concerned with identifying potential conflicts

among requirements, new risk-taking behaviors, and financial innovations that result in additional risks not captured by current and proposed regulations.

For nonbanks, potential systemic risks arise from their varied financial activities, as well as the transmission of systemic risk between banks and nonbanks. Differences in regulation can cause risky activities to migrate from banks to nonbanks.

In addition, public guarantees of some nonbanks' solvency during the financial crisis may create incentives for nonbanks to take risks, much the same way deposit insurance can create risk-taking incentives for banks.Through this program, we will contribute to discussions about nonbank policymaking options. We are pursuing research on all types of nonbanks that can affect the stability of the financial system.

Risks in Financial Institutions Program Core Components

- **Assess the risks financial institutions pose** that current regulations do not address.
- **Identify and fill gaps in data** needed to assess financial stability.
- **Evaluate regulatory policies designed to promote financial stability,** including their interactions and unintended consequences.
- **Monitor and assess risks** related to financial innovations.

FY 2016 Risks in Financial Institutions Published Works

What Can We Learn from Publicly Available Data in Banks' Living Wills? (Steve Bright, Paul Glasserman, Christopher Gregg, and Hashim Hamandi)

This brief analyzed the public portions of resolution plans, or "living wills," in which large U.S. banks describe how they would manage their own potential failures. The authors found that the public information in the living wills is not sufficient to determine whether these banks could go through bankruptcy without extraordinary government support.

For example, living wills' public sections do not address the challenges of the resolution of banks with cross-border activities or provide information about the financial connections between bank holding companies and their subsidiaries. The limitations of the publicly available data in living wills make drawing definitive conclusions difficult, the brief found. It also found that reducing interconnectedness could help in resolving a bank holding company in a fast and orderly way.

Additional data and standardization of the public portions would strengthen the understanding of progress toward resolving U.S. global systemically important banks without extraordinary government support. (Brief no. 16-05, May 25, 2016)

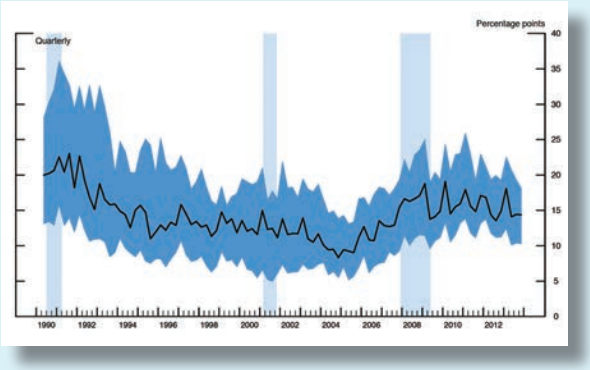
The Real Consequences of Bank Mortgage Lending Standards (Cindy M. Vojtech, Benjamin S. Kay, and John C. Driscoll)

This paper explored the relationship between changing loan standards and loan denial rates, aggregate mortgage credit, and loan performance. By matching responses to the Federal Reserve's Senior Loan Officer Opinion Survey and Home Mortgage Disclosure Act data, the authors found that when respondents report tightening loan standards, mortgage denial rates increase about one percentage point. The increase in denial rates corresponds with a $690 million decrease in total aggregate mortgage credit per quarter. When the survey reports tightening, applications for loans with high interest rates (often subprime and nontraditional mortgages) fall 14 percent to 20 percent.

When the survey reports easing standards, mortgage denial rates decline.

The paper found Metropolitan Statistical Areas with more exposure to banks that reported tightened standards had lower delinquency rates two years after the tightening. House prices fell in these areas.

This trend suggests that tighter lending standards are associated with better loan performance, and changing standards can potentially be used as a leading indicator of the financial industry's vulnerability to shocks. (Working Paper no. 16-05, May 11, 2016)



Credit Ratings in Financial Regulation: What's Changed Since the Dodd-Frank Act? (John Soroushian)

The Dodd-Frank Act required federal regulators to remove credit rating references from their regulations. Regulators have responded by substituting definitions of creditworthiness, requiring regulatory models, and hiring third parties other than rating agencies to set credit standards. This brief examined the challenges of each approach.

Financial regulators have relied on credit rating agencies for decades. Financial institutions could satisfy certain regulations — for example, about how much capital they must have — by holding assets with high ratings from certain recognized rating agencies.

The financial crisis illustrated the potential risks from incentives for credit rating agencies to inflate their ratings to expand their businesses.

However, the brief found that alternatives to credit rating agencies all come with challenges. In addition, the new regulatory framework could promote the growth of new types of services that are similar to rating agencies but subject to less stringent oversight.

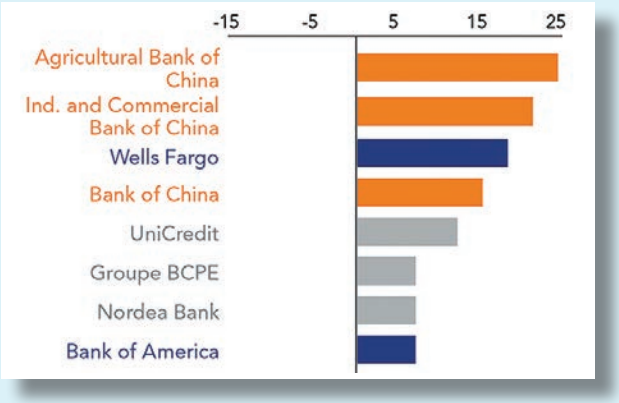
One way to address these concerns would be by using updated credit rating models regularly reviewed by regulators and independent third parties. They could suggest and implement remedies to enhance these models when they identify weaknesses — a complicated task. (Brief no. 16-04, April 21, 2016)

Systemic Importance Data Shed Light on Global Banking Risks (Bert Loudis and Meraj Allahrakha)

This brief used the latest available data to show that U.S. banks remain among the most systemically important banks in the world. Also with this brief, we introduced an online interactive chart to help users compare the 30 G-SIBs.

G-SIBs are banks whose failure could pose the greatest threat to the international financial system. The brief found that, although the systemic importance scores of U.S. G-SIBs are among the highest, the scores of Chinese banks increased the most in the latest year that data were available. According to the data, the systemic importance scores of most U.S. G-SIBs changed little. Wells Fargo was the notable exception; its score rose 18 percent.

For the first time, the Basel Committee publicly disclosed a full list of international banks that submitted systemic importance data. These data allow a deeper analysis of the systemic importance of all reporting banks.



Starting this year, regulators are using the new data to determine capital requirements for these banks. The information also helps in analyzing risks that the largest banks pose to financial stability and how those risks are changing. (Brief no. 16-03, April 13, 2016)

Stopping Contagion with Bailouts: Microevidence from Pennsylvania Bank Networks During the Panic of 1884 (John Bluedorn and Haelim Park)

Little research has been done to understand if and how bailouts can stabilize the financial sector. This paper found that bailouts, either from the public or private sector, can contribute to financial stability by preventing the spread of crises related to systemically important banks.

The authors studied the Panic of 1884. New York clearinghouse member banks assisted Metropolitan National Bank, an important bank for many banks outside of New York City, and prevented a minor crisis in New York from becoming a system-wide event. Even though the actions prevented a system-wide event, the paper cited some near- and medium-term effects on the behavior of banks outside of New York.

Policymakers and regulators are currently working to tighten regulations and end reliance on government-funded bailouts. The persistence of the too-big-to-fail problem highlights the importance of these efforts. (Working Paper no. 16-03, March 30, 2016)

Form PF and Hedge Funds: Risk-measurement Precision for Option Portfolios (Mark D. Flood and Phillip Monin)

This paper examined Form PF as a way to assess systemic risk and investor protection. Form PF implements a Congressional mandate enacted after the financial crisis to report hedge fund risk exposures.

The authors examined risk-measurement tolerances by creating simulated hedge funds and reporting their risk exposures using the instructions on Form PF. The authors assessed how precisely Form PF captured the risk exposures of hedge funds. The paper found that hedge funds with identical presentations on Form PF had significant differences in risk and performance.

Form PF has helped to increase transparency and reduce risk outside the framework of prudential oversight and supervision of the traditional banking system.

The paper suggested changes to improve risk reporting on Form PF. For example, Form PF would be a more precise risk measurement tool if all Form PF filers were required to complete questions that are currently optional, if methodologies were established for calculating certain items on the form, and if the form were revamped to provide more detail. (Working Paper no. 16-02, March 23, 2016)

Mind the Gaps: What Do New Disclosures Tell Us About Life Insurers' Use of Off-Balance-Sheet Captives? (Jill Cetina, Arthur Fliegelman, Jonathan Glicoes, and Ruth Leung)

This brief analyzed regulatory reforms to strengthen disclosure and asset quality standards for U.S. life insurers' use of captive reinsurance. Because of limitations and exemptions, disclosure requirements apply to only 35 percent of the captive industry.

Some U.S. life insurance companies use wholly owned captive reinsurers to reduce regulatory requirements. In a captive reinsurance transaction, a life insurance company transfers risk to a captive reinsurer that is part of the same parent group.

The brief found use of captives by U.S. life and reinsurance companies has increased sharply since 2002. Although captives can be an integral part of a life insurer's operations, they can also cloud regulatory reporting of an insurer's financial position and create "blind spots" in the monitoring of threats to financial stability.

The brief found that publicly available data are insufficient to analyze fully the risks from captives and the impact on insurers' financial conditions. Regulators have revised reporting standards to improve the public data, but gaps remain.

Regulators should require more disclosure about captives and evaluate the case for exemptions to asset quality requirements for captives, the brief said. (Brief no. 16-02, March 17, 2016)

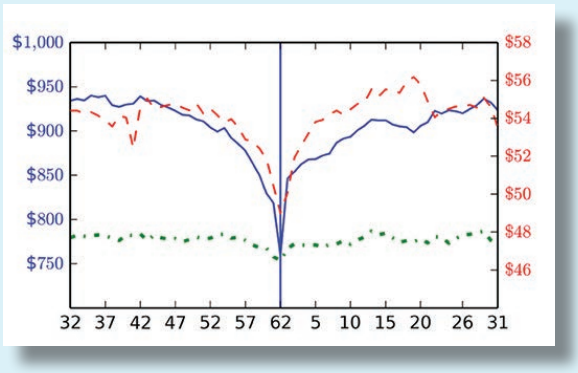
Regulatory Arbitrage in Repo Markets (Benjamin Munyan)

This working paper documented a pattern of foreign-owned broker-dealers reducing their borrowing in the U.S. triparty repo market, a key source of short-term funding in the financial system, at quarter end, and immediately returning to the market when a new quarter begins. This activity reduces their capital requirements under the leverage ratio.

The paper found that non-U.S. banks with low capital ratios appeared to temporarily remove an average of $170 billion from the U.S. repo market before the end of each quarter. It explored how this "window dressing" can create spillover effects and affect systemic risk.

Window dressing understates a bank's leverage and obscures the fact that systemic risk is higher than quarter-end reports indicate. The practice also creates the spillover effect of making the end of the quarter a good time to buy bonds from dealers.

Findings suggest that using daily reporting of a quarterly average for capital requirements could fix the issue. (Working Paper no. 15-22, Oct. 29, 2015)



Contagion in Financial Networks (Paul Glasserman and H. Peyton Young)

This working paper surveyed the growing amount of literature about interconnectedness and financial stability. The interconnectedness of the financial system remains one of the least understood factors of the recent financial crisis.

To determine whether bank interconnectedness promotes greater stability through risk sharing or if it makes markets more fragile by spreading contagion, analysis must account for leverage levels and differences in institution size, the paper found.

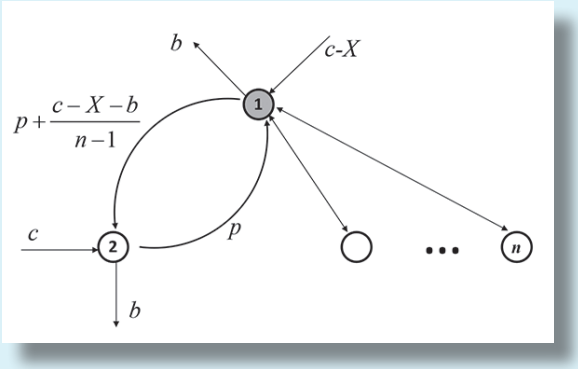
Additional research is needed to find ways to identify the most vulnerable institutions and those most likely to generate contagion and to identify ways to measure the size of a systemwide event. More work is also needed on making inferences from incomplete data and partial observations of network data. (Working Paper no. 15-21, Oct. 20, 2015)

The Difficult Business of Measuring Banks' Liquidity: Understanding the Liquidity Coverage Ratio (Jill Cetina and Katherine Gleason)

Bank regulators adopted a new requirement called the liquidity coverage ratio (LCR) after the financial crisis to help ensure that banks maintain enough liquid assets to cover their financial obligations during times of stress.

This working paper found that a bank's LCR can vary in ways unrelated to underlying liquidity risk. In addition, differences in international and U.S. rules for calculating the LCR reduce the measure's comparability among banks. Changes to the LCR by U.S. regulators could have unintended consequences, such as difficulty in interpreting daily fluctuations in U.S. banks' LCRs.

The paper identified potential methods to make the LCR comparable among banks and to strengthen its efficacy as a regulatory metric. Additional study on the LCR and its implications for central banks' strategies is needed. (Working Paper no. 15-20, Oct. 7, 2015)



Stress Testing

The Dodd-Frank Act set stress testing requirements for large financial firms and requires the OFR to evaluate and report on stress tests.

Since the financial crisis, substantial emphasis has centered on strengthening the supervisory stress testing of banks. Bank capital requirements and liquidity regulation are designed to help banks survive severe shocks, but stress tests can help in identify emerging vulnerabilities.

Stress tests can also offer supervisors greater flexibility in evaluating possible shocks that could differ from previous stress periods used to calibrate banks' regulatory requirements.

In addition, supervisors can use the tests to assess the risk management capabilities of the industries and individual firms they supervise.

Through the stress testing program, we will continue to conduct policy-oriented research and analysis to strengthen U.S. regulators' stress-testing methodologies and approaches.

OFR research in previous years suggested that a broader range of stress scenarios should be considered in U.S. bank stress tests. However, the approach to stress testing in the United States remains essentially microprudential, focusing on the resilience of individual banks to specific shocks rather than on the broader and more complex macroprudential question of how stress might be transmitted among firms, through financial markets, and into the real economy.

Stress tests could show whether certain large firms are more likely to pose systemic risks when adverse situations arise.

Any U.S. financial firm with assets of more than $10 billion and whose primary regulator is a federal agency must conduct annual company-run stress testing.

Government-sponsored enterprises, broker-dealers, asset managers, CCPs, and insurers are all subject to stress testing requirements, but with varying degrees of prescriptiveness. For nonbank financial institutions, capital or liquidity regulation might not exist, depending on the type of firm. Also, some supervisors do not employ standardized scenarios or they view stress testing as a task to be carried out by firms instead of supervisors.

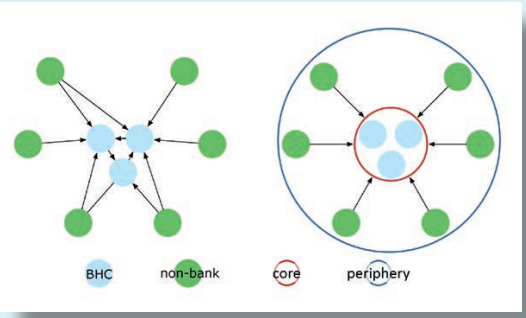
In the fourth quarter of FY 2016, the OFR began to receive stress testing data collected by the Federal Reserve as part of its Comprehensive Capital Analysis and Review for the largest U.S. banks. The OFR plans to begin producing research using these data in FY 2017.

FY 2016 Stress Testing Published Works

Stressed to the Core: Counterparty Concentrations and Systemic Losses in CDS Markets (Jill Cetina, Mark Paddrik, and Sriram Rajan)

This paper applied the Federal Reserve's supervisory stress test scenarios to examine the impacts on banks — and the banking system as a whole — from defaults by their largest counterparties in the credit derivatives markets. The authors found higher loss concentrations for the banking system than for individual firms and the potential for large indirect losses when a major counterparty defaults.

The authors applied supervisory stress test scenarios from the Federal Reserve's Comprehensive Capital Analysis and Review to evaluate the default of a bank's largest counterparty. They found that indirect effects of such a default through the bank's other counterparties would be larger than the direct impact on the bank.



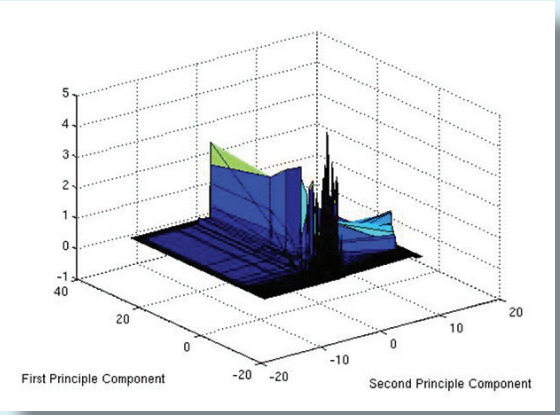
The paper highlighted the importance of robust data collection and analysis by regulators. Specific detailed data are needed to analyze systemic risks.

Government supervisors must also have the capacity to compute market losses similar to the losses that would be realized under stress. Current data collections and analysis may not extend far enough, the paper said. (Working Paper no. 16-01, March 8, 2016)

Measuring the Unmeasurable: An Application of Uncertainty Quantification to Financial Portfolios (Jingnan Chen, Mark D. Flood, and Richard B. Sowers)

Uncertainty is a key factor in financial stability, but measuring and quantifying uncertainty can be difficult. Using engineering techniques that focus on understanding the probability of a system failure such as an airplane crash or bridge collapse, the authors applied stress testing to a portfolio of Treasury bonds.

This paper found that uncertainty in the financial system spiked in late 2008 during the financial crisis, precisely when certainty was needed most. When the method described in this working paper is applied at the level of an individual firm, human decision making can affect the stress testing process; firm-level stress testing will likely never be fully automated. This method works better at the portfolio level and with financial processes that are more automated, such as securities trading and portfolio risk analysis. This methodology will be of greater use as financial processes become increasingly automated. (Working Paper no. 15-19, Oct. 1, 2015)



Activities and Published Work Outside of Programs

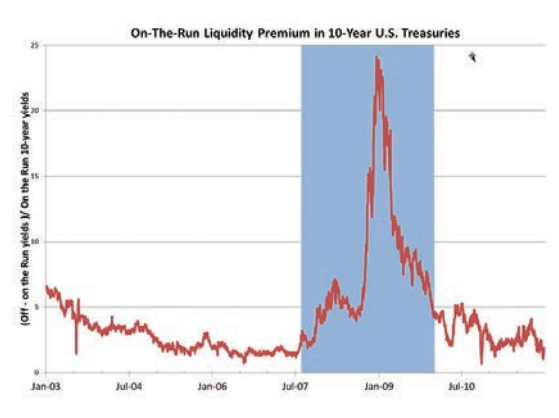
Although the majority of our core work falls securely within our eight current programs, the OFR also has some significant initiatives not aligned with a program, mostly notably, our work on shadow banking. We published one working paper in 2016 not aligned with a program.

FY 2016 Miscellaneous Published Work

Safe Assets as Commodity Money (Maya Eden and Benjamin Kay)

This paper examined the systemic implications of the supply of liquid safe assets, such as Treasury bills. The paper explored how liquid safe assets facilitate the trades of risky assets. The paper found that financial markets may be remarkably resilient to changes in the stock of liquid assets. The paper advanced the understanding of the properties of safe assets as a medium of exchange in financial trading.

The authors found that a monetary system that relies on safe assets as a medium of exchange is relatively efficient. (Working Paper no. 15-23, Nov. 25, 2015)




Central Counterparties Data Accessibility Data Quality
Data Scope Market Structure Monitors Risks in Financial
Institutions Stress Tests Data Accessibility Data Quality
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Status of the Efforts of the OFR in Meeting Its Mission

OFR Mission - Promote financial stability by delivering high-quality financial data, standards, and analysis for the FSOC and the public.

Under the Dodd-Frank Act, a primary purpose of the OFR is to support the FSOC and FSOC-member agencies. We also strive to meet our dual research and data mission by collecting and standardizing financial data, assessing threats to financial stability, and evaluating financial stability policies.

This chapter focuses on our FSOC support and the framework for our programmatic approach to our mission-critical work.

It also discusses how we are working to achieve our mission through wide-ranging collaboration in the United States and internationally, ways we work to ensure we are transparent and accountable, continued execution of our strategic plan, and initiatives to nurture and build our workforce.

In addition, this chapter contains a summary of our budget and highlights of the information technology infrastructure and safeguards essential for our work.

Support of the FSOC and Its Member Agencies

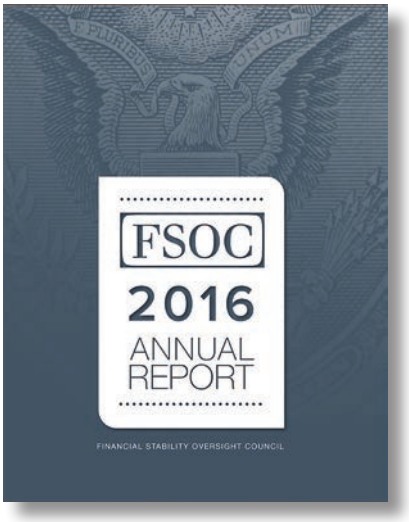
The OFR Director is a nonvoting member of the FSOC, and members of the OFR staff are involved daily in a wide variety of FSOC activities and initiatives.

We chair the FSOC Data Committee, which works on common challenges related to data management and governance. We also co-chair the committee's working group that updates the Interagency Data Inventory, the catalog of data collected by FSOC member agencies. Now in its third year, the inventory references 428 datasets, covering nine FSOC member agencies. The inventory is on the OFR website to promote public understanding of financial regulatory data collections.

We are also participating in the FSOC's analysis of risks in hedge funds and other asset management activities, and we supply monthly data and analysis of market trends.

The OFR contributes to the process of identifying and prioritizing threats to financial stability by presenting updates of our monitors and delivering ongoing threat assessments to the FSOC Systemic Risk Committee.

In addition, we provide data and analysis to support the FSOC's nonbank designation process as the FSOC considers whether nonbank financial firms meet thresholds in the FSOC's initial quantitative metrics and merit further analysis.



OFR staff members also make presentations and participate in discussions for a variety of other FSOC working groups, including the Regulation and Resolution Committee, Insurance Industry Working Group, and CCP Working Group. CCP stands for central counterparty.

In addition, the OFR assists the FSOC in developing its annual report through analysis and writing support.

Finally, the OFR supports the FSOC Secretariat by providing procurement contract support for the Secretariat's purchase of commercial data. This support allows the Secretariat to benefit from OFR expertise on processes and issues related to commercial data acquisition and management.

In fiscal year (FY) 2016, we continued to assist the CFTC — an FSOC member agency — with a project begun in FY 2014 to improve the quality of data collected from swap data repositories. We gave recommendations for the standardization of the large amount of daily data that companies report to repositories about swap trades. The project also analyzed existing swap data to determine the best approach for aggregating data to calculate risk exposures and liquidity.

We also continue to work with FSOC member agencies and other U.S. regulators to require a Legal Entity Identifier (LEI) in data reported to them by mortgage originators, servicers, and others, as well as a universal loan identifier in mortgage transactions and data collections.

In addition, the OFR continued during the fiscal year to engage in the effort begun in 2015 by the primary regulators for the housing and mortgage sectors to convene an interagency workshop on integrating the fragmented data produced by the U.S. mortgage finance system.

Our Programmatic Approach

Late in 2015, we launched our programmatic approach to focus our mission-critical work on the areas most important to our stakeholders and successful pursuit of our mandate under the Dodd-Frank Act.

We initially launched eight programs for coordinating our work on data, research, and analysis. We expect to expand that number over time.

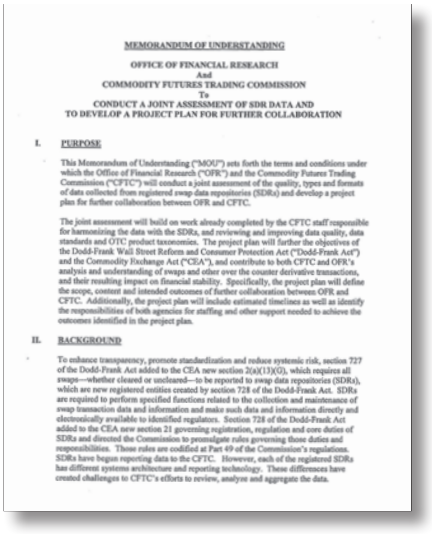
Each program contains an array of elements, including an analytical framework, assessment of risks, identification of data requirements, and evaluation of program-specific policy tools. In each case, we have linked program goals to our statutory requirements.

The approach also includes important internal and external activities that are not part of a program (for example, producing this report), as well as day-to-day activities essential to the operation of the organization.

In FY 2016, we established and built out the governance structure for our programmatic approach, headed by a Program Review Board of senior leaders.

We also continued our work on important projects under the programs during the year and made the results of that work public. In July, we released the U.S. Money Market Fund Monitor on the OFR website.

We plan to build on the programmatic approach in coming years. We believe this approach helps us convey more clearly to Congress and other stakeholders the progress of our day-to-day work toward achieving our statutory mission.



MEMORANDUM OF UNDERSTANDING

OFFICE OF FINANCIAL RESEARCH
And
COMMODITY FUTURES TRADING COMMISSION
To
CONDUCT A JOINT ASSESSMENT OF SDR DATA AND
TO DEVELOP A PROJECT PLAN FOR FURTHER COLLABORATION

I. PURPOSE

This Memorandum of Understanding ("MOU") sets forth the terms and conditions under which the Office of Financial Research ("OFR") and the Commodity Futures Trading Commission ("CFTC") will conduct a joint assessment of the quality, types and formats of data collected from registered swap data repositories (SDRs) and develop a project plan for further collaboration between OFR and CFTC.

The joint assessment will build on work already completed by the CFTC staff responsible for harmonizing the data with the SDRs, and reviewing and improving data quality, data standards and OTC product taxonomies. The project plan will further the objectives of the Dodd-Frank Wall Street Reform and Consumer Protection Act ("Dodd-Frank Act") and the Commodity Exchange Act ("CEA"), and contribute to both CFTC and OFR's analysis and understanding of swaps and other over the counter derivative transactions, and their resulting impact on financial stability. Specifically, the project plan will define the scope, content and intended outcomes of further collaboration between OFR and CFTC. Additionally, the project plan will include estimated timelines as well as identify the responsibilities of both agencies for staffing and other support needed to achieve the outcomes identified in the project plan.

II. BACKGROUND

To enhance transparency, promote standardization and reduce systemic risk, section 727 of the Dodd-Frank Act added to the CEA new section 2(a)(13)(G), which requires all swaps—whether cleared or uncleared—to be reported to swap data repositories (SDRs), which are new registered entities created by section 728 of the Dodd-Frank Act. SDRs are required to perform specified functions related to the collection and maintenance of swap transaction data and information and make such data and information directly and electronically available to identified regulators. Section 728 of the Dodd-Frank Act added to the CEA new section 21 governing registration, regulation and core duties of SDRs and directed the Commission to promulgate rules governing those duties and responsibilities. Those rules are codified at Part 49 of the Commission's regulations. SDRs have begun reporting data to the CFTC. However, each of the registered SDRs has different systems architecture and reporting technology. These differences have created challenges to CFTC's efforts to review, analyze and aggregate the data.

Collaboration

Collaboration is central to the OFR's success. We foster a virtual research-and-data community to extend the reach and impact of what our staff members can accomplish alone by collaborating with colleagues in government, industry, and academia in the United States and around the globe.

We interact with our Financial Research Advisory Committee and benefit greatly from the vast experience and wise counsel of its members.

We also collaborate with colleagues around the world — a necessity for tracking threats to financial stability in an economy that spans national boundaries.

In addition, we engage with Congress, industry organizations, think tanks, and a broad array of other stakeholders to explain our work and its importance, and receive feedback on how we can best pursue it.

To promote dialogue and exploration of issues related to financial stability, we hold and cosponsor conferences and other events.

Our outreach also includes remarks, presentations, and appearances in panel discussions by OFR Director Richard Berner and other members of the OFR staff who speak at events sponsored by industry groups, government regulators, academic institutions, and others.

For example, the Director delivered keynote remarks in June during a conference in Philadelphia sponsored by the Federal Reserve Bank of Philadelphia, the Wharton Financial Institutions Center, the Imperial College Business School, and the Journal of Financial Services Research. He also made remarks in April at the 25th Annual Hyman P. Minsky Conference on the State of the U.S. and World Economies in New York State.

In the international arena, Berner delivered remarks in Basel, Switzerland, in early October at the Third Annual Workshop on Financial Interconnectedness, hosted by the Bank for International Settlements, DeNederlandscheBank, and Deutsche Bundesbank Eurosystem.

Other OFR staff members participated in a conference on securities lending hosted by the Risk Management Association in October and a conference on market liquidity hosted by the Bank of England in December. OFR staff members also participated in a conference on managing financial risks in Colombia in May and the National Bureau of Economic Research summer meetings in July.

Members of the OFR research staff participated as invited speakers or panelists in more than 29 conferences, seminars, and workshops related to our mission in FY 2016.

FY 2016 Financial Stability Sponsored or Cosponsored Events

February 5, 2016	The OFR and the FSOC co-sponsored the fifth annual conference, "Taking Stock of Financial Resilience."	Speakers and panelists included representatives of the Federal Reserve Board, Federal Deposit Insurance Corp., Department of the Treasury, SEC, CFTC, and the financial services industry.
December 3-4, 2015	The OFR and the Federal Reserve Bank of Cleveland cosponsored the conference, "Financial Stability: Policy Analysis and Data Needs."	The event brought together academics, policymakers, and market participants to discuss macroprudential policy development and implementation, tools that measure vulnerabilities in the financial system and identify potential threats to financial stability, and the measurement challenges of implementing Dodd-Frank Act regulations.
October 29-30, 2015	The OFR, the Bank of England, and the European Central Bank co-sponsored the second workshop for central bankers and financial regulators, "Setting Global Standards for Granular Data."	Participants from around the world discussed potential solutions and examples of global standards for detailed data, such as best practices for managing data inventories and taxonomies and standards related to stress testing.
October 22-23, 2015	The OFR and the Center on Finance, Law, and Policy at the University of Michigan cosponsored a conference, "Interdisciplinary Approaches to Financial Stability."	The conference brought together experts and practitioners in policy, law, finance, economics, computer science, neuroscience, engineering, biology, ecology, mathematics, statistics, and other disciplines to learn from each other and gain fresh insights about financial stability.

In addition, the OFR sponsors a Research Seminar Series for OFR staff members to listen to presentations and engage in discussion and debate with outside experts from government agencies, academic institutions, and international organizations. More than 30 outside experts appeared at these seminars during the fiscal year. Titles included:

- "Sovereign Debt Default and Debt Ownership: Domestic Debt as a Commitment Device for Debt Repayment"
- "Contagion in the Credit Default Swap Market"
- "Dynamic Interpretation of Emerging Systemic Risks"
- "Liquidity Regulation and Unintended Financial Transformation in China"
- "Market Dominance and Information Propagation in Bond and CDS Interdealer Networks"

Staff members from the OFR Data Center also collaborated at domestic and international events during the year in the United States and around the world. For example, in May, the OFR Deputy Director and Chief Data Officer participated on a chief data officer panel at the North American Financial Information Summit in New York City. He also spoke on, "Data Strategy, Governance and Company Structure," and served as a panelist in November in New York City at the Standards and Regulation conference of the Society for Worldwide Interbank Financial Telecommunication Institute.

Financial Research Advisory Committee

The Financial Research Advisory Committee, organized in 2012 under the Federal Advisory Committee Act, has 29 members who are experts and practitioners in the fields related to the OFR mission.

The advisory committee met twice in FY 2016. In February, the panel met in the historic Cash Room at the U.S. Department of the Treasury and discussed OFR programs on monitors, central counterparties, data scope, data quality, data accessibility, stress testing, market structure, and risks in financial institutions.

In late July, the committee met at the Federal Reserve Bank of New York and discussed the OFR's latest financial stability assessment, shadow banking, the research agenda of the OFR stress testing program, and projects of the OFR's data programs.

The committee has three subcommittees: (1) Research, (2) Data and Technology, and (3) Financial Services and Risk Management. The subcommittees develop proposals for the full committee to consider recommending to the OFR.

Several working groups have also been established to address topics of particular relevance to the OFR, including financial innovation, global vulnerabilities, and funding and market liquidity.

During the meeting in July, the committee's Government-sponsored Enterprise Working Group and Liquidity Working Group each delivered a

FY 2016 OFR Global Collaboration

- The OFR Deputy Director and Chief Data Officer in the Data Center chaired a panel discussion on "Capital Market Data Harmonisation and Sharing at the EU and Global Levels" at the Eurofi Financial Forum in Bratislava, Slovakia, on September 9, 2016.

  The panel discussed gaps and inconsistencies in global data about capital markets. It also reviewed progress in global data sharing and implementing global data standards, identifiers, and repositories. Panelists included representatives of the European Central Bank, the Bank of Italy, the International Organization of Securities Commissioners, the Society for Worldwide Interbank Financial Telecommunication (SWIFT), and the Depository Trust & Clearing Corporation.

- After completing a third and final year as Chairman of the Regulatory Oversight Committee that oversees the Global Legal Entity Identifier System, the OFR's Chief Counsel continues to serve on the Executive Committee of that body. Several other OFR staff experts also contribute to its work.

- In April 2016, Director Berner participated in a panel at the Eurofi High Level Seminar in Amsterdam on "Repo and Market Making: What Trends and Possible Actions in the Current Regulatory Context?"

- The OFR Director participated in a panel at a European Systemic Risk Board conference in June 2016 on the macroprudential use of margins and haircuts.

- The OFR's Associate Director for Data Strategy and Standards sits on the board of the Accredited Standards Committee X9, an organization that develops financial data standards. The X9 Board of Directors is the U.S. voting body on financial data standards in the International Organization of Standards (ISO). A senior standards specialist from the OFR chairs X9's securities subcommittee, which develops U.S. standards and promotes them to ISO for global use.

- Working on behalf of the Basel Committee on Banking Supervision, a liquidity stress testing working group led by the Associate Director for Policy Studies in the OFR's Research and Analysis Center electronically published a paper in November 2015 for the Bank for International Settlements examining ways to improve bank supervisors' stress tests.

- A senior OFR researcher serves on the Data Experts Group established by the international Financial Stability Board. The group issued a report in November 2015 citing data elements that regulators should collect for a clearer view of securities financing transactions. The data aggregated across jurisdictions will help market monitoring and improve analysis of potential vulnerabilities.

presentation to the full committee and the OFR. The presentations are on the OFR website, www.financialresearch.gov.

Global Counterparts

The worldwide impact of events overseas during the fiscal year, such as the United Kingdom's "Brexit" vote to leave the European Union and sharp declines in the Chinese stock market, served as the latest reminders that the economy is global and the OFR must collaborate on a global scale to promote financial stability.

The OFR serves in leadership roles in international groups dealing with financial stability issues and standards. OFR officials exchange ideas with their colleagues in other countries about best practices and cross-border problems and potential solutions. They also work together on breaking down the barriers to more effective data standards and appropriate data sharing needed for a global view of threats to financial stability.

In FY 2016, we also completed work in on a memorandum of understanding on data sharing with the Bank of England.

In addition, three senior staff members in the OFR Data Center continued to serve on the Working Group for Harmonization of Over-the-Counter Derivatives Data Elements, established by the Committee on Payments and Market Infrastructures – International Organization of Securities Commissions, known collectively as CPMI-IOSCO.

Global Organizations and Development Efforts of the OFR

- Committee on Payments and Market Infrastructures – International Organization of Securities Commissions Data Harmonization Working Group
  - Unique Product Identifier
  - Unique Transaction Identifier
  - Critical Data Elements
  - Enterprise Data Management Council
- Financial Industry Business Ontology (FIBO) Loans & Mortgages
  - FIBO Securities & Equities
  - FIBO Vocabulary
- Global Legal Entity Identifier (LEI) System
  - LEI Regulatory Oversight Committee
- International Organization for Standardization (ISO): via Accredited Standards Committee X9 Inc.
  - ISO 6166: International Securities Identification Numbering System
  - ISO 10962: Classification of Financial Instruments
  - ISO 20022: Universal Financial Industry Message Scheme
  - ISO 17442: Legal Entity Identifier
- Mortgage Industry Standards Maintenance Organization

The working group is developing the unique product identifier, unique transaction identifier, and other standards for critical data elements.

The transaction identifier will help in the matching of trades and preventing duplicate reporting when aggregating information among multiple trade repositories in multiple jurisdictions. The working group is scheduled to release its final consultative report on the transaction identifier in late 2016.

The product identifier will allow for unique identification of products, better data aggregation, and analysis of potential asset-specific risks. The group published its second consultative report on the product identifier in mid-August and is requesting public feedback.

The OFR is also co-chairing a CPMI-IOSCO harmonization group working on standards for critical data elements. That work has prioritized standardization for 86 other data elements important for combining and analyzing data, such as settlement methods, valuation dates, and notional amounts.

The first 14 elements in that group have been standardized. The second batch of 27 data elements representing dates, times, identifiers, and other information is ready to distribute to industry for comment.

Work is continuing on the remaining elements, and the subgroup, co-led by the OFR, is developing a governance infrastructure and collaborating with ISO.

Transparency and Accountability

The OFR promotes transparency and accountability by engaging with Congressional committees with oversight of the Office; responding to information requests from members of Congress and their staffs; answering audit requests, including from the Government Accountability Office; and making the work of the Office accessible to the public through media outreach, our website, and social media.

The work of the OFR continues to be cited as authoritative and enlightening among policymakers, industry participants, and academia.

The OFR produces quarterly reports to Congress as required by the Consolidated Appropriations acts of 2014, 2015, and 2016. The reports describe the OFR's use of funds, staffing levels, and actions to achieve its goals and objectives. The report also includes measures of performance.

The OFR is committed to keeping the public informed of its work and progress. The OFR is aware that transparency is essential to demonstrate to all Americans the importance of its work and its mission of promoting financial stability.

One way the OFR remains transparent is by reaching out to the news media on a routine basis and keeping members of the media informed about OFR products and progress. For example, in July, the OFR held demonstrations of the OFR's U.S. Money Market Fund Monitor for the media in New York and Washington, D.C.

Also in July, OFR Director Berner hosted a media briefing to discuss the OFR's latest financial stability assessment.

Other important channels for making the OFR and its work transparent and accessible to the public are our website at financialresearch.gov and the OFR Twitter site. The website displays a broad array of OFR information and products, including all of our papers series, speeches, reports, monitors, press releases, conference details, and blogs from the Director and other senior managers. In FY 2016, we added short biographies of our researchers and associate directors and descriptions of the eight OFR programs.

On our twitter site, we highlight OFR products, post incisive charts, and notify viewers about the Director's latest speeches.

Another way we notify the public about new OFR work is by sending e-mail alerts to subscribers who have signed up for the alerts on our website. The number of subscribers has grown exponentially in recent years, nearly tripling since we launched our current website in February 2015. In FY 2016 alone, the number of subscribers climbed from about 13,000 to more than 23,000, an increase of 77 percent.

Strategy and Performance

During FY 2016, we continued to execute our FYs 2015-19 Strategic Plan. This

FYs 2015-19 Strategic Plan

The OFR's mission is to promote financial stability by delivering high-quality financial data, standards, and analysis for the Financial Stability Oversight Council and the public.

Goal: The OFR is an essential source of data and analysis for monitoring threats to financial stability.	Goal: Standards that improve the quality and utility of financial data are identified and adopted.	Goal: Leading-edge research improves financial stability monitoring and the scope and quality of financial data, and informs policy and risk management.
■ The OFR's monitoring tools and analyses are widely used and critical to assessing financial stability.	■ Recognition of the need for standards by policymakers and industry.	■ The OFR is the recognized center for objective, innovative research on financial stability.
■ Data used to monitor financial stability are comprehensive, reliable, and accessible to policy-makers and the public through the OFR.	■ The OFR is the source of expert knowledge needed to develop and implement types and formats of data reported and collected.	■ OFR research is widely cited and used to improve policymaking, risk management, financial stability, and the scope and quality of financial data.
■ Data providers and the public trust, acknowledge, and recognize that OFR data are protected and secure.	■ Financial data standards that create efficiencies and facilitate analysis are widely used.	

five-year strategic plan and groundwork for developing and rolling out our programmatic approach give our staff members a clear framework for achieving our mission and guide our work in producing value for stakeholders.

During our planning for executing the OFR programs, we are identifying our needs for skills and staffing to accomplish program objectives, and we are incorporating the results into our workforce plan.

As we follow our strategic plan through FY 2019, we remain mindful that the plan is not set in stone and must be flexible to adjust to changes in circumstances, such as the development of the programmatic approach.

Human Resources

Workforce Planning and Retention

Establishing and sustaining the OFR as a world-class workplace remains the most important human capital goal. To achieve its mission, the OFR must build and maintain a workforce that is diverse and highly skilled.

During FY 2016, the OFR aligned its organizational structure to better support our strategic plan and enhanced its tools for recruitment, retention, and workplace flexibilities to attract and retain high-quality employees.

We conducted a high-level organizational needs assessment and workforce planning exercise to compare the current workforce to our future needs for meeting the mission. The OFR's leadership team continues to focus on functions and positions within each area and on promoting collaboration and teamwork.

The OFR has three centers — the Data Center, the Technology Center, and the Research and Analysis Center — each headed by a Deputy Director. The senior management team is the Director of the OFR, the Chief of Staff, the Deputy Directors of the three centers, and the Chiefs of External Affairs, Operations, and Legal. Most OFR employees are based in the Washington, D.C., headquarters. An office in New York City supports interactions with the financial community. At the end of FY 2016, the OFR had 214 employees (not including contractors, reimbursable, and detailed staff members).

In FY 2016, the senior management team made high priorities of filling the remaining mid-level management positions and building teams to deliver value to stakeholders. The OFR's success relies on teamwork. OFR leaders have taken steps to improve communications, opportunities, and employee engagement and to develop future leaders.

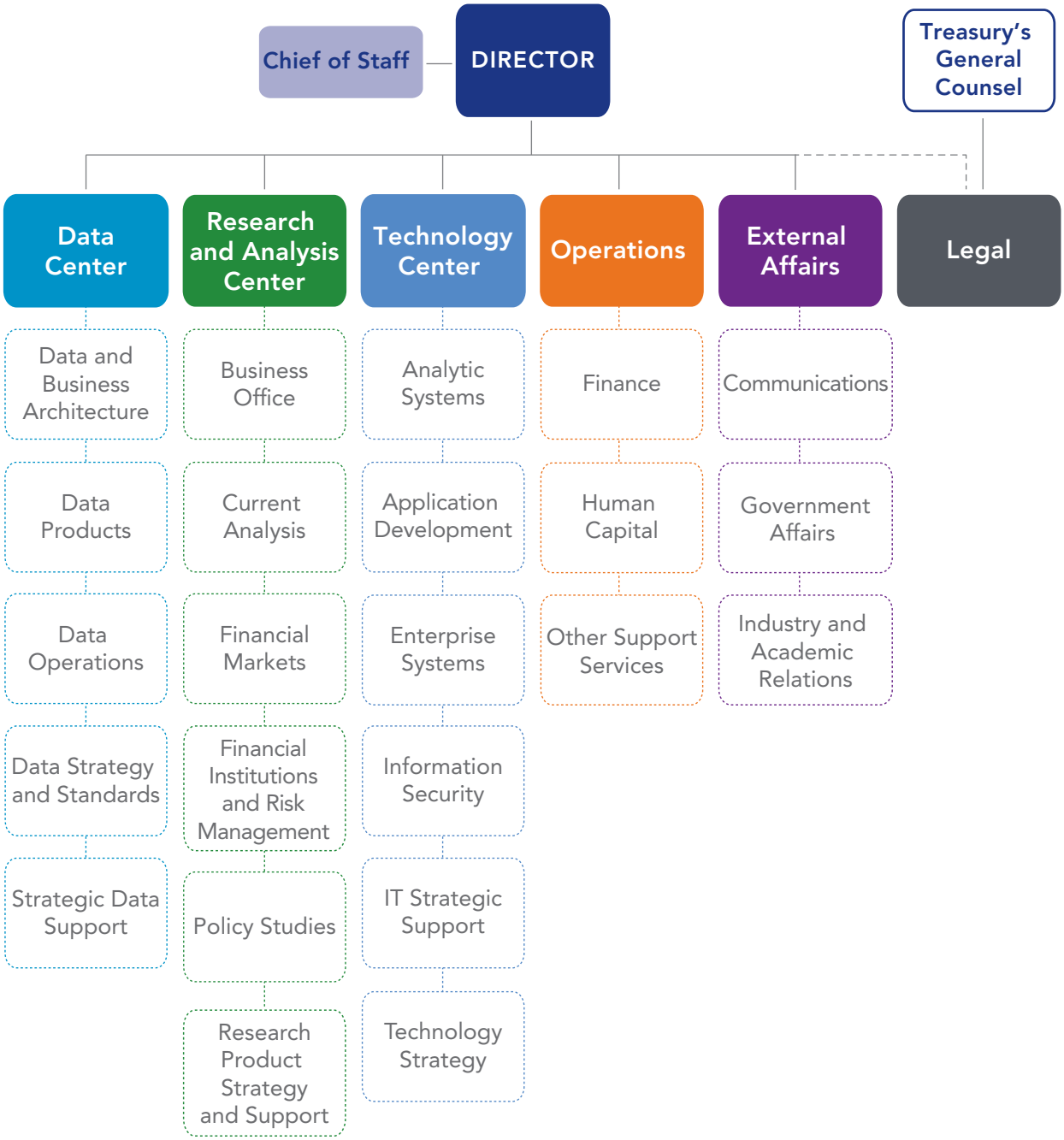
The OFR works to attract and retain employees with the highly specialized skills needed to meet its strategic goals and objectives. Workforce planning helps us identify our needs for a flexible workforce and distinguish requirements for permanent resources from needs for temporary employees or contractors.

The OFR uses Title 5 pay flexibilities, such as recruitment and retention incentives, the student loan repayment program, and credit for nonfederal

service for leave accrual to more effectively attract and retain staff members with critical skills and competencies.

In FY 2016, the OFR focused on workforce and succession planning, including position description reviews and career paths. We also created and implemented a mentoring program pilot to improve leadership and communication skills, employee development, and internal relationships among employees.

Figure 23. OFR Organational Chart



In addition, the OFR made progress during the fiscal year toward delivering on commitments and forecasting needs to fulfill our vision of a virtual research-and-data community that includes visiting scholars who bring their special skills to the OFR for limited periods.

Fellowships and detail arrangements bring staff members from other agencies and external organizations to the OFR workforce with needed skills and experience and offer developmental opportunities for employees. Fellowships and work details also foster collaboration with other organizations that have research and-data-related missions, such as FSOC member agencies.

The OFR supports training and development for all employees. Access to training creates a culture of learning within the OFR and helps employees contribute to the OFR's mission. Employee development through training helps the OFR retain and motivate its diverse and skilled employees to accomplish its mission and meet its goals.

Another way we emphasized the value of our workforce in FY 2016 was by developing and implementing an OFR recognition program to highlight the achievements of our staff members and their contributions to the organization.

OFR Benefits

The OFR strives to recruit and retain top-notch talent; respond to issues raised by employees; be a responsible steward of funds; and maintain comparability with federal financial regulators and other government organizations covered by the Financial Institutions Reform, Recovery, and Enforcement Act (FIRREA). Section 152(d)(3) of the Dodd-Frank Act requires the OFR to "seek to maintain comparability regarding compensation and benefits" with FIRREA agencies.

The OFR faces a challenge in attracting and retaining diverse talent because of competition from businesses, academic institutions, FIRREA agencies, and non-FIRREA financial regulators for prospective candidates with the same specialized skills. The OFR participates in the FIRREA comparability survey and benchmarks salary data and benefits.

In addition, the OFR has workforce flexibility programs to help recruit, retain, and develop a skilled workforce by further encouraging employee productivity and wellness.

The OFR provides leave, telework, and alternative work schedules that allow employees to balance work requirements with family needs. In addition, after a 2015 Supreme Court ruling mandated states to issue and recognize same-sex marriage licenses, federal benefits rules changed to help ensure the federal government is a model employer for diversity, inclusion, and equality.

Budget

Since 2012, the OFR has collected semiannual assessments from bank holding companies with total consolidated assets of $50 billion or more and nonbank financial companies supervised by the Board of Governors of the Federal Reserve System. In the most recent assessment (September 2016), the fee rate was about $2,300 per $1 billion of assets held by the assessed companies.

As the OFR grows, we are continuing to manage expenditures to help ensure we closely tie all spending to our strategic plan objectives and reflect good stewardship of funds. The OFR continues to use reimbursable administrative support services from the U.S. Department of the Treasury's Departmental Offices, personnel benefits services through the Office of the Comptroller of the Currency, and human resources and procurement services from the Bureau of the Fiscal Service's Administrative Resource Center. Use of these services can be more efficient than if the OFR were to provide them on its own.

In FY 2016, the OFR spent about $96 million (see **Figure 24**). Our estimated budget for FY 2017 is $101 million. OFR budget details appear annually in the President's Budget proposal.

Figure 24. OFR Funds Obligated in Fiscal Year (FY) 2016, by Quarter ($ thousands)

	Q1	Q2	Q3	Q4
Compensation	8,942	7,765	7,758	7,763
Benefits	2,535	2,726	3,035	2,735
Labor Total	11,477	10,491	10,793	10,498
Travel	155	117	166	115
Communications and Utilities	0	2	0	0
Printing and Reproduction	1	4	0	6
Other Services*	10,239	3,297	13,896	9,965
Supplies and Materials	1,584	2,070	2,484	3,573
Equipment	0	754	534	3,235
Grants	9	9-	0	900
Nonlabor Total	11,988	6,234	17,080	17,794
TOTAL	$23,465	$16,725	$27,873	$28,292

* Other services include rent and administrative support to human resources, conferences and events, facilities, and procurement

Source: OFR analysis

Information Technology

Information Security

One of the OFR's top priorities is safeguarding sensitive information. The OFR analytical environment (OFRAE) was built to securely support large amounts of data. This support includes creation, collection, use, processing, storage, maintenance, dissemination, disclosure, and disposal of data. The OFRAE contains information technology (IT) systems and tools to conduct analysis on information stored by the OFR.

The OFR continues to cultivate a strong security and privacy awareness culture. As required by statute, all employees with access to nonpublic data are subject to post-employment restrictions to help ensure data security.

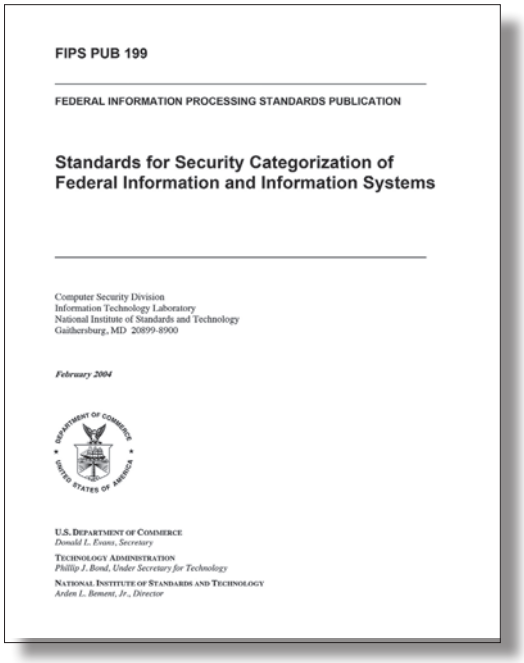
The OFR follows applicable federal regulations, directives, and best practices such as the Federal Information Security Management Act of 2014, OMB Circular A-130, NIST Federal Information Processing Standards (FIPS), and NIST Special Publication 800.

The OFR's information security program works to ensure that the analytic environment has effective security controls and procedures that match the level of risk posed by the information systems, tools, and data the OFR holds.

To safeguard against breaches of confidentiality, integrity, and availability of information within the OFRAE, the OFR performs a security assessment and accreditation process before authorizing an IT system to support information.

All IT systems in the OFRAE passed a triennial certification and accreditation process at the end of FY 2016. The OFR is currently working toward implementing the U.S. Department of Homeland Security's Continuous Diagnostics and Mitigation program and Einstein 3 Accelerated security services within the OFRAE.

Information processed, stored, and transmitted within the OFRAE must receive a data classification level, which follows a documented process that begins with the identification and categorization of data in accordance with NIST FIPS Publication 199, (Standards for Security Categorization of Federal Information and Information Systems). The process defines security controls and associated handling requirements to help ensure data are kept secure throughout their lifecycle.



FIPS PUB 199

FEDERAL INFORMATION PROCESSING STANDARDS PUBLICATION

Standards for Security Categorization of Federal Information and Information Systems

Computer Security Division
Information Technology Laboratory
National Institute of Standards and Technology
Gaithersburg, MD 20899-8900

February 2004

U.S. DEPARTMENT OF COMMERCE
Donald L. Evans, Secretary
TECHNOLOGY ADMINISTRATION
Phillip J. Bond, Under Secretary for Technology
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
Arden L. Bement, Jr., Director

Security Assessment Steps

Our security assessment is in accordance with NIST Special Publication 800-37 (Guide for Applying the Risk Management Framework to Federal Information Systems). The assessment follows these steps:

1. Categorize the type of information to be processed, transmitted, or stored within the IT system by performing a comprehensive impact-level assessment according to NIST Federal Information Processing Standard (FIPS) Publication 199 (Standards for Security Categorization of Federal Information and Information Systems).
2. Select applicable security controls from NIST SP 800-53 Revision 4 (Security and Privacy Controls for Federal Information Systems and Organizations) and identify security controls based on organizational need to reduce risk to an acceptable level.
3. Implement physical, technical, and administrative security controls for the IT system.
4. Independently assess the effectiveness of the implemented security controls in accordance with NIST SP 800-53A Revision 4 (Assessing Security and Privacy Controls in Federal Information Systems and Organizations) to help ensure the security controls are adequately functioning.
5. If all identified security controls pass assessment, present security assessment report to the designated authorizing official for final decision on whether to grant the authorization to operate the IT system.
6. Load information into the IT system if authorization to operate is granted. After the information is loaded, continuously monitor, assess (internally and independently), and maintain security posture while in production. The IT system is decommissioned when it is no longer needed or unable to maintain adequate security posture.

The OFR reviews the classification process at multiple levels to help ensure accurate FIPS categorization, including an assessment to identify personally identifiable information and risk to personal privacy. After an OFR data classification for a dataset is determined, the dataset is brought into the environment according to a process with multiple layers of security controls.

Once information is loaded into an authorized OFRAE IT system, OFR users must request permission for access. Requests are reviewed at multiple levels to verify a valid need for access and confirm that access adheres to terms of applicable agreements related to the information. Information access is subject to periodic auditing and granted only on a per-user basis. Access control allows security groups and policies to be applied at a detailed level, ensuring a high degree of oversight.

Access to the analytic environment is managed through documented procedures and granted on a need-to-know basis. Special security training is required for elevated privileges in accordance with NIST SP 800-16 Revision 1 (A Role-Based Model for Federal Information Technology/Cybersecurity Training).

All of these safeguards are overlaid with an extensive training program for users.

The OFR continues to strengthen its privacy program operations by developing a series of internal procedures and guidance for OFR employees handling personally identifiable information and building a culture that promotes information privacy through transparency, accountability, and efficiency.

As a key part of our information security program, the privacy program oversees the safeguarding of personally identifiable information, including its appropriate collection, use, maintenance, dissemination, and destruction.

The OFR recognizes its responsibility to safeguard data collected and used in support of its mission. Appropriate management of all data ensures that the OFR remains an essential source of data and analysis for monitoring threats to financial stability.

IT Projects

The OFR Technology Center spent much of FYs 2013-15 deploying the core analytic and nonanalytic IT systems for the OFR. During FY 2016, the Technology Center worked on expanding those systems to meet the evolving objectives of the OFR.

Analytic Systems

The OFR's analytic environment comprises several distinct platforms. Combined, the systems have 50 terabytes of memory, 2,000 core processors, and 7 petabytes of storage.

Before FY 2016, systems users needed a high degree of technical knowledge to leverage the full power of the systems.

In FY 2016, the Technology Center deployed an enhanced architecture that allows users to run most analytic tools on any underlying platform and includes an interface that makes the system easier to use. End users of all skill levels can now take advantage of the full power of the OFR's analytic systems while using their most familiar analytic tools. System usage has increased by 350 percent.

Collaboration and Coordination Systems

In conjunction with other OFR divisions, the Technology Center completed implementation in FY 2016 of the OFR's internal collaboration and coordination systems. This collection of systems provides project and portfolio management, customer relationship management, and internal SharePoint-based collaboration. The collection also includes the OFR Knowledge Catalog and its metadata repository. Extensive process automation was completed and will continue to be expanded.

Participation in Government Initiatives

As an office within the Department of the Treasury, the OFR participates in the Department's implementation of the Federal IT Acquisition Reform Act and complies with all relevant information technology reporting requirements.


Central Counterparties Data Accessibility Data Quality Data Scope Market Structure Monitors Risks in Financial Institutions Stress Tests

Our programmatic approach and its eight initial programs form the framework for the ongoing pursuit of our mission.

In the past year, we have built the governance for this framework while we worked on a parallel track on the important research, analysis, and data-related initiatives described in this report.

As we noted, we have made a lot of progress, but much more work remains.

Some of the key projects we are pursuing next year by program are:

- **Data Accessibility** – Build a prototype of a metadata repository that will become the premier catalog of financial data for regulation and policymaking and link it to such repositories at other regulatory agencies.
- **Data Quality** – Publish a white paper for public comment about how we plan to develop and make available a financial instrument reference database — envisioned as a widely adopted, free standard.
- **Data Scope** – Launch a rulemaking process to create permanent data collections on bilateral repurchase agreements and securities lending markets. Continue to participate with the Federal Reserve in a project to explore possible alternatives to a set of interest rate benchmarks formerly known as the London Interbank Offered Rate or LIBOR.
- **Central Counterparties** – Analyze and publish reports on potential risks to financial stability and data gaps related to central clearing by CCPs.

Our Future Direction

Our strategic plan contains eight high-level guideposts for the OFR's future direction:

1. Be a trusted partner among FSOC agencies in efficiently filling critical gaps in financial data, standardizing essential data, and making them appropriately and securely available through sharing.
2. Continue to support the FSOC, as mandated by the Dodd-Frank Act.
3. Be a trusted and objective source of data and analysis by consistently and routinely providing valuable offerings effectively and efficiently to stakeholders.
4. Publish rules that promote the standardization of data to improve their quality and reduce regulatory reporting burdens.
5. Work through OFR programs to analyze and monitor the biggest risks to U.S. financial stability, homegrown and global.
6. Promote comprehensive analysis and monitoring of vulnerabilities and their implications for systemwide resilience, including low-impact vulnerabilities that, linked together, can add up to a vulnerability larger than the sum of its parts.
7. Analyze a wide range of financial stability topics for the benefit of OFR stakeholders to promote understanding of financial stability issues and to inform and support policy decisions.
8. Maintain strong working relationships with regulatory bodies, Congress, industry, the academic community, and the public.

- **Market Structure** – Partner with the SEC and CFTC to analyze the interplay among the markets supervised by the two agencies. This type of analysis could enhance market oversight and financial stability monitoring by facilitating early detection of cross-market behavior that may disrupt markets and by aiding in forensic analysis and enforcement after a market disruption.
- **Monitors** – Continue to improve our Financial Stability Monitor and U.S. Money Market Fund Monitor, and develop and make other monitors public as appropriate.
- **Risks in Financial Institutions** – Expand our analytical capacity, tools, and metrics for assessing cybersecurity risks.
- **Stress Testing** – Analyze and evaluate the Federal Reserve's stress tests using data newly acquired from the Federal Reserve. Make the results of that analysis public.

We are also continuing to explore risks posed by shadow banking, work that cuts across our programs. Our shadow banking analysis pays particular attention to risks in money market funds; risks in similar funds and investment pools; risks of fire sales and runs in secured funding markets, such as repurchase agreements and securities lending transactions; and risks from nonbanks that extend credit.

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