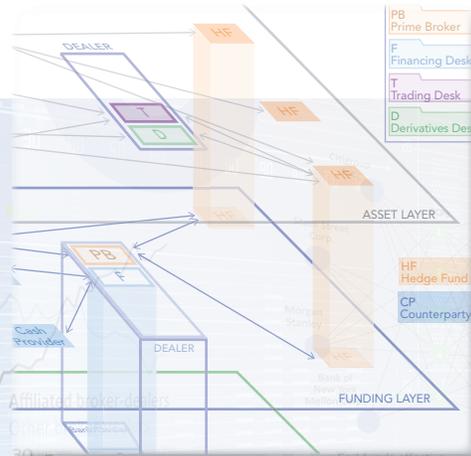




OFFICE OF FINANCIAL RESEARCH

2015 Annual Report to Congress

- Volatility
- Interest Rate Risk
- Positioning
- Asset Valuations
- Corporate Sector
- Households
- Financial Sector
- Funding Conditions



Threats
Research and Data
Mission

I am pleased to present the Office of Financial Research *2015 Annual Report to Congress*. Like the three preceding it, this fourth annual report analyzes potential threats to U.S. financial stability, documents our progress in meeting the mission of the Office of Financial Research (OFR), and reports on key research findings.

Over the past year, the resilience of the United States financial system has continued to improve and threats to overall U.S. financial stability remain moderate. Both are trends we've discussed for the past four years. But as we've also previously warned, there's no cause for complacency.

In fact, several financial stability risks have continued to edge higher over the past year. Three major themes stand out: (1) the persistent effects of low interest rates, (2) elevated and rising credit risks, and (3) the uneven resilience of the financial system.

This year we are reporting to Congress and the public in two installments. We presented to the public in-depth analyses in our *2015 Financial Stability Report* in December. In addition to summarizing those analyses, this *Annual Report to Congress* documents our progress and presents plans for further advancement this year and in coming years. I hope that, taken together, 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 the ways we pursue it.

These reports, like the three we published previously, reflect the views of the OFR and our staff. As before, however, we also benefitted from consultation with Financial Stability Oversight Council member organizations and their staffs. Consultation and collaboration — with our domestic and global counterparts — is essential for our work and a critical ingredient in fostering what we call a virtual research-and-data community.

The OFR has continued its progress in FY 2015 in meeting its unique, multipart mission. Although the core of our mission includes both financial data and research, it is the data part of our mission that makes the OFR unique. Our mandates to improve the scope, the quality, and the accessibility of financial data are designed to expand our capacity and that of our stakeholders to spot and track vulnerabilities in the financial system. Here, we report our progress in pursuing our data initiatives, as well as our plans for enhancing them.

No less important, our independent research mandate is critical for three reasons. First, it is essential for fulfilling our data mandates and is complementary to them. Framing

Letter from the Director continued

how we assess and monitor threats to financial stability is essential to fill data gaps with high-quality financial information fit for its intended purpose. In addition, our research agenda is central to filling gaps in our understanding, develop new tools for analysis, and assess the resilience of the financial system. Finally, as an independent office that does not make policy, the OFR is guided by an objective research agenda in fulfilling the mandate to study and advise on the impact of policies related to financial stability, including evaluating and reporting on stress tests. We report here the significant progress we've made in meeting this analytical mandate.

The OFR has developed a strategic plan and built a strong research-and-data organization to meet our mission. We have assembled a world-class staff and built a robust technical infrastructure with powerful computing tools and multiple levels of security to safeguard sensitive data.

To advance our mission in coming years, create a sustainable organization, and be transparent and accountable to the public, the OFR is building on our strategic plan with a programmatic approach to our work. OFR programs will align our priorities with our mission and strategic plan, clearly communicate those priorities to our stakeholders, and set clear direction and milestones for achieving them. For example, we will organize our work on central counterparties, or CCPs, in a single program covering risk assessment, our analytical framework, data collection, and evaluation of risk-mitigating policy tools. This report describes in some detail our programmatic approach and our eight initial programs.

I am deeply grateful for the opportunity to lead this unique and extraordinary organization and our team of diverse, talented, and dedicated professionals. They have made and continue to make remarkable strides toward meeting our mission. Financial innovation and the migration of financial activity across markets and jurisdictions will always challenge our ability to measure and analyze vulnerabilities in the financial system and evaluate the financial stability toolkit. But I am confident that our dedication, strategic direction, and culture of collaboration will continue to help us meet those challenges and contribute to making our financial system more resilient.



Richard Berner
Director, Office of Financial Research

From the Director

Preface

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OFR Responsibilities

The Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 established the OFR. Section 153(a) of the law directed the OFR to support the Financial Stability Oversight Council (FSOC) and member agencies by:

- Collecting data on behalf of FSOC, and providing such data to FSOC and member agencies
- Standardizing the types and formats of data reported and collected
- Performing applied research and essential long-term research
- Developing tools for risk measurement and monitoring
- Performing other related services
- Making the results of OFR activities available to financial regulatory agencies
- Assisting FSOC member agencies in determining the types and formats of data they should collect

The Act directs the OFR Data Center, on behalf of the FSOC, to collect, validate, and maintain all data necessary to carry out its duties. The Data Center acquires the data from FSOC member agencies, commercial data providers, publicly available sources, and financial entities under certain statutory authority. The law specifically directs the OFR to collect data on financial transactions and positions and to prepare and publish a financial company reference database, financial instrument reference database, and formats and standards for OFR data and data reported to the OFR.

The Dodd-Frank Act directs the OFR Research and Analysis Center, on behalf of the FSOC, to:

- Develop and maintain independent analytical capabilities and computing resources for reporting systems to identify and study risks to U.S. financial stability
- Monitor, investigate, and report to the FSOC and Congress on changes in systemwide risk levels and patterns
- Conduct, coordinate, and sponsor research to support and improve regulation of financial entities and markets
- Evaluate and report on stress tests or other stability-related evaluations of financial entities overseen by FSOC member agencies
- Maintain the expertise to support requests for advice or assistance from regulators
- Investigate disruptions and failures in the financial markets, report findings, and make recommendations to the FSOC based on those findings
- Conduct studies and provide advice on the impact of policies related to systemic risk and promote best practices for financial risk management

The Dodd-Frank Act established the OFR as an independent office within the Department of the Treasury.

We work to fulfill our mission by:

- Improving the scope, quality, and accessibility of financial data
- Assessing and monitoring threats to financial stability
- Developing tools for risk measurement and monitoring that reach across the financial system
- Conducting applied and fundamental research on the stability of the financial system
- Conducting studies and providing advice on the impact of policies designed to improve resilience in the financial system.

Section 154(d)(2) of the Dodd-Frank Act requires the Office to submit a report to Congress annually that assesses the state of the United States financial system, including:

- An analysis of any threats to the financial stability of the United States
- The status of the efforts of the Office in meeting its mission
- Key findings from the research and analysis of the financial system by the Office

The OFR has produced three annual reports since 2012 to fulfill that mandate.

In December, the OFR published the *2015 Financial Stability Report*, which provides the same type of in-depth analysis contained in the OFR's first three annual reports.

The OFR *2015 Annual Report to Congress* summarizes our financial stability assessment, reports on the key findings of our research and analysis, and provides an update on the efforts of the Office in meeting its mission.

The annual report fulfills the OFR's responsibility to report to Congress and the public.

We hope that by creating these two reports, we are best serving the needs of our wide array of stakeholders, while fulfilling our commitment to be transparent and accountable.

2015 Annual Report to Congress

The main chapters of this *2015 Annual Report to Congress* follow the statutory requirement to prepare and submit a report to Congress annually assessing the state of the United States financial system, including:

- Analysis of threats to the financial stability of the United States
- Key findings from OFR's research and analysis of the financial system
- 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 arise when shocks expose vulnerabilities in the financial system. This chapter highlights our assessments of risk and resilience in the financial system, our framework for monitoring them, and the tools we are developing and refining to achieve this mandate.

Threats to U.S. financial stability have crept higher since our *2014 Annual Report*, but are still moderate in our judgment. Events since we published our *2015 Financial Stability Report* last month, including the Federal Reserve's subsequent incremental increase in short-term interest rates, have not altered that conclusion.

Three key vulnerabilities stand out: (1) the long-term impact on risk-taking of persistently low interest rates, (2) mounting debt and declining credit quality in U.S. corporations and emerging-market countries, and (3) weaknesses that remain in the system despite financial reforms and better risk management by financial companies.

We base our assessments on analysis of key data and specific vulnerabilities across the financial system. Our Financial Stability Monitor helps organize that analysis, using a heat map that depicts five risk categories and includes breakout displays of two of those categories.

The chapter also discusses other risks from diverging global economic conditions and policies, searching for yield amid still-low interest rates and volatility, and cybersecurity breaches.

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

Although the OFR does not make policy, we have a mandate to conduct studies and provide advice on financial stability policies. We present our key findings on the effectiveness and potential unintended consequences of some of those policies, and findings from our analysis of financial activities.

Policymakers have taken important steps to eliminate the implied taxpayer support for large, complex financial institutions whose serious distress — or whose size, complexity, or interconnectedness — could threaten financial stability.

OFR research found that U.S. banking activity remains highly concentrated in eight global systemically important banks and that changes in regulation appear to have reduced the perception of competitive advantages for them.

Our research also found that clearing derivatives trades through central counterparties (CCPs) has significant benefits in reducing the risks to counterparties of default — as long as the CCP has the resources to meet payment obligations in the event of member default. But a CCP can also be a single point of vulnerability for failure and creates the potential for propagation of risks.

Stress testing is an effective tool for testing the safety and soundness of individual financial institutions, and we offer approaches to “macroprudential” stress testing that spans the financial system.

Our initial evaluations of policies related to asset management, the leverage ratio, non-bank lending, and housing-market finance point the way to further investigation.

Our *2015 Financial Stability Report* on our website and recent OFR papers about research and data, listed and grouped here by theme, discuss these findings at greater length.

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

The OFR has made significant progress in meeting its unique, multipart mission, and we have consequential plans for further progress. This final chapter enumerates OFR accomplishments since its creation in 2010, including our five-year strategic plan.

The next step is to implement our programmatic approach to achieve the plan's goals and objectives. OFR programs are based on core areas of concentration to help align our priorities with our mission and provide clear direction for us to achieve them.

Initially, OFR programs will focus on eight core areas:

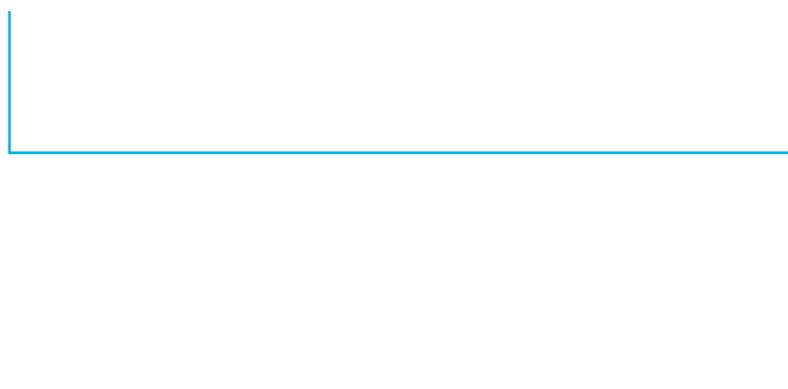
1. **Monitors** – We are developing a suite of tools to assess, measure, and monitor risks across the financial system to complement our Financial Stability Monitor and Financial Markets Monitor.
2. **Central Counterparties** – We are evaluating and measuring vulnerabilities in CCPs, which have benefits but also potential risks.
3. **Data Quality** – We are continuing and expanding the already substantial work we have done to standardize financial data and assist FSOC member agencies with data standardization.
4. **Data Scope** – We are continuing to assess and fill gaps in financial data, and to assure that data for financial stability monitoring are comprehensive and detailed.
5. **Data Accessibility** – We are increasing transparency and facilitating research by fostering secure and appropriate data sharing with other officials, industry, and the public.
6. **Stress Tests** – We are following our mandate to evaluate and report on the stress testing of banks, nonbanks, and the broader financial system.
7. **Risks in Changing Market Structure** – We are investigating disruptions and failures in financial markets as we conduct, coordinate, and sponsor research to support and improve market regulation.
8. **Risks in Financial Institutions** – We are conducting and promoting research to improve regulation of banks, insurance companies, and other financial institutions.

We have made significant progress in data-related initiatives, such as promoting the legal entity identifier system, improving data quality in swap data repositories, and conducting the bilateral repo and securities lending pilot projects. In the coming year, we will prepare for permanent collections of repo and securities lending data. We will also develop and launch a financial instrument reference database.

Analysis of Threats to the Financial Stability of the United States

This chapter presents the OFR's assessment of threats to the financial stability of the United States, discusses our framework for monitoring risk and resilience in the financial system, and highlights the tools the Office is developing and refining to achieve this core part of our mission.

The three chief threats are the: (1) impact of persistently low interest rates, (2) increasing debt and declining credit quality in U.S. corporations and emerging markets overseas, and (3) areas of weakness in the system that remain despite financial reforms and better risk management by financial companies.



Threats to Financial Stability

Threats to U.S. financial stability have edged higher since our annual report last year, but remain in the medium, or moderate, range. That assessment has not changed since we published our *2015 Financial Stability Report* last month and the Federal Reserve's subsequent incremental increase in short-term interest rates does not alter that assessment.

We continue to base our assessment on our Financial Stability Monitor, observation of the financial system, and analysis of key data and specific vulnerabilities.

Before and after the Federal Reserve raised short-term policy rates from the near-zero levels prevailing since 2008, the Fed clearly communicated its expectations: Economic conditions would evolve in a way warranting only gradual increases in the federal funds rate and short-term interest rates would probably remain below historical averages for some time. Consequently, the initial market reaction to the rate increase was orderly.

We expect that such a gradual pace of future increases, as well as other factors holding down long-term rates, will keep long-term interest rates at historically low levels for some time.

Those circumstances will probably sustain incentives for investors to take more risks for higher yields on their investments. We believe that this continued "reaching for yield" behavior — combined with vulnerabilities from heavy debt loads and eroding credit quality in emerging markets and among nonfinancial U.S. businesses, as well as pockets of uneven resilience in the financial system — will increase the vulnerability of the U.S. financial system to shocks.

The interplay among these three themes merits further discussion:

1 Long-term impact of low interest rates – Although some interest rates have recently moved higher, given the context just described, we expect the incentives for risk-taking from historically low interest rates to endure for some time.

Persistently low rates will continue to prompt investors to take higher risks to increase their returns on investment and may encourage excessive borrowing.

The section on "Other Selected Risks" later in this chapter explores this theme in more detail.

2 Rising debt and ebbing credit quality in nonfinancial U.S. businesses and emerging markets – We have been warning for some time, including in our *2014 Annual Report*, of growing threats to financial stability from rising debt and deteriorating credit quality in U.S. corporations and emerging markets overseas. The ratio of the debt of nonfinancial businesses in the United States to gross domestic product is historically high and companies' leverage (the ratio of debt to earnings)

What Is Financial Stability?

Financial stability occurs when the financial system can provide its six basic functions, even under stress: (1) credit allocation and leverage, (2) maturity transformation, (3) risk transfer, (4) price discovery, (5) liquidity provision, and (6) facilitation of payments.

Financial stability is not about curbing market volatility, predicting financial shocks, or preventing them. Financial stability is about resilience. When shocks hit, a resilient financial system will continue to provide those basic functions to facilitate economic activity.

Threats to financial stability arise from vulnerabilities in the financial system — failures in these functions exposed by shocks. Resilience depends on the system having enough shock-absorbing capacity to continue to function under stress, as well as incentives being aligned to limit excessive risk-taking.

Shock absorbers buffer hits, while “guard rails” — or incentives that affect behavior — constrain risk-taking by increasing its cost.

Resilience of the financial system and its converse, threats to financial stability, are systemwide concepts. To measure, assess, and monitor them, we must look across the financial system. We must examine financial institutions and markets to improve our understanding of how threats spread from one institution or market to others. Only then will we be able to find ways to counter those risks and make the financial system more resilient.

continues to rise. The hunt for yield and current historically low default rates are promoting easy credit and heavy borrowing.

Today's low default rates seem unlikely to persist. Stress in energy and commodity industries from declining prices could spread as investors reassess their risks.

Global economic risks are a broader concern. Global growth has slowed and the strong dollar is dampening U.S. exports by making U.S. goods more expensive for foreign buyers. The dollar's rise has also pushed down the prices of dollar-denominated commodities. In many emerging markets, such as markets in China, Russia, Latin American nations, and parts of Asia and Eastern Europe, debt levels in the private sector have reached historic highs after years of heavy borrowing. These concerns are most pronounced for economies that produce energy and other commodities and economies most exposed to the slowdown in global growth.

A shock that erodes perceptions about credit quality in U.S. corporations or emerging markets could pose a threat to financial stability.

3 Pockets of vulnerability – Reforms and companies’ improvements in managing their risks after the financial crisis have strengthened key parts of the financial system. For example, these changes resulted in higher capital for banks and enhanced transparency for derivatives markets.

Despite the improvement in overall resilience, pockets of vulnerability remain:

- New regulations and other factors have spurred the migration of some financial activities and their related risks to areas that may be less transparent and less resilient.
- Rapid, sharp declines in market liquidity — exhibited during events from the “flash crash” of May 2010 to episodes in 2015 — have amplified market shocks. If larger shocks hit, a decline in liquidity could disrupt market functioning and could pose a threat to financial stability. (Ample market liquidity allows large volumes of assets to be traded or exchanged for cash quickly without substantially affecting price.)
- Risks that short-term, wholesale funding could be vulnerable to the kind of runs and fire sales that marked the financial crisis continue to exist despite regulatory reforms that forced banks to reduce their reliance on this type of funding used to finance their operations and investments.
- Interconnections among financial companies are evolving and the ramifications are not yet known. These connections can serve as channels for the propagation of shocks through the financial system.

These three themes and other risks are discussed later in this chapter.

Monitoring Tools

Monitors are tools for tracking risks in key parts of the financial system. The OFR currently produces two monitors and has several more in development.

In fiscal year (FY) 2016, the OFR will launch a monitors program to organize and plan the further development and implementation of this suite of monitors (see Chapter 3).

The two monitors in production are the Financial Stability Monitor, a graphic heat map and related material that give a snapshot of vulnerabilities in the financial system, and the Financial Markets Monitor, a periodic publication that gives the interpretation of the OFR research staff of developments in financial markets.

Other OFR monitors in development are the Money Market Fund Monitor, the Credit Default Swaps Monitor, the Hedge Fund Monitor, and the Correlation Monitor, as shown in more detail in Figure 1.

Figure 1. OFR Financial Stability Monitoring Tools

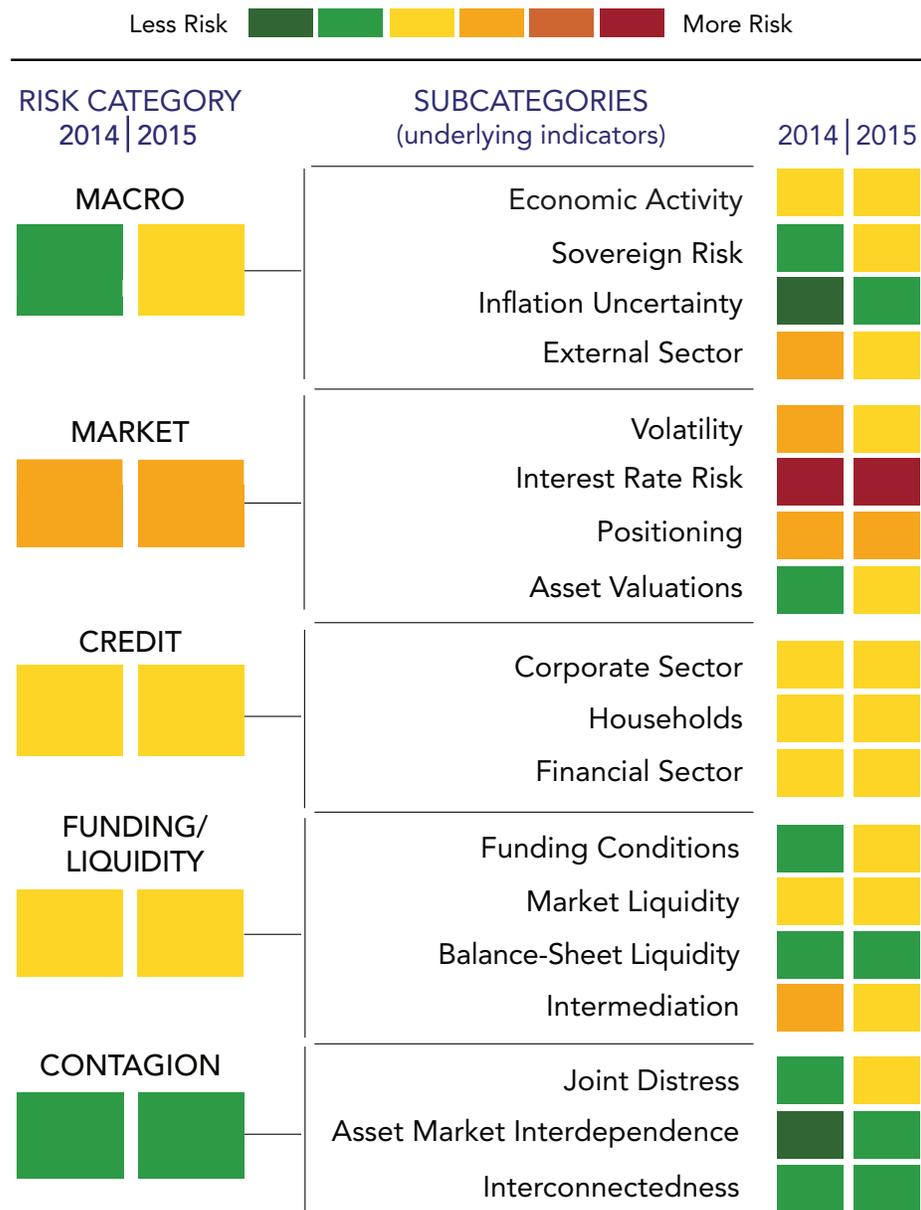
Tool	Frequency	Description	Audience	Data Used
Financial Stability Monitor	Semi-annual	Provides a snapshot of weaknesses in the financial system based on five functional areas of risk: macroeconomic, market, credit, funding and liquidity, and contagion. The monitor is not designed to predict the timing or severity of a financial crisis but to identify, at a high level, underlying vulnerabilities that may predispose the system to a crisis.	Internal, Financial Stability Oversight Council (FSOC), public	Public data, commercially acquired data, and industry analyses
Financial Markets Monitor	Monthly	Provides an overview on major developments and emerging trends in global capital markets.	Internal, FSOC, public	Public data, commercially acquired data, and industry analyses
Money Market Fund Monitor	Monthly	Will examine individual funds and the industry as a whole on the basis of credit, interest rate, and liquidity risk. Each risk category will be analyzed based on portfolio statistics and holdings.	Internal, FSOC, public	Securities and Exchange Commission (SEC) data (Form N-MFP)
Credit Default Swaps (CDS) Monitor	TBD	Will provide analytics on various financial stability metrics in the CDS market, such as excessive market concentration and interconnectivity, through risk metrics and visual assessment techniques.	Internal, restricted FSOC	Depository Trust & Clearing Corporation data and commercially acquired data
Hedge Fund Monitor	TBD	Will provide analytics on potential risks that could arise out of the hedge fund industry.	Internal, restricted FSOC	Commercially acquired data and SEC supervisory information
Correlation Monitor	Daily	Will explore cross-asset correlations through interactive visualizations.	Internal, FSOC, public	Public data, commercially acquired data

The OFR's monitoring program entails not only developing new monitors but also refining existing ones. For example, the Financial Stability Monitor is a tool that is continually evolving to become more forward looking and better represent the weaknesses in the financial system.

Financial Stability Monitor

The Financial Stability Monitor displays current weaknesses in the financial system based on five functional areas of risk: macroeconomic, market, credit, funding and liquidity, and contagion. The monitor is designed

Figure 2. OFR Financial Stability Monitor

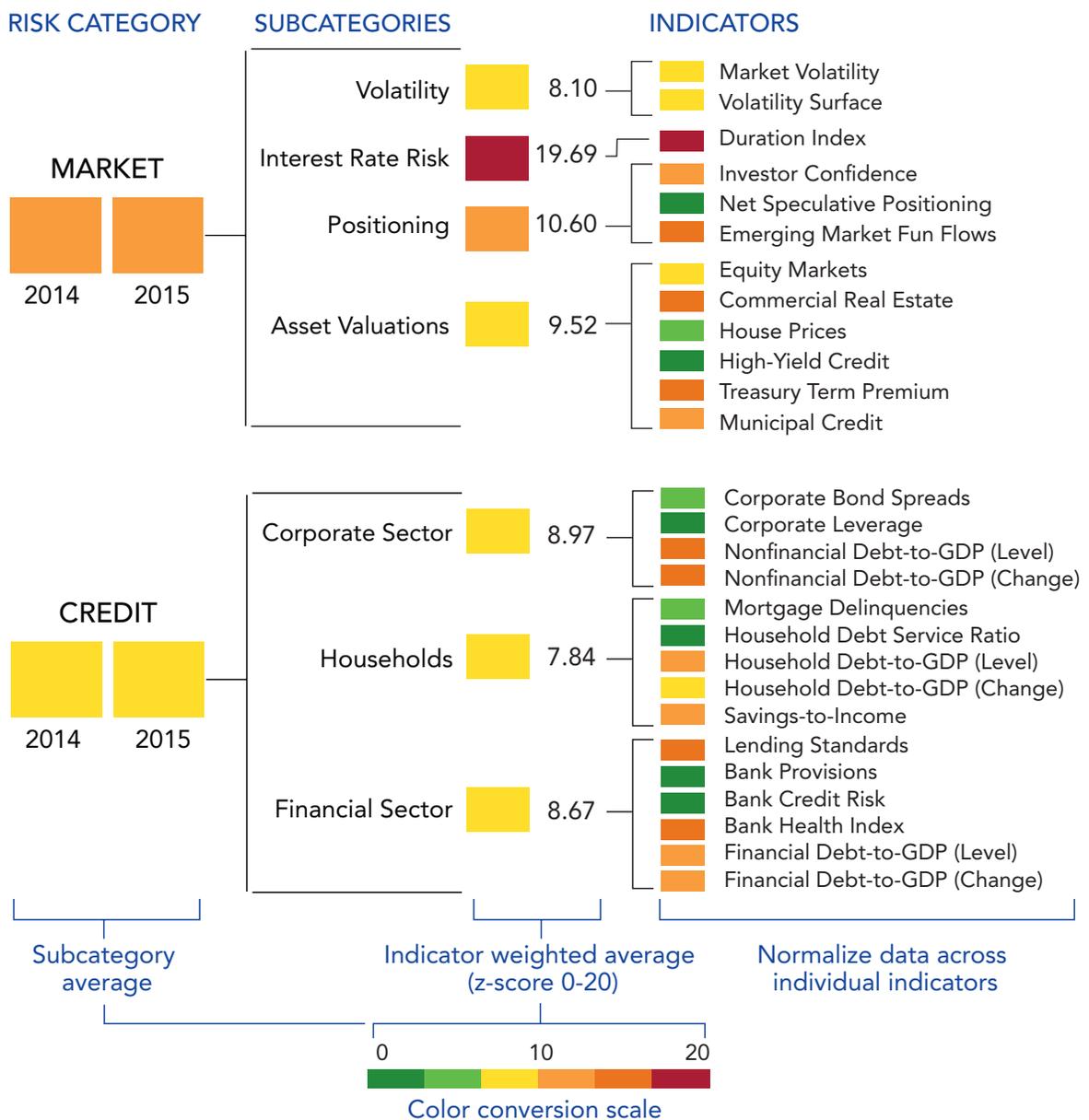


Note: For more detail on how the monitor is structured, see the note accompanying Figure 2.1 in the *Financial Stability Report* on our website.

to identify underlying vulnerabilities that may predispose the financial system to a crisis, not to predict the timing or severity of a crisis. By looking across the financial system, the monitor can help identify potential threats wherever they arise.

The monitor displays these risks in a clear and easy-to-understand, high-level format. It represents about 60 indicators that are aggregated from a vast pool of underlying data. The indicators are collected from models, market prices, and surveys, cutting across different jurisdictions,

Figure 3. Financial Stability Monitor Expanded: Market and Credit Risks

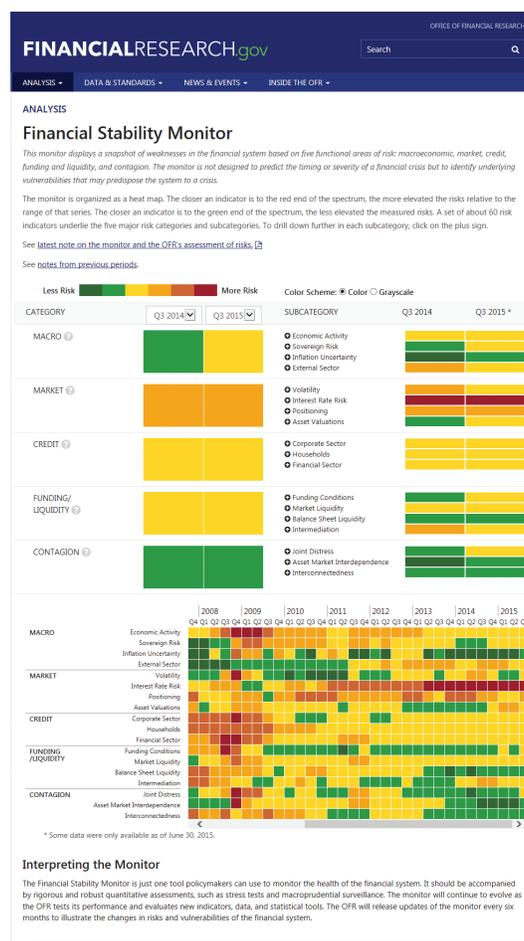


industries, and institutions. We derive each risk measurement from an indicator's position within its historical range.

The monitor first appeared in the OFR's *2013 Annual Report* and since then, our researchers and data experts have been working to refine the indicators, make the monitor more forward looking, and make other improvements.

In June 2015, the OFR posted an expanded, interactive, online version of the monitor on the OFR website at financialresearch.gov. In the online version, users can explore the monitor's risk categories and subcategories, drill down to its indicators, and view its historical performance. The display of the underlying indicators can be instructive by signaling risks that might not be apparent in the higher-level risk categories. For example, a yellow color signifying medium risk in one of the five major categories might have red, elevated risks underpinning it, as well as green, more benign risks that "cancel out" the red ones. Figure 3 includes some of that drill-down detail.

The release of the online monitor was the first time the OFR made public an interactive online tool for visualizing metrics related to financial stability. We plan to update the online version and the underlying analysis every six months to complement the versions in each of our annual financial stability reports and annual reports to Congress (see *The OFR's Financial Stability Risk Assessments*).



The OFR's Financial Stability Risk Assessments

- **December 2015: 2015 Financial Stability Report** – This new report analyzed threats to financial stability, evaluated policies to reduce those threats, described actions to improve U.S. financial data, and reported key findings from OFR research. The report preceded this *2015 Annual Report to Congress* and is on our website.
- **June 2015: Financial Stability Monitor** – In this inaugural online version of the monitor, we judged that “overall risks to financial stability remain at a medium level. Many of the risks that were present at the time of our last assessment remain relevant, while some have diminished.”

Assessment of the Monitor's Five Risk Categories

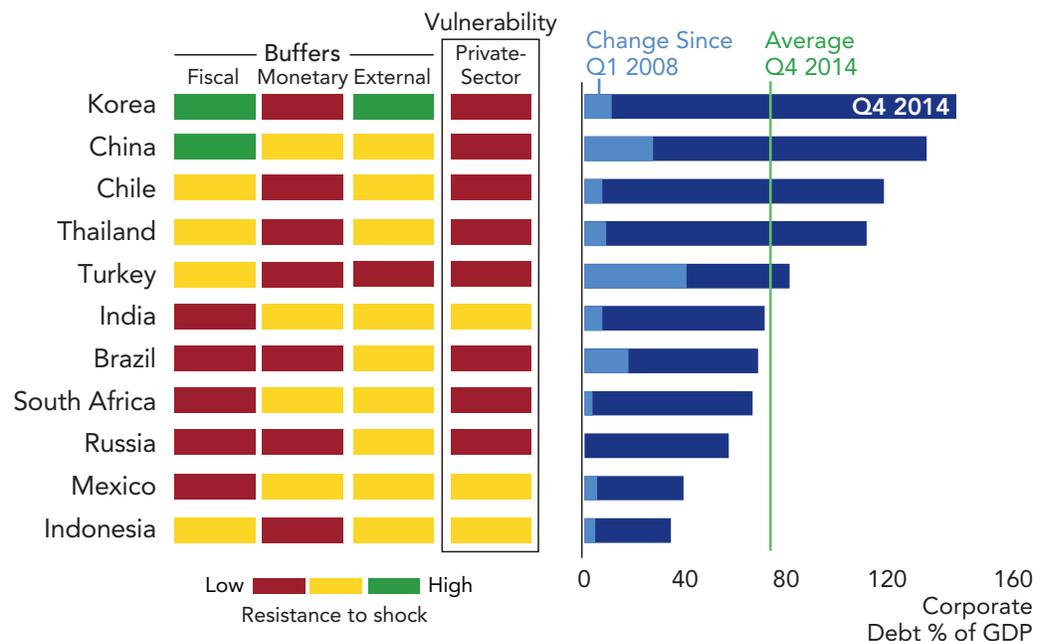
1 Macroeconomic – Macroeconomic risks have risen since our last annual report, largely due to economic deterioration in China and other emerging market economies. Economic growth there has slowed, investors are wary, investment capital is retreating, and authorities have moved to protect the value of their currencies (see **Figure 4**).

In addition, the levels of debt among corporations in emerging markets — already high and rising rapidly — will become increasingly difficult to manage during the economic slowdown.

In a sample of large emerging market countries, total corporate debt increased from \$10 trillion to \$24 trillion in 2008. In China, South Korea, Thailand, and Chile, ratios of corporate debt to gross domestic product are now more than 100 percent (see **Figure 4**).

Nonfinancial firms in emerging markets are under particular stress. Profits are declining, debt levels are high, and the ability to pay down or pay off their debts is declining. Among large countries in emerging markets, Brazil, Turkey, and China stand out for the highest debt among nonfinancial companies in relation to their economies. Since 2010, corporations in the raw materials and energy sectors have had the largest increases in debt-to-earnings ratios, coupled with diminishing profits.

Figure 4. Emerging Market Risk Levels



Note: For more detail, see Figure 2-33 and Figure 2-32 in the *Financial Stability Report* on our website. GDP=gross domestic product.

Sources: Bloomberg L.P., Haver Analytics, International Monetary Fund, OFR analysis

The U.S. economy has been resilient to these global problems so far, but continued or magnified problems overseas could harm future growth and financial stability in the United States.

The buildup of debt in producers of energy and other commodities helped fuel a protracted and significant expansion in the global supply of commodities. Commodity producers kept pace with demand from China and the U.S. shale oil boom added to the availability of crude oil. As global growth slowed and demand declined, the prices of energy, metals, and other commodities declined sharply. The supply has been slow to adjust.

As a result, the slowdown in China and the rest of the global economy is taking a toll on countries that export large amounts of commodities and capital goods for sale to Chinese businesses. For example, the deceleration means that China is importing less oil to fuel its industrial production, exacerbating the global oil glut. Other emerging market economies are facing some of the same problems, as well as spillover effects from China.

A third of U.S. corporate profits originate overseas. The stronger dollar and weaker global growth are dragging overall earnings lower. Total U.S. exposure from direct financial links between the United States and emerging markets, including U.S. investments in emerging markets and U.S. bank loans, is estimated to be \$2 trillion to \$3 trillion, or 1.1 percent to 1.6 percent of the financial assets in the U.S. private sector, according to OFR estimates based on private and public data sources.

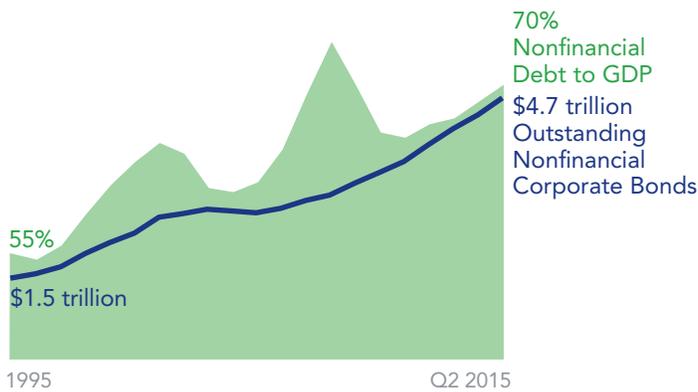
The U.S. economy has been resilient to these global problems so far, but continued or magnified problems overseas could harm future growth and financial stability in the United States.

2 Market – A number of market risks, the risk of losses from declines in asset prices, are also elevated and a cause for concern. Long-term Treasury yields barely compensate investors for the risks of holding them, as indicated by near-zero “term premiums,” which measure the risk that short-term Treasury yields will not evolve as investors expect. The low yields on bonds that use Treasuries as the benchmark for their pricing pull down yields on riskier ones, such as bonds issued by corporations. As investors have acquired longer-term debt to boost returns, they have increased their duration risk — duration being the sensitivity of bond prices to changes in interest rates — to the high end of its historical range. The result is that investors are vulnerable to noticeable losses from even relatively moderate changes in interest rates.

3 Credit – Credit risk, or the risk of borrowers defaulting and failing to repay their debts, is high and rising among nonfinancial U.S. businesses. Our analysis indicates that the risk is higher than our Financial Stability Monitor indicates. As noted earlier, debt among nonfinancial companies has been growing for years and is at a historic high relative to U.S. gross domestic product (see **Figure 5**).

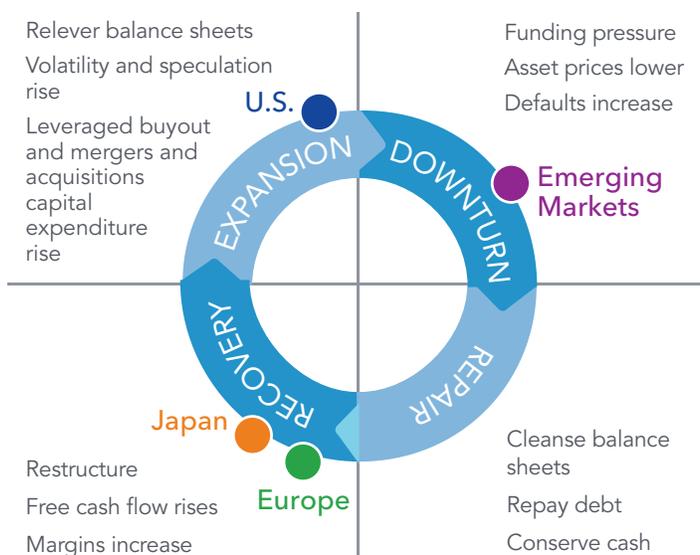
In addition, the ratio of debt to earnings for nonfinancial U.S. corporations will rise further if earnings continue to decline. The buildup of debt

Figure 5. U.S. Corporate Debt - Nonfinancial Firms



Sources: Haver Analytics, Federal Reserve Financial Accounts of the United States

Figure 6. The United States in the Corporate Credit Cycle



Note: For more detail see Figure 2-3 in the *Financial Stability Report* on our website.

Sources: Bloomberg L.P., Haver Analytics, Morgan Stanley, OFR analysis

is starkest among companies already vulnerable because of existing debt levels and weakening capacity for repaying their debts.

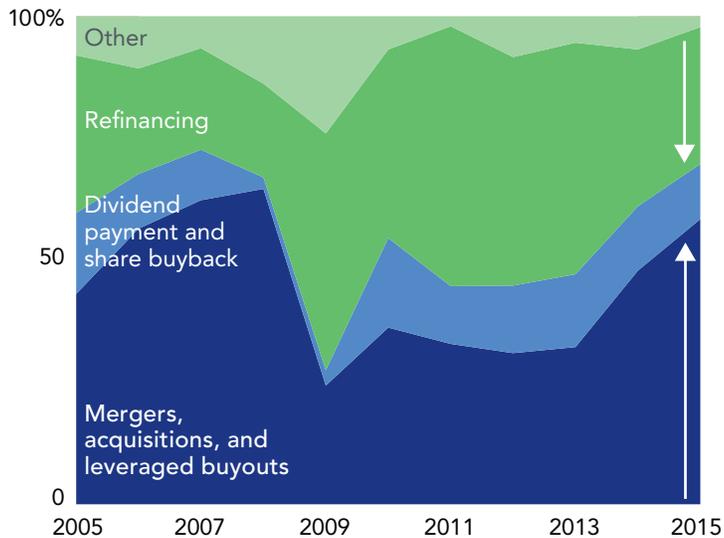
Elevated debt and sinking earnings are hallmarks of the late stage of the credit cycle, which typically precedes a rise in default rates (see Figure 6). As the figure shows, emerging markets are in the downward portion of the cycle with defaults increasing, asset prices falling, and funding harder to obtain for operations and investments. Europe and Japan are still in the recovery phase.

Meanwhile, the drop in the price of oil and other commodities, coupled with the slowdown in global economic growth, has diminished the ability of multinational companies and firms in the

energy and commodity industries to repay their debts.

In the United States, regional banks with exposures to energy companies or to local economies reliant on the energy industry face the prospect of increases in troubled loans. Many of them have already increased their loan-loss reserves in response, but the ultimate magnitude of losses in these industries and regions is uncertain.

Figure 7. Leveraged Loan Use Shift



Sources: Standard & Poor's, OFR analysis

Some U.S. corporations have tried to maintain their earnings growth by cutting costs. Instead of using loan proceeds to pay off their debt, other companies are increasing debt through acquisitions, leveraged buyouts, dividend payments to shareholders, and buying back their stock (see Figure 7). Joint action by federal financial regulators in 2013 and 2014 has helped to reduce the number of bad loans and to curtail banks from issuing leveraged loans, which are loans to companies or individuals that already have significant debt loads. Despite that progress, standards for loan underwriting remain weak.

4 Funding and liquidity – Wholesale funding markets appear stable. Financial firms use this type of funding, frequently on a short-term basis, for their operations and to manage risk. Regulatory reforms after the 2007-09 financial crisis forced banks to reduce their use of short-term wholesale funding and increase their capital cushions. These requirements helped reduce the risk of banks failing and triggering runs. Many of the largest broker-dealers, which are at the center of these markets, became part of bank holding companies and are subject to these requirements. These changes, combined with changes in the behavior of market participants and improvement in companies' risk management, dramatically reduced the size of these markets since the crisis.

In contrast, market liquidity risk represents a pocket of vulnerability in the financial system, as mentioned earlier. The years after the crisis have had long stretches of relatively ample liquidity and low volatility, interrupted by episodes of spiking volatility and impaired market liquidity, even in markets considered deep and liquid.

Examples of these episodes are listed in Figure 8. Analysis of these events shows steep declines in liquidity that amplified the shocks. If the shocks were significantly larger, the resulting evaporation of market liquidity could threaten financial stability.

Although some participants in the bond market have attributed the deterioration in liquidity to changes in government regulations, such as requirements for banks to hold more capital, a number of other factors have also been at play since the financial crisis. Some of these factors involve market structure, including the surge in automated trading,

Figure 8. Recent Illiquidity Shocks in Major Markets

Funding Market Incident and Date	Liquidity Analysis
"Flash Crash" May 6, 2010	The prices of many U.S. equities and equity-based products experienced a severe, short-lived sell-off, with many stocks falling 5 percent to 15 percent before reversing.
"Taper Tantrum" Mid-2013	U.S. Treasury yields sold off sharply, beginning in late May, triggered by a change in U.S. monetary policy expectations, with spillovers across U.S.-dollar denominated bond markets.
"Flash Rally" October 15, 2014	U.S. Treasury yields fell by seven-to-eight standard deviations during the day, despite the lack of a significant fundamental driver. The single-day trading range was the fourth largest on record.
Bund sell-off April-May 2015	After reaching historic lows, yields on German Bund futures rose sharply over several days as crowded trades associated with the European Central Bank's asset purchase program were rapidly unwound. Price action on May 7 represented a four-standard-deviation move for a single trading day.
Equity and exchange-traded fund (ETF) dislocations August 24, 2015	U.S. equities sold off sharply, triggering market circuit breakers that halted trading in futures and cash equities. This sell-off complicated trading and pricing for ETFs linked to the equities.

changes in the appetite of investors for taking risks, and transformation in the types of investors active in the markets. Other factors relate to economic cycles, such as lower returns when interest rates are low and changes in the availability of collateral. The relative importance of these factors is difficult to measure.

5 Contagion – The risk of financial stress being transmitted across different entities and markets, known as contagion risk, has risen since our last annual report. The driver was volatility in financial markets in the third quarter of 2015.

Although the Financial Stability Monitor suggests that overall contagion risk is low, this risk is difficult to measure in the absence of financial stress. In our assessment, contagion risk is actually higher than current measures indicate.

Further Discussion of Selected Risks

This section discusses risk from divergent global policies and economic conditions, interest rate risk, volatility risk, and cybersecurity risk.

Risk from Divergent Global Policies and Economic Conditions

Economic conditions in the United States have diverged in recent years from conditions in Japan and countries that use the euro as their currency, known as the euro area. U.S. growth has been stronger than in these countries and the difference has led to differing monetary policies, which has been a powerful force in driving down U.S. interest rates since early 2014.

In the United States, the Federal Reserve ended its large asset-purchase program in October 2014 and began increasing interest rates in December 2015. In contrast, the Bank of Japan and the European Central Bank (ECB) have implemented large-scale asset purchase programs since 2013 to combat weak growth and inflation (see Figure 9).

In Germany, expectations for the launch of the ECB program had the effect of pushing down yields on long-term government bonds in 2014 and early 2015. The drop affected U.S. financial markets, increasing the attractiveness of long-term U.S. Treasuries. The upturn in demand for Treasuries drove down Treasury yields, despite pressure in the other direction from the Federal Reserve winding down its purchases of U.S.

Figure 9. Asset Purchase Programs in Europe and Japan

	Key Program Dates	Monthly Purchases	Expected Central Bank Balance Sheet Expansion	Purchased Assets
	Announced Start-End	Local Currency (U.S.\$)	U.S.\$ (% of Balance Sheet)	
Bank of Japan	April 2013, October 2014 April 2013 - Indefinite	¥6.7 trillion (\$60 billion)	\$720 billion/year (46%)	Government bonds, ETFs, J-REITs
European Central Bank	January, December 2015 March 2015 - March 2017	€60 billion (\$68 billion)	\$1.7 trillion by March 2017 (70%)	Government bonds, corporate bonds, asset-backed securities, municipal bonds

Note: Using exchange rate from date of program announcement. Balance sheet size as of program initiation. Monthly purchase amount for Bank of Japan program is calculated based on purchase amounts announced on Oct. 31, 2014. ETFs = exchange-traded funds. J-REITs = Japanese real estate investment trusts.

Sources: Bloomberg L.P., Bank of Japan, European Central Bank

Treasuries, the U.S. economy strengthening, and expectations increasing for the Federal Reserve to begin raising interest rates.

If these global forces intensify, they could amplify some of the vulnerabilities mentioned previously. Specifically, they could further depress earnings growth and erode credit quality in the United States and emerging markets, appreciate the dollar in foreign exchange markets, and depress prices for energy and other commodities.

Interest Rate Risk

In the OFR Financial Stability Monitor, interest rate risk is a subcomponent of market risk and, in the heat map, its color is red to indicate a high level of risk. As mentioned, with investors striving to maximize their yields, bond issuers are extending the maturities of their debts. As a result, the sensitivity of bond prices to changes in interest rates (duration risk) is at a historic high.

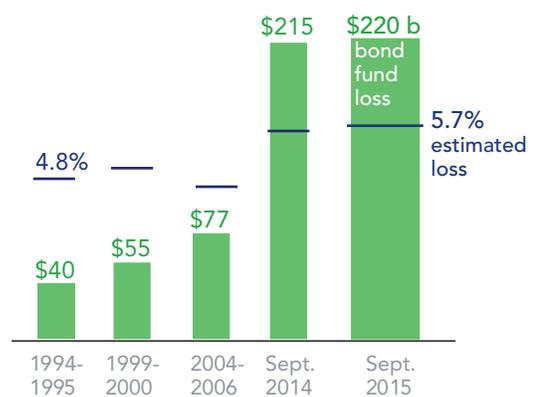
In addition, investors' exposures to fixed-income assets are substantial. Bond mutual funds and exchange-traded funds (investment funds whose shares are traded on an exchange) in the United States hold about \$3.8 trillion in assets. If the Barclays U.S. Aggregate Bond Index shown in

Figure 10. Barclays U.S. Aggregate Bond Index Duration



* Approximate percentage change in price in response to a 1 percentage point change in interest rates.
Source: Bloomberg L.P.

Figure 11. Loss to U.S. Bond Funds After 100-Basis-Point Shock to Interest Rates (Estimated)



Note: Bond funds include mutual funds and exchange-traded funds (representing \$3.8 trillion in total assets) that report to the Investment Company Institute
Sources: Bloomberg L.P., Haver Analytics, OFR analysis

Persistently low rates will continue to prompt investors to take higher risks to increase their returns on investment and may encourage excessive borrowing.

Figure 10 represents the yield on funds, a 100-basis-point increase in market interest rates would have a significant impact — an unhedged loss of \$214 billion across these funds, or an average loss of 5.6 percent (see Figure 11). These losses would be larger than during other periods of interest rate increases because of the large current size of bond funds and the buildup of duration risk.

Against this backdrop, the Federal Reserve is beginning to adjust short-term policy rates away from the near zero level of the past seven years. At its December 2015 policy meeting, the Federal Reserve's Federal Open Market Committee (FOMC) increased the federal funds target range from near zero by 25 basis points.

The Federal Reserve's language about its future path for interest rates and the immediate reaction of the markets to the Federal Reserve's announcement fell in line with expectations that future adjustments would depend on economic conditions and would probably be gradual, and there was the muted reaction in financial markets. U.S. stock markets and credit markets were relatively stable, the reaction in emerging markets was mixed but moderate, and the dollar appreciated slightly against currencies in other developed countries.

As mentioned, slower global growth, low inflation, and monetary policies in other countries are depressing interest rates worldwide. In addition, the requirements of recent regulations have increased the global demand for Treasuries and other high-quality liquid assets. These forces, together with gradual increases in rates in the United States, may keep U.S. interest rates low for some time, prolonging or amplifying the associated risks to financial stability.

At the same time, these circumstances leave investors vulnerable to significant losses if interest rates were to spike. If the environment changed suddenly and sharply at home or abroad, prompting officials to increase interest rates at a faster pace, the resulting shocks could threaten financial stability.

Even if the Federal Reserve raises rates gradually as expected and continues to communicate its policy intentions clearly, market participants still might overreact to changing circumstances, triggering a spike in volatility and worsening financial conditions. A likely example of this scenario occurred in the 2013 sell-off in bond markets known as the "Taper Tantrum," sparked by new Federal Reserve communications before any change in policy. The vulnerability of market liquidity in bond markets could amplify any such shock.

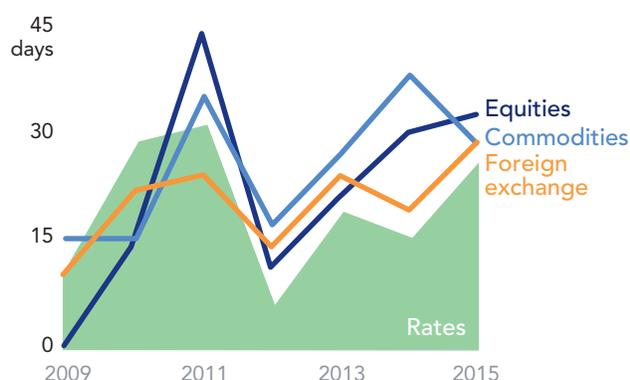
Volatility Risk

Volatility risk has declined since our last annual report. Volatility risk is the risk of losses on investments because of unpredictable changes in the volatility of the prices of underlying assets. Last year, we warned that expectations of low volatility and continued favorable economic conditions could create incentives for market participants to take too much risk. This concern has subsided somewhat as volatility has risen toward long-term average levels (see Figure 12).

Although volatility risk eased this year, the pockets of vulnerability related to market risks and market liquidity we discussed earlier create the potential for unsettling spikes in volatility. In fact, market metrics suggest that the recent rise in volatility is creating incentives for some investors to bet that volatility will stay at current levels or decline. Any sustained spikes in volatility could spell losses for market participants that had expected volatility to fall.

Value-at-risk (VaR) is a statistical measure of expected trading losses over a specified time and at a certain confidence level during normal market conditions. A VaR shock hits when a large spike in volatility forces investors such as hedge funds, broker-dealers, and banks that manage their risk by staying below a certain VaR to unload investments when their VaR calculations exceed predetermined limits. Such a shock could cause a cascade of fire sales of assets (see Figure 13).

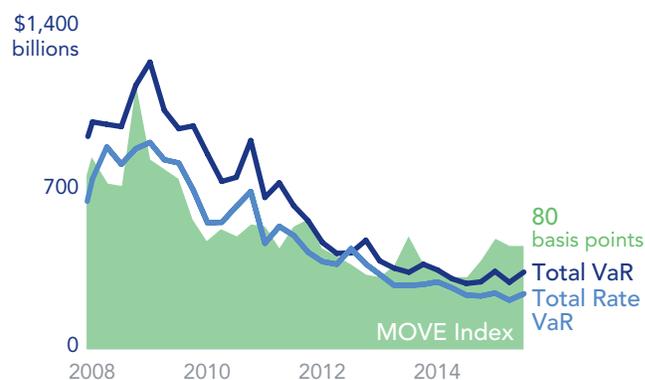
Figure 12. Days of Unusually High Intraday Volatility for Asset Prices



Note: Unusually high intraday volatility means the range (highest price minus lowest price as a percentage of prior day close) was greater than four standard deviations from the trailing three-month average.

Sources: Bloomberg L.P., OFR analysis

Figure 13. Large Broker-Dealers' Value-at-Risk vs. Interest Rate Volatility



Note: Total average daily value-at-risk (VaR) for Citigroup, Goldman Sachs, Bank of America, JP Morgan, Morgan Stanley, and Lehman Brothers before its bankruptcy and merger with Merrill Lynch. VaR confidence levels varies from 95 percent to 99 percent and are at the firm level.

Sources: Bloomberg L.P., OFR analysis

U.S. investment banks, which had elevated VaR levels leading up to the financial crisis, curbed their risk positions during the subsequent period of low volatility. Total VaRs reported by the five U.S. global trading banks declined 65 percent between the fourth quarter of 2009 and the third quarter of 2015.

Cybersecurity Risk

Cybersecurity breaches pose risks to financial stability. A cyberattack could impair the operations of individual firms and markets by disrupting electronic trading, transaction processing, and other computer network functions at the heart of the financial industry. Such an attack could undermine confidence in the resilience of the financial system.

In both industry and government, officials have responded.

For example, the Financial Services Information Sharing and Analysis Center, an industry organization, promotes collaboration on critical security threats facing the global financial services industry.

The Financial and Banking Information Infrastructure Committee, made up of federal and state financial regulators, coordinates efforts to improve the reliability and security of the financial system's critical infrastructure.

In addition, the Department of the Treasury, Department of Homeland Security, and regulators have collaborated to develop tabletop exercises with financial institutions and government agencies to assess and improve readiness to respond to cyber events.

In June 2015, the Federal Financial Institutions Examination Council, an interagency body of federal financial regulators, released a Cybersecurity Assessment Tool based on the Cybersecurity Framework of the National Institute of Standards and Technology. This framework is becoming a standard for firms seeking guidance about countering cyber threats.

Regulators also need to coordinate to collect data to assess the impact of cybersecurity attacks on the U.S. financial system, as noted in a recent report by the U.S. Government Accountability Office. Current information on the frequency and concentration of cybersecurity incidents in the financial sector may be inadequate to detect trends and determine investment priorities (see **Figure 14**).

Although financial companies may be reluctant to disclose cybersecurity breaches because of concerns about undermining their reputations, U.S. regulators could require the firms they supervise to monitor and report details about the cost and frequency of cybersecurity breaches or risks in the financial system.

Figure 14. Sources for Public Information About Cybersecurity Breaches

Type of Provider	Information Provider	Collection Methodology	Limitations	Report Contents		
				Narrative Description	Frequency Statistics	Cost Estimates
IT Industry	Ponemon Institute, sponsored by IBM	Annual survey of 350 firms in 11 countries	Broader than financial sector. Underlying data for further analysis unavailable beyond annual report.	✓	✓	✓
	Symantec Corp.	Annual proprietary collection by Symantec	Underlying data for further analysis unavailable beyond annual report.	✓	✓	✓
	Information is Beautiful	Ongoing compilation from media reports of major cyber incidents	Data available for download but quality uncertain. Breaches of smaller firms not represented (except for media coverage).	✓	✓	
Regulators	SEC	Quarterly reporting requirement in public company financial disclosures	Disclosure requirements are vague; narrative format only. No summary public data provided.	✓		
	New York State Department of Financial Services	One-time survey of 154 banking institutions in New York state	Underlying data for further analysis unavailable beyond annual report.	✓	✓	✓
Law Enforcement	Financial Services Information Sharing and Analysis Center (FS-ISAC)	Ongoing self-reporting by FS-ISAC members	Most data are restricted to FS-ISAC members and law enforcement. Data shared provide information on cyber threats, though it may be relevant to assessing cyber-related operational risks.		✓	

Source: OFR analysis

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

This chapter discusses key findings in two areas of OFR analysis: (1) our evaluation of the effectiveness and potential unintended consequences of some financial stability policies, and (2) the results of OFR research.

We have produced a significant body of publicly available work that includes annual reports, OFR briefs, the Working Paper Series, staff discussion papers, Financial Markets Monitors, and the new annual Financial Stability Report.

In 2016 and in coming years, we will organize our analytical and data initiatives in programs, as explained in Chapter 3.

Evaluating Financial Stability Policies

The OFR analyzes tools designed to address potential cyclical and structural vulnerabilities in the financial system and considers their effectiveness, as well as their possible unintended consequences. We base our policy analysis on our monitoring and assessment of vulnerabilities — their causes and consequences.

Although the OFR does not make policy, the Office has a mandate under the Dodd-Frank Act to conduct studies and provide advice on policies related to financial stability.

Financial policies and regulation come in two forms — microprudential and macroprudential. Regulators issue microprudential policies to assure the safety and soundness of individual financial companies and the functioning and integrity of financial markets. Examples of microprudential policies include standards for bank capital and liquidity, requirements for stress testing of individual banks, and reporting requirements for broker-dealers and asset managers.

Macroprudential policies are designed to make the overall financial system more stable and able to withstand shocks. Macroprudential policies can be cyclical — related to fluctuations in financial or economic activity — or structural, which means related to the underlying structure of the financial system. Examples of macroprudential policies include tools to limit firms' overreliance on short-term funding, new rules for money market funds to reduce the risk of runs, and risk-retention rules requiring entities that originate and sell loans packaged into securities for sale to retain some of the risk, or "skin in the game."

Systemically Important Financial Institutions

Since the financial crisis, a major policy question has been how to restore market discipline for large, complex financial institutions whose material distress — or whose size, complexity, or interconnectedness — could threaten financial stability. Eliminating the implied taxpayer support for such firms has required determining which firms to designate for consolidated supervision by the Federal Reserve and enhanced prudential standards to reduce the risk of failure and, in some cases, to make them easier to resolve.

Global systemically important banks (G-SIBs) are identified by national banking supervision authorities, primarily based on a scorecard of systemic importance established by the Basel Committee on Banking Supervision in 2011. The Basel scorecard includes 12 financial indicators across five categories to identify G-SIBs (see **Figure 15**).

In July 2015, the Federal Reserve issued a final rule implementing the requirement for U.S. G-SIBs to hold additional capital — a "capital add-on." The final U.S. rule uses both the Basel Committee methodology and an alternative formula, and then selects the higher of the two surcharges as the requirement (see **Figure 16**).

Figure 15. Top 25 Global Systemically Important Banks (International)

Bank Holding Company (basis points)	Size	Interconnectedness			Substitutability			Complexity			Cross-Jurisdictional Activity		2014 Score	Bucket
	Total exposures	Intrafinancial system assets	Intrafinancial system liabilities	Securities outstanding	Payments activity	Assets under custody	Underwriting activity	Amount of over the counter derivatives	Adjusted trading and available for sale securities	Level 3 assets	Foreign claims	Total cross-jurisdictional liabilities		
Weight (percent)	20	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	10	10		
JPMorgan Chase	417.5	483.0	530.2	432.7	1248.3	1495.7	759.9	843.7	811.6	631.5	294.5	328.8	494.7	4
HSBC	362.9	350.7	370.8	281.4	331.1	451.5	666.9	352.7	147.6	220.7	742.3	800.1	438.4	
Citigroup	308.5	332.1	426.0	341.1	1061.7	887.6	574.2	710.3	423.3	538.4	398.1	397.5	426.0	3
BNP Paribas	305.1	322.9	471.9	275.2	203.6	392.0	303.8	552.9	630.7	416.5	574.1	482.9	404.7	
Deutsche Bank	224.7	326.1	217.3	187.9	635.4	189.7	526.6	741.9	213.9	432.8	479.3	356.8	360.0	
Barclays	262.7	358.0	366.5	199.7	190.0	14.5	626.3	600.1	344.0	630.9	396.6	352.1	349.4	
Bank of America	313.4	319.6	211.4	337.0	359.9	9.9	690.5	672.6	576.4	278.7	167.3	146.4	324.5	2
Credit Suisse	147.7	276.4	180.1	188.2	132.8	11.7	371.2	632.7	269.6	498.3	320.3	371.4	269.5	
Goldman Sachs	165.5	342.2	105.3	221.4	43.7	71.8	535.8	691.3	373.4	559.0	159.3	152.3	260.5	
Mitsubishi	315.4	217.1	207.7	212.7	288.4	108.8	129.1	147.5	307.3	148.0	349.9	262.4	242.1	
Morgan Stanley	142.9	232.1	109.9	166.0	45.0	111.6	513.1	446.2	720.4	277.1	167.3	156.7	235.7	
Ind. and Comm. Bank of China	420.7	369.6	243.9	210.5	179.1	66.6	127.9	5.3	253.2	312.7	70.5	97.9	218.9	1
Royal Bank of Scotland-	191.0	251.7	229.2	110.8	236.5	12.1	231.6	599.9	94.0	103.5	274.3	222.8	212.5	
Société Générale	190.8	155.6	199.5	164.2	129.7	331.7	177.7	290.8	330.6	108.9	247.5	214.7	210.3	
Bank of China	327.6	283.2	235.0	192.1	272.4	72.8	109.6	7.7	151.2	61.4	165.3	340.2	208.4	
Banco Santander	197.1	174.8	251.7	260.8	61.2	81.2	55.6	64.6	133.2	38.9	479.5	462.5	208.4	
Wells Fargo	244.5	174.8	158.7	398.0	132.5	177.2	259.7	72.9	339.5	404.6	48.0	77.5	202.6	
UBS	110.0	162.4	134.0	151.9	87.1	240.6	216.6	312.9	217.5	149.0	271.3	286.4	189.2	
Crédit Agricole	233.3	216.0	216.3	214.3	106.2	202.5	125.4	204.3	160.7	99.8	178.2	188.2	186.3	
China Construction Bank	341.4	332.4	180.1	187.1	88.9	48.9	99.5	3.7	42.5	367.4	29.7	63.0	167.6	
Unicredit	140.1	192.1	242.1	152.4	45.4	22.8	135.2	39.2	129.4	105.1	254.2	410.2	165.4	
Agricultural Bank of China	321.6	184.2	144.7	164.5	143.7	56.7	75.6	2.1	29.9	627.2	15.2	33.5	164.4	
Mizuho	200.7	88.2	165.7	159.3	219.0	82.3	119.4	120.5	214.8	148.2	176.2	140.0	159.6	
Groupe BCPE	181.0	233.6	240.0	237.8	152.1	6.4	68.3	168.5	57.5	233.8	144.0	75.1	151.3	
Bank of NY Mellon	46.7	62.2	230.9	45.1	844.3	1746.3	7.6	15.3	62.8	1.1	45.0	91.3	150.8	

Note: Bucket assignments for individual companies reflect data that the Basel Committee released in November 2015.
Sources: Company G-SIB disclosures, OFR analysis

Global systemically important insurers (G-SIIs) are insurance firms whose distress or failure could harm financial markets because of their size, market position, and global interconnectedness. In July 2013, the Financial Stability Board (FSB) released an initial list of nine G-SIIs that were identified using the assessment methodology of the International Association of Insurance Supervisors. The list included

the three insurance holding companies the FSOC designated for heightened supervision by the Federal Reserve in the United States: American International Group, MetLife, and Prudential (see Figure 17). (The FSB identified no additional U.S. insurers.)

Although U.S. insurance companies are currently not subject to federal capital or reserve requirements, state and foreign regulators are developing capital standards for insurance companies. In addition, the Federal Reserve will establish enhanced prudential standards for the three designated insurers.

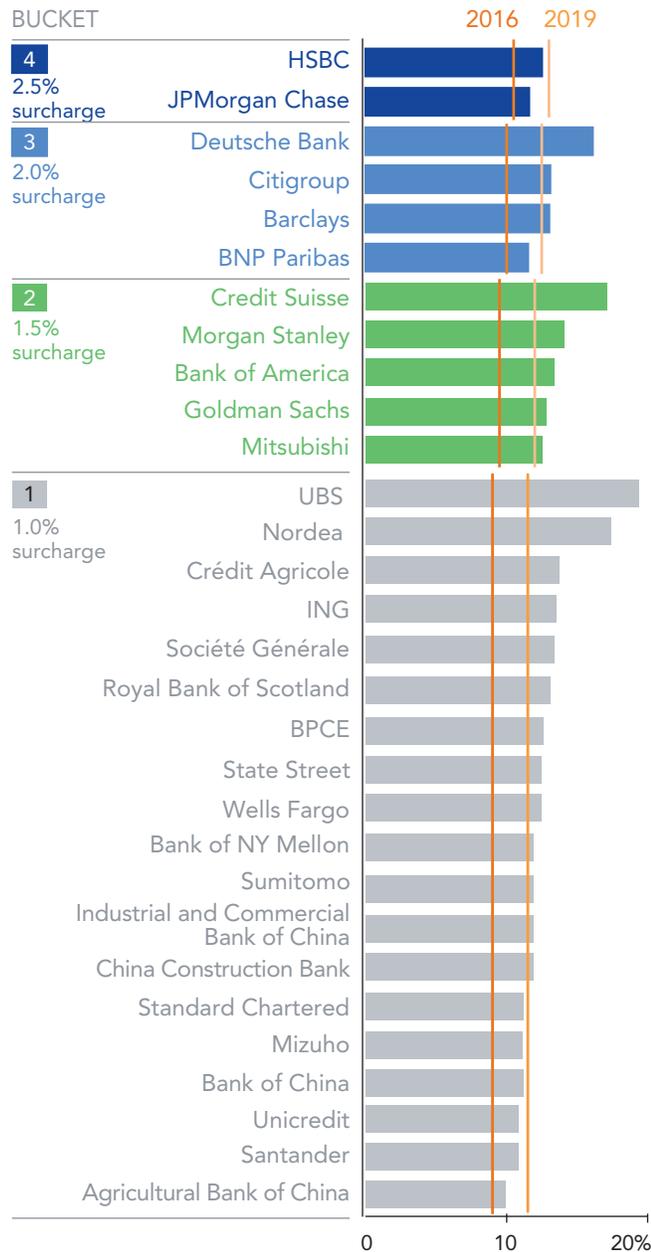
The FSOC has also designated for enhanced risk-management standards eight systemically important financial market utilities primarily supervised by the Commodity Futures Trading Commission (CFTC), the Securities and Exchange Commission (SEC), or the Federal Reserve. Five of them are central counterparties (CCPs) and the other three are companies that provide critical services for financial markets.

As a nonvoting member of the FSOC, the OFR Director is not involved in designation decisions. However, the OFR plays an important supporting role in the process by providing data and the analysis of the data to FSOC for the first stage of the designation process.

In OFR working papers and briefs, our researchers have analyzed how best to measure systemic importance and the level — currently at \$50 billion or more in assets — for U.S. bank holding companies to be designated as systemically important.

For example, a paper in the OFR Brief Series in February 2015 used a new dataset collected by the Federal Reserve to analyze the systemic importance of the largest U.S. bank holding companies. The brief

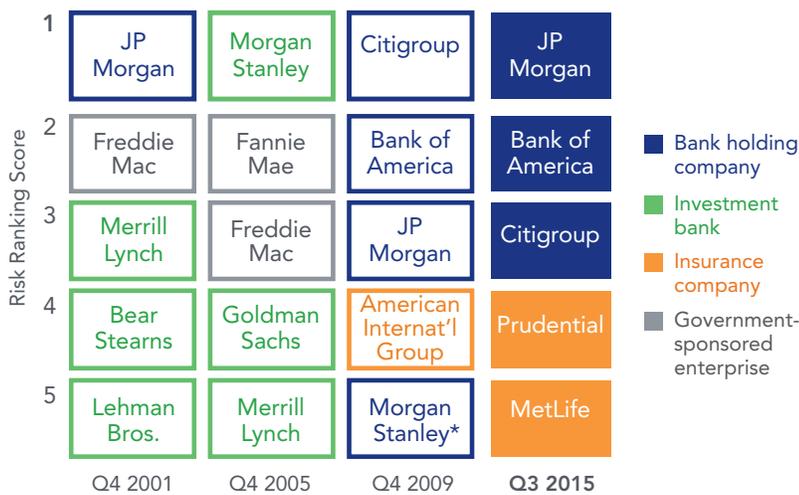
Figure 16. Global Systemically Important Banks' Tier 1 Risk-Based Capital Surcharge



Note: Vertical lines show Basel III total capital requirements, including capital conservation buffer and G-SIB add-on, as of 2016 and as fully phased-in by 2019. Horizontal bars reflect Tier 1 capital as a percent of risk-weighted assets as of December 31, 2014. Bucket assignments for individual companies reflect data that the Basel Committee released in November 2015.

Sources: Basel Committee on Banking Supervision, OFR analysis

Figure 17. Top Five U.S. Financial Institutions by Systemic Risk Ranking Score



* Morgan Stanley converted into a bank holding company in September 2008.

Source: New York University Volatility Institute

compared the companies based on their size, interconnectedness, complexity, global activity, and “substitutability,” a measure of the companies’ dominance in customer services.

Capital is a critical buffer against failure for banks and regulators typically require riskier banks to hold more capital. A brief in August 2015 found that G-SIBs with higher systemic importance scores do not consistently have higher risk-based capital ratios (see Figure 16).

Two papers in the OFR Working Paper Series in May 2015 also covered subjects related to systemically important financial institutions. One paper explored evidence of a too-big-to-fail subsidy for large financial firms and found that the

expectation of government bailouts did not uniformly lead to lower borrowing costs for the largest financial firms. The second paper examined credit default swap spreads in a sample of international banks and found evidence of a benefit related to possible measures of systemic importance (see **Research and Data Publications — Financial Institution Risks and Regulation** for details about these papers).

We summarize key themes in the OFR’s FY 2015 research later in this chapter (see **Research and Data Publications**).

Central Clearing and Central Counterparties

Derivative contracts such as credit default swaps and interest rate swaps historically traded over the counter between dealers or between dealers and clients. This bilateral approach exposes each party to the risk of its counterparty defaulting. The Dodd-Frank Act mandates that certain swaps be cleared with a central counterparty (CCP) between the buyer and seller in the transaction.

CCPs have three benefits for regulators and market participants. First, prices are typically updated more frequently and reliably than for trades between two parties. Second, through their operations, CCPs have access to data on derivatives trades. These data give regulators a view into the operations of derivatives markets.

Third, central clearing can reduce the risk of counterparty default — as long as the CCP has the resources to meet payment obligations. However, a

CCP is a single point of vulnerability for failure and creates the potential for propagation of risks, potentially offsetting the advantage.

CCPs require each clearing member to post a payment called a “margin” that is deposited in a default fund. If a member defaults, the defaulting member’s deposits and other resources would cover losses. If those resources are not sufficient, the CCP’s own funds or funds paid by other members would cover the losses.

The CFTC and SEC require CCP default funds to be able to cover losses of the single largest clearing member. Some CCPs have a stricter requirement that their CCP default funds cover a loss if the two largest clearing members default.

CCPs in the United States are required to conduct stress tests to determine if CCP resources are adequate. Discussions among international regulators have centered on the merits of standardizing CCP stress tests. Standardization could resolve testing inconsistencies, but might fail to account for the diversity of CCP products and services.

The FSOC has designated five CCPs as systemically important: CME Clearing, the Fixed Income Clearing Corp., ICE Clear Credit, the National Securities Clearing Corp., and the Options Clearing Corp.

These five CCPs are connected with G-SIBs that serve as settlement banks and where CCPs and their members deposit funds (see Figure 18). U.S. G-SIBs are also clearing members of multiple CCPs. A G-SIB default could cause a CCP default and possible strain multiple CCPs at once, a scenario that current CCP stress tests may fail to capture.

Some CCPs also have connections to each other, for example, through “cross-margining” agreements by which positions can be netted across CCPs to central counterparties overseas, and to CCPs not designated as systemically important.

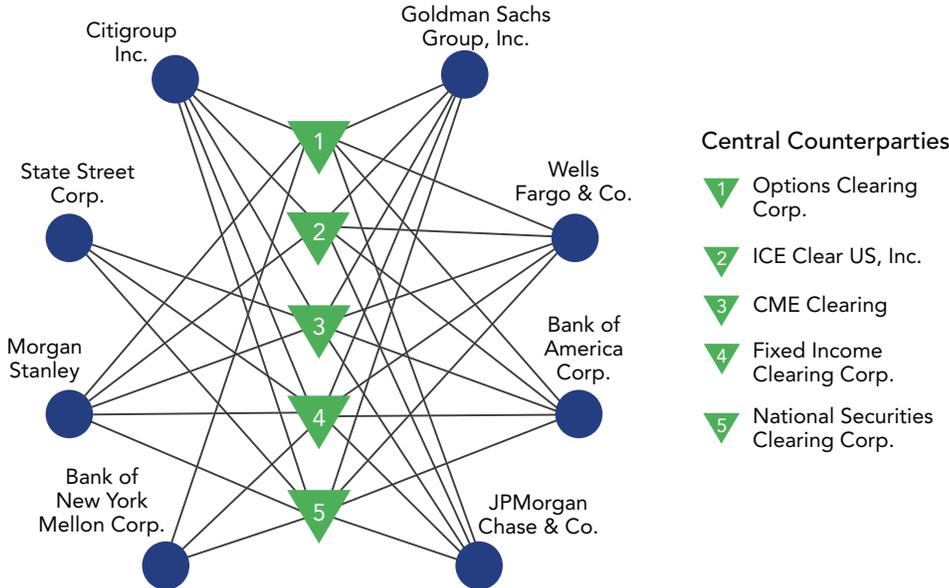
A CFTC rule requires (and an SEC proposed rule) would require CCPs to have recovery-and-resolution plans for continuing services to market participants even if they face losses, liquidity shortfalls, or other weaknesses. The SEC’s proposed rule would add a layer of protection against the risks of a potential CCP default by requiring CCPs to hold net liquid assets funded by equity to cover potential losses.

In FY 2015, the OFR staff conducted research on risks in CCPs. For example, the Office released two working papers in May 2015. One paper focused on risks in markets cleared by multiple CCPs. The paper found that swaps dealers can split their positions among multiple CCPs, effectively obscuring potential liquidation costs and gaining cost advantages over

The FSOC has designated five CCPs as systemically important:

1. CME Clearing
2. Fixed Income Clearing Corporation
3. ICE Clear Credit
4. National Securities Clearing Corporation
5. Options Clearing Corporation

Figure 18. Globally Systemically Important U.S. Central Counterparties and U.S. Banks (How They Are Linked)



Sources: Membership data from individual central counterparty websites, OFR analysis

competitors. Unless CCPs share information, the result can be a “race to the bottom,” and CCPs with the most optimistic views of liquidation costs could drive competitors out of the market. The second paper showed that concentration risks to a CCP posed by large clearing members can increase over time. The concentration increases the exposure of a CCP to the failure of its largest clearing members (see **Research and Data Publications — Central Counterparties**).

For the OFR, improving the quality of data available for evaluating risks in CCP operations is critical. We are following such a recommendation from our Financial Research Advisory Committee and planning ways to improve the quality and scope of related data.

In FY 2016, risks in CCPs and CCP data quality will be part of an OFR program, as explained in **Chapter 3** (see **Core Programs: The Next Step**).

Stress Testing

Regulators now routinely require stress testing to assess the safety and soundness of individual financial institutions, such as banks, and to set requirements for the capital that banks must hold as a buffer against losses and other shocks.

Large, global financial institutions began to use stress tests internally in the 1990s and regulators significantly expanded their use after the financial crisis. Stress testing can also be a macroprudential tool for monitoring risks to financial stability.

In a typical bank stress test, a bank is given a stress scenario, and the bank and its supervisor measure how the scenario would affect the bank's revenue and the performance of its loans and other assets. Since 2010, the Federal Reserve has conducted an annual stress test for bank holding companies, the Comprehensive Capital Analysis and Review (CCAR). The Federal Reserve, Office of the Comptroller of the Currency, and Federal Deposit Insurance Corporation (FDIC) have conducted the Dodd-Frank Act Stress Test (DFAST) since 2013.

CCAR and DFAST help determine the resilience of large banks, specifically, whether they could continue to provide key financial services during a severe economic downturn. The results of the supervisory bank stress tests are integrated with banks' capital planning processes to ensure banks have enough capital to continue lending after a severe shock.

The OFR staff produced several research papers about stress testing in FY 2015. For example, an OFR brief in July 2015 discussed how stress tests could incorporate liquidity shocks. Another paper explored whether stress test results had become predictable (see **Research and Data Publications — Stress Testing**).

Stress testing will be an OFR program in the coming year, as discussed in **Chapter 3**.

Asset Management Stress Testing — Stress testing is less developed in asset management than in banking. In 2014, the SEC updated a 2010 rule and began requiring money market funds to test their ability to maintain 10 percent of assets in securities that could be liquidated within one week. The rule requires that funds disclose the test results to their boards of directors at regular intervals. It does not require reporting results to regulators.

Hedge funds are required to run limited stress tests and report results in Form PF, while stress testing for mutual funds has been discussed but not adopted.

Insurance Company Stress Testing — Stress testing of insurance companies should assess whether insurers have adequate reserves and capital to meet their obligations in adverse scenarios.

Insurance companies face some of the same risks as asset management firms; both hold large investment portfolios, subjecting them to risks from drops in the prices of stocks, bonds, and real estate. However, insurance companies help households and businesses manage risks, such as risks related to life, health, and property damage. So, insurers hold investments as reserves to meet expected obligations to policyholders, while asset managers generally hold them on behalf of clients. Insurance companies also face risks that vary by their lines of business. For example, property and casualty insurers face underwriting risks from natural disasters and property damage, while health insurers face risks from poor health and pandemics.

In 2012, the National Association of Insurance Commissioners adopted a model law for stress testing to be phased in by 2015. To date, 34 states have adopted the law. The guidelines for stress tests have few specifics about stress scenarios or analysis.

CCP Stress Testing — The CFTC requires CCPs to conduct weekly or, in some cases, daily stress tests to determine if CCPs would have sufficient resources to continue operating after failure of a clearing member. Some CCPs designated as systemically important must demonstrate they can continue to operate even if two members fail. CCPs also use stress tests to determine how much clearing members should contribute to each CCP's default fund.

These tests are not standard among CCPs, but some market participants have called for standardized CCP stress tests. In May 2015, two international standards groups, the Committee on Payments and Market Infrastructures and the International Organization of Securities Commissions, began a review of CCP stress testing practices.

Systemwide Stress Testing — Stress testing could also take a “macroprudential” perspective, becoming a potentially powerful tool for monitoring risk across the financial system and crafting policy responses by incorporating interactions among the parts of the financial system and broader economy.

A key area of stress-testing research relates to risk-propagation and contagion. Analysis of financial networks and agent-based modeling can be helpful in applying a systemwide framework to stress testing.

For example, a recent OFR working paper presented a dynamic macroprudential stress-testing framework (see [Research and Data Publications](#)

Stress testing could also take a “macroprudential” perspective, becoming a potentially powerful tool for monitoring risk across the financial system and crafting policy responses by incorporating interactions among the parts of the financial system and broader economy.

— **Stress Testing**). We also contributed to a recent Basel Committee working paper suggesting that supervisory stress tests could consider recent research on agent-based models and could make more use of network analysis to evaluate the role of bank networks in transmitting risks.

Asset Management

The financial crisis showed that the activities of asset managers such as mutual funds and hedge funds can generate risk because investors expect to be able to redeem their shares quickly, and the assets underlying the fund often are not all easily converted to cash. The risk lies in the mismatch between the liquidity of the assets a fund manages and the liquidity of investors' shares.

The severity and scope of these risks differ considerably among types of funds. Regulations based on the Investment Company Act of 1940 make mutual funds unlikely primary causes of a systemic market event. But losses in a few heavily leveraged funds could cause market fluctuations and shocks could spread quickly. Fire sales sparked by large-scale redemptions could create the possibility of these funds becoming channels for transmitting and amplifying risks across markets to otherwise unconnected investors.

These kinds of risks can pose threats when fund investments are concentrated in illiquid assets, such as bank loans or emerging market debt. Fund managers must hold sufficient cash and other liquid assets to satisfy redemption requests by investors, margin calls, and other obligations in a timely manner.

Regulators around the world are assessing the risks in asset management activities. For example, the FSOC released a notice in December 2014 seeking public comment on potential risks associated with the asset management industry (particularly liquidity and redemptions, leverage, operational functions, reinvestment of cash collateral in securities-lending transactions, activities in separately managed accounts, and resolution). Determination of any potential risks is pending its further work.

Information on separately managed accounts is scant. These accounts are portfolios of assets or securities directly owned by investors and managed by professional investment firms. More detailed information about holdings in these accounts, estimated to be worth tens of trillions of dollars, is essential to understanding potential vulnerabilities. Toward this end, the SEC has proposed amendments to its Form ADV, filed by registered investment advisers, to gather basic data on advisers' separately managed account businesses. The data will include investment composition, derivatives use, and borrowing.

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Focus on Financial Networks

Connections among financial institutions can serve as shock absorbers that diversify risk and increase the resilience of the financial system, but they can also propagate systemic shocks and act as vulnerabilities. Financial networks are part of the structure of the financial system and understanding them is essential to understand contagion — when a shock in one part of a network leads to significant losses in other parts and spreads through the network.

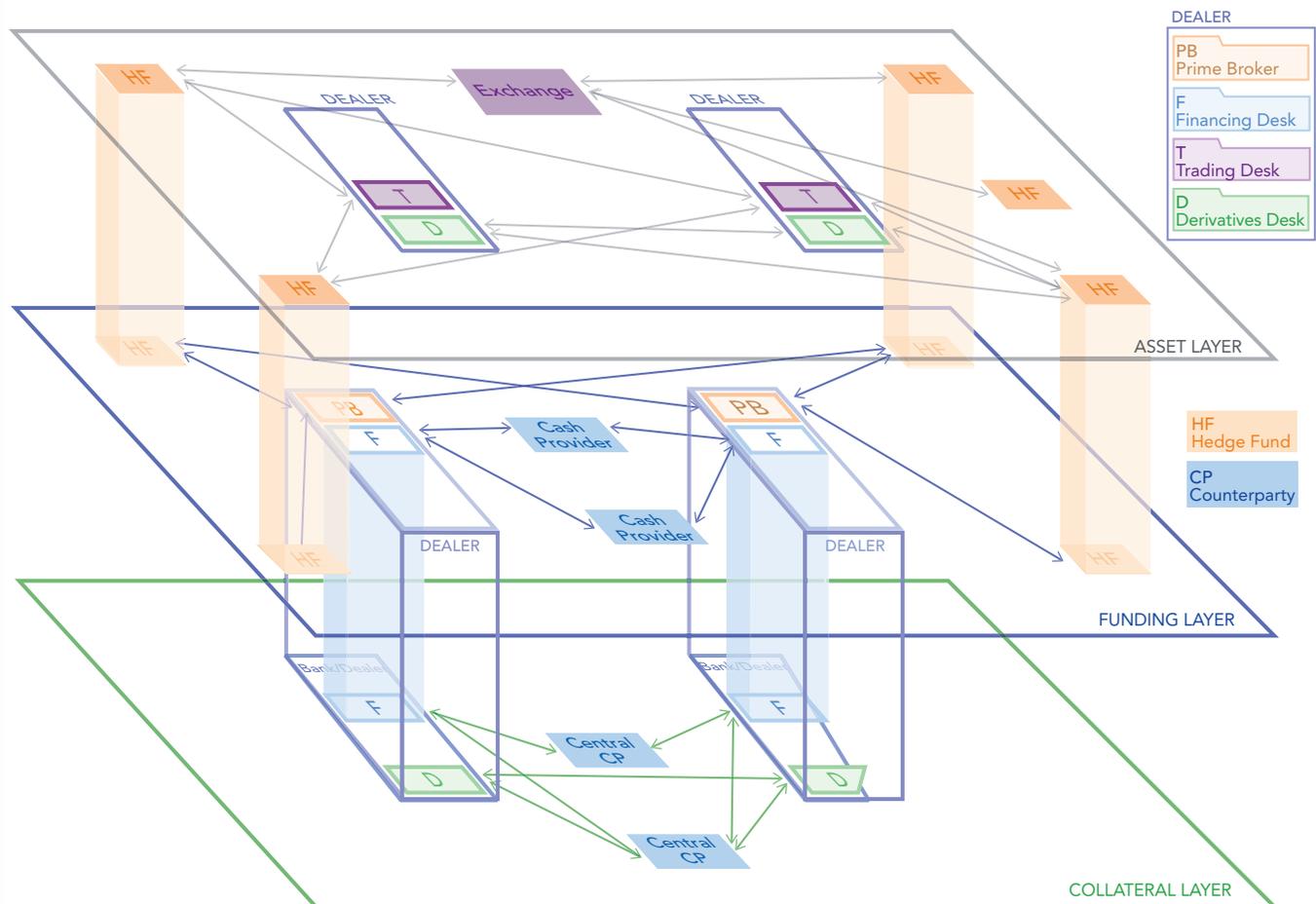
The OFR is studying financial networks to learn more about how they support resilience or vulnerability in the financial system. OFR researchers produced a working paper in February 2015 that examined financial network models to trace the path of potential instability in the financial system. Another OFR research paper in October 2015 surveyed academic research about contagion in financial networks

(see **Research and Data Publications — Connectedness, Contagion, and Risk Concentration**).

OFR researchers are mapping the financial system as a multi-layer interdependent network, investigating connections and dependencies between the layers, and evaluating the implications for financial stability (see **Figure 19**).

Network analysis can also help in understanding contracts between market participants in asset markets, for example, in the credit default swap (CDS) market. OFR researchers have been using CDS data from the Depository Trust & Clearing Corporation to apply Federal Reserve stress tests scenarios to all counterparties in the U.S. CDS market. The research is exploring how the failure of a bank's single largest counterparty could affect the bank, compared with the impact of such a failure on the bank's other counterparties.

Figure 19. The Financial System as a Multilayer Network



Sources: OFR analysis

In September 2015, the SEC proposed a rule to strengthen management of liquidity risk and improve public disclosures by open-end mutual funds (funds without restrictions on how many shares they may issue) and exchange-traded funds (funds traded on an exchange). Under the proposed rule, these funds would be required to adopt programs to manage liquidity risk and disclose information for investors and regulators to evaluate the liquid assets available to meet redemptions.

After the financial crisis, the SEC began collecting confidential data in Form PF to measure risk exposures for private funds, including hedge funds. OFR analysis of Form PF data shows that the 50 largest hedge funds managed \$1.93 trillion in gross assets on June 30, 2015, an increase from \$1.53 trillion on March 31, 2013.

In a working paper in July 2015, OFR researchers analyzed the effectiveness of Form PF data for measuring the risk exposures of these funds. The paper's findings suggested that although Form PF represents a significant step toward more effective reporting by hedge funds, the data from the form may not completely identify all potential risks related to the funds. In fact, our paper found that the form could result in private funds with different risk profiles reporting similar risk measurements to regulators (see **Research and Data Publications — Data and Data Analytical Techniques**). We maintain an active dialogue with the SEC on potential ways to improve Form PF.

Leverage Ratio

Since the financial crisis, international regulators have strengthened the leverage ratio, which is aimed at determining the minimum capital that banks must hold and is calculated as the ratio of a bank's high-quality capital to its exposures (both on and off their balance sheets). A recent OFR working paper documented a pattern of regulatory arbitrage (circumventing regulations) by foreign-owned, U.S.-based broker-dealers. They reduced 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 returned to the market in the following quarter. This activity reduced their capital requirements under the leverage ratio because foreign regulators do not measure compliance on a continuous basis (see **Research and Data Publications — Financial Institution Risks and Regulation**).

U.S. regulators implemented a more stringent "enhanced supplemental" leverage ratio for the largest U.S. banks and their holding companies. A potential unintended consequence of making the leverage ratio more stringent is that the change could encourage banks to shed low-return,

A potential unintended consequence of making the leverage ratio more stringent is that the change could encourage banks to shed low-return, low-risk investment positions in favor of higher-return, higher-risk positions.

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OFR analysis of data collected by the Federal Reserve on the triparty repo market suggests that, after the proposal to introduce more stringent leverage ratio requirements, broker-dealers associated with U.S. bank holding companies reduced the percentage of their total repo funding backed by government securities and increased the percentage backed by more volatile collateral. No comparable trend was evident for broker-dealers not affiliated with banks. The substantial changes in the repo market have generated interest in more central clearing of repo transactions to allow large banks to engage in greater netting and reduce the effects of the leverage ratio. However, as discussed earlier in this chapter, central clearing creates risks as well as benefits.

Nonbank Lending

When regulators restrict risk-taking by banks, other firms with different or fewer regulatory requirements or less supervisory oversight can take their places in the market. Over the past five years, bank lending has grown moderately, while lending through nonbanks such as managers of collateralized loan obligations (CLOs), business development companies, mutual funds, and hedge funds has advanced more rapidly. Although banks may use deposits to finance their lending activities, nonbank lenders may use wholesale funding such as repurchase agreements, or repos, that are more vulnerable to runs, as described in **Chapter 1**.

“Leveraged loans”—loans to companies already heavily indebted—are a case in point. To reduce excessive risk-taking, banking regulators issued guidelines in 2013 to restrain leveraged lending by banks. Partly in response, leveraged lending has shifted significantly to nonbanks in the past few years and has accelerated. That acceleration eased somewhat in 2015, in part because of impending rules to require managers of CLOs to retain some risk — called “skin in the game.” CLO issuance in the United States, for example, declined from \$124 billion in 2014 to an estimated \$97 billion in 2015. Still, the U.S. leveraged corporate credit market is sizable, with an estimated \$1 trillion outstanding of leveraged loans and \$1.5 trillion of speculative-grade corporate bonds (lower-graded bonds commonly called junk bonds).

The 2015 Shared National Credit Review of bank loans and loan underwriting standards by federal banking agencies showed that nonbanks owned less than a quarter of total loans but more than two-thirds of the highest-risk loans. Many of these leveraged loans made by nonbanks are

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known as “covenant-lite” loans because they contain fewer restrictions or legal covenants to protect the lender.

The parts of the financial system most exposed to credit shocks when the corporate default cycle turns are difficult to pinpoint with available data. But, as the Shared National Credit Review suggested, they are likely to lie where persistent structural deficiencies are found in loan underwriting.

Credit Risk Sharing in Housing Market Finance

In its role as conservator of the Federal National Mortgage Association (Fannie Mae) and the Federal Home Loan Mortgage Corporation (Freddie Mac), the Federal Housing Finance Agency has pushed them to reduce the risk they pose to taxpayers.

The government-sponsored enterprises (GSEs) have responded by offering credit risk-sharing deals to private investors. The deals are noteworthy because they expose investors to the risk of GSE default and signal the impaired condition of private housing finance since the crisis.

Each of these debt offerings is linked to the performance of a specified pool of 30-year fixed-rate agency mortgages, with the GSEs retaining a minimum of 5 percent.

Fannie Mae and Freddie Mac have used their market power to help assure loan quality through “putback clauses” that force loan originators to repurchase loans that have underwriting defects. Investors have shown strong interest in the offerings. In 2014, credit-risk-transfer bonds accompanied more than half of the GSEs’ issuances.

Although credit-risk-transfer issuances have increased, private-label loan securitizations remain rare and primarily limited to pools of extremely high-quality loans.

OFR analysis of loan origination data from the GSEs and CoreLogic, Inc., for mid-2013 through mid-2015 suggest that the risk-sharing deals allow investors to take credit risk while limiting their exposure to defects that can arise in private-label securitizations. They also reduce taxpayer exposure to mortgage losses, but they are not a cure-all because they expose investors to the risk of GSE default. This possibility is remote under federal conservatorship, but potentially problematic in the future.

Research and Data Publications

The OFR has three publication series — briefs, working papers, and discussion papers — designed to advance understanding of topics related to financial stability analysis and measurement, test theories and hypotheses, and elicit discussion among researchers, industry and market participants, regulators, academia, and the public.

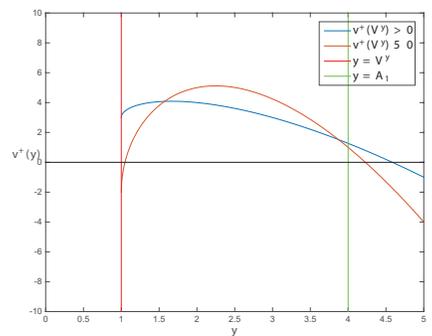
It is worth noting again that views and opinions expressed in these papers are those of the authors and do not necessarily represent official positions or policies of the OFR or of the Department of the Treasury.

From our last annual report, through FY 2015 and to the end of November 2015, researchers in the OFR Research and Analysis Center and their coauthors produced seven briefs, 24 working papers, and three staff discussion papers. All are on the OFR website at financialresearch.gov.

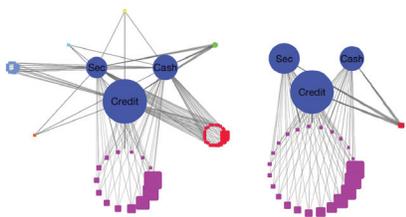
This section groups these publications, some of which we have already mentioned, by theme. Several themes relate to the OFR programs initiative discussed in Chapter 3 (see **Core Programs: The Next Step**).

Central Counterparties

- **Hidden Illiquidity with Multiple Central Counterparties** (Paul Glasserman, Ciamac C. Moallemi, and Kai Yuan). This working paper focused on the systemic risks in markets cleared by multiple central counterparties. Each CCP charges margins based on the potential impact from the default of a clearing member and subsequent liquidation of a large position. Swaps dealers can split their positions among multiple CCPs, effectively hiding potential liquidation costs. A lack of coordination among CCPs can lead to a “race to the bottom” because CCPs with lower perceived liquidation costs can drive competitors out of the market.
- **Systemic Risk: The Dynamics Under Central Clearing** (Agostino Capponi, W. Allen Cheng, and Sriram Rajan). This working paper developed a model for concentration risks that clearing members pose to central counterparties. Over time, larger clearing members crowd out smaller clearing members. High clearing member concentration results in relatively lower lending, a higher cost of capital, and increasingly costly hedging, creating systemic risk. To address this risk, the paper proposed a self-funding systemic risk charge.



Stress Testing



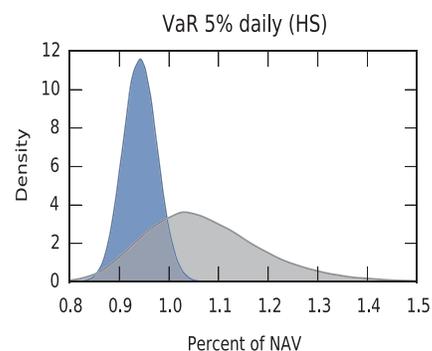
- **Measuring the Unmeasurable: An Application of Uncertainty Quantification to Financial Portfolios** (Jingnan Chen, Mark D. Flood, and Richard B. Sowers). Uncertainty is a crucial factor in financial stability, but it is notoriously difficult to measure. This working paper extended techniques from engineering to quantify fundamental economic uncertainty, and applied the method to an example of portfolio stress testing. By this measure, uncertainty peaked in late 2008.
- **Incorporating Liquidity Shocks and Feedbacks in Bank Stress Tests** (Jill Cetina). This brief discussed how stress tests could incorporate four types of shocks — credit, funding, liquidity, and collateral values — and showed that shocks can affect regulatory ratios for capital and liquidity simultaneously. Additionally, in times of stress, a bank's responses to a binding regulatory ratio can spread shocks to other banks.
- **Are the Federal Reserve's Stress Test Results Predictable?** (Paul Glasserman and Gowtham Tangirala). This working paper examined the results of four rounds of stress testing of the largest U.S. bank holding companies, starting in 2009. The data revealed a growing correlation in results from one year to the next, highlighting whether the stress tests in their current form may be losing some of their information value over time. The authors discussed the implications of these patterns and recommended greater diversity in the stress scenarios analyzed.
- **Dynamical Macroprudential Stress Testing Using Network Theory** (Dror Y. Kenett, Sary Levy-Carciente, Adam Avakian, H. Eugene Stanley, and Shlomo Havlin). This working paper presented a dynamic bipartite network model for a stress test of a banking system's sensitivity to external shocks in individual asset classes. As a case study, the model was applied to investigate the Venezuelan banking system from 1998 to 2013. The model quantifies the sensitivity of bank portfolios to different shock scenarios and identifies systemic vulnerabilities that stem from connectivity and network effects, and their time evolution. The model provides a framework for dynamical macroprudential stress testing.

Data and Data Analytical Techniques

- **Repo and Securities Lending: Improving Transparency with Better Data** (Viktoria Baklanova). This brief focused on data gaps in U.S. repurchase agreements and securities lending markets. A paucity of data and a limited understanding of the institutional structure of these markets prevented regulators from fully identifying and responding to vulnerabilities during the 2007-09 financial crisis. The

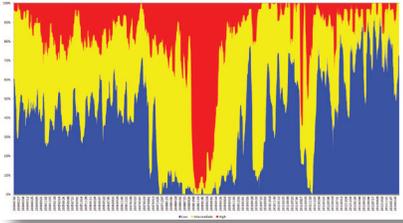
OFR and Federal Reserve conducted a pilot data collection to close these data gaps.

- **Contract as Automaton: The Computational Representation of Financial Agreements** (Mark D. Flood and Oliver R. Goodenough). This working paper showed that the fundamental legal structure of a well-written financial contract follows a logic that can be formalized mathematically as a “deterministic finite automaton.” This allows, for example, automated reasoning to determine whether a contract is internally coherent and complete. The paper illustrated the process by representing a simple loan agreement as an automaton.
- **Clustering Techniques and Their Effect on Portfolio Formation and Risk Analysis** (Victoria Lemieux, Payam S. Rahmdel, Rick Walker, B.L. William Wong, and Mark D. Flood). This discussion paper showed that risk can be distributed in complex and unexpected ways across financial markets. Grouping financial assets into broad portfolios is a common practice, but this aggregation tends to hide important nuances of the overall risk profile. For example, large long and short positions may individually be important, but they may cancel out in the aggregate. This paper introduces the “RiskMapper,” an interactive, visual tool for exploring the benefits of different approaches for aggregating and disaggregating financial portfolios. It describes early-stage research into the strengths, weaknesses, and ramifications of different rules, risk measures, and visualization approaches.
- **Gauging Form PF: Data Tolerances in Regulatory Reporting on Hedge Fund Risk Exposures** (Mark D. Flood, Phillip Monin, and Lina Bandyopadhyay). This working paper examined the precision of Form PF, a regulatory filing introduced after the financial crisis to measure risk exposures for private funds, including hedge funds. The paper found that Form PF’s measurement tolerances are large enough to allow private funds with dissimilar risk profiles to report similar risk measurements to regulators.



Market Structure

- **Concentrated Capital Losses and the Pricing of Corporate Credit Risk** (Emil Siriwardane). This working paper used credit default swap (CDS) data from 2010 to 2014 to show that capital fluctuations for sellers of CDS protection are an important determinant of CDS spread movements.
- **Market Liquidity and Heterogeneity in the Investor Decision Cycle** (Richard Bookstaber, Michael D. Foley, and Brian F. Tivnan). This working paper presented a model of market liquidity where those who need to sell come into the market with a greater need for immediacy than those who are willing to buy. This is a critical market dynamic behind the illiquidity that arises during market dislocations



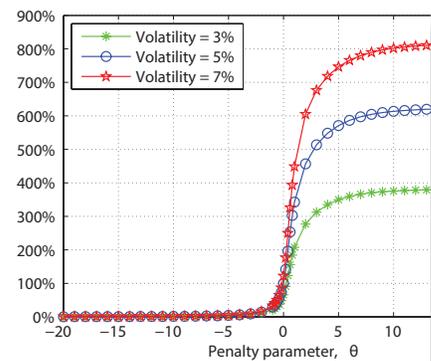
and crises, when some are in forced-selling mode, while others are hesitant to come in and take the other side of the trade.

- **Systemwide Commonalities in Market Liquidity (Mark D. Flood, John C. Liechty, and Thomas Piontek).** This working paper identified hidden liquidity regimes (high, medium and low) across a broad range of financial markets that can be used for characterizing periods of market stress and identifying underlying predictors of liquidity shocks. This regime could have provided meaningful predictions of liquidity disruptions up to 15 trading days in advance of the financial crisis. These methods offer a potential framework for monitoring and predicting a systemwide collapse in market liquidity, which could signal a collapse of liquidity in the funding markets as experienced in the crisis.
- **Reference Guide to U.S. Repo and Securities Lending Markets (Viktoria Baklanova, Adam Copeland, and Rebecca McCaughrin).** This working paper is a reference guide on U.S. repo and securities lending markets. It discussed the main institutional features of these markets, their vulnerabilities, and data gaps that prevent market participants and regulators from addressing known vulnerabilities.
- **Quicksilver Markets (Ted Berg).** This brief stated that U.S. stock prices appeared high in late 2014 and early 2015 by historical standards, using a quantitative threshold to identify potential stock market bubbles. Although the financial stability implications of a market correction could be moderate because of limited liquidity transformation in the U.S. equity market, the brief discussed other financial stability issues that may be more relevant, such as leverage, compressed pricing of risk, interconnectedness, and complexity.

Financial Institution Risks and Regulation

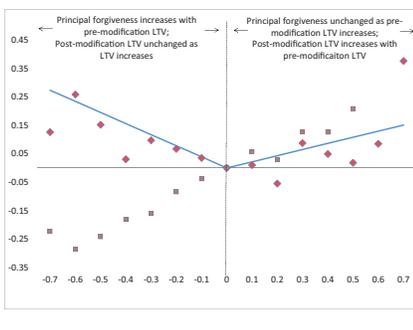
- **Systemic Importance Indicators for 33 U.S. Bank Holding Companies: An Overview of Recent Data (Meraj Allahrakha, Paul Glasserman, and H. Peyton Young).** This brief analyzed new data about the nation’s most systemically important bank holding companies — financial institutions whose failure could pose the greatest threat to financial stability.
- **A Comparison of U.S. and International Global Systemically Important Banks (Paul Glasserman and Bert Loudis).** Among global systemically important banks (G-SIBs), U.S. banks rank high in systemic importance relative to foreign banks, this brief said. G-SIBs with higher systemic importance scores do not consistently have higher risk-based capital ratios, despite the importance of capital as a buffer against failure.

- **More Transparency Needed for Bank Capital Relief Trades** (Jill Cetina, John McDonough, and Sriram Rajan). This brief stated that more data are needed to allow investors and counterparties to assess how banks reduce their required regulatory capital by transferring credit risk to third parties. The authors used public regulatory data to show that 18 banks purchased \$38 billion in credit protection as of the fourth quarter of 2014 to obtain regulatory capital relief. They also estimated the impact of these transactions on banks' risk-based capital ratios and noted that no data exist for other types of capital relief transactions.
- **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.
- **Private Fund Data Shed Light on Liquidity Funds** (David C. Johnson). This brief analyzed for the first time new confidential data on liquidity funds collected by the SEC on Form PF. Liquidity funds generally invest in short-term assets and have portfolios structured to meet investors' near-term liquidity needs. Compared with prime money market funds, liquidity funds hold assets with relatively longer maturities, have larger holdings of Treasury securities, and invest in a broader range of asset classes.
- **Are the Borrowing Costs of Large Financial Firms Unusual?** (Javed Ahmed, Christopher Anderson, and Rebecca Zarutskie). This working paper examined evidence of a too-big-to-fail subsidy for large financial firms by comparing borrowing costs of large and small firms across industries. The paper found that larger firms borrow more cheaply in many industries. This size effect is often largest in nonfinancial industries. These results challenge the notion that expected government bailouts are behind borrowing cost advantages enjoyed by the largest financial firms.
- **The Influence of Systemic Importance Indicators on Banks' Credit Default Swap Spreads** (Jill Cetina and Bert Loudis). This working paper examined CDS spreads in a sample of international banks for evidence of a benefit related to possible measures of systemic importance. The authors found a consistent, statistically significant negative relationship between five-year CDS spreads of banks and nine different systemic importance indicators. The paper showed that the benefit is most pronounced for banks within a certain asset-size range. The evidence was weaker for banks identified by regulators as global systemically important banks.



- **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 after the financial crisis to help ensure banks maintain enough liquid assets to cover their financial obligations during times of stress. This working paper used a series of increasingly complex examples to demonstrate issues in analyzing this new liquidity metric.
- **Bounding Wrong-Way Risk in Measuring Counterparty Risk (Paul Glasserman and Linan Yang).** This working paper proposed a new method for bounding the impact of "wrong-way risk" on counterparty credit risk measurement for a portfolio of derivatives. Wrong-way risk refers to the possibility that a counterparty's default risk increases with the market value of the exposure.
- **Corporate Governance Responses to Director Rule Changes (Benjamin S. Kay and Cindy M. Vojtech).** This staff discussion paper explained the governance changes induced by the director rules under the Sarbanes-Oxley Act and stock exchange rule changes. The paper used the law change as a natural experiment to test how firms adjust the choice and magnitude of governance tools given a "floor level" of monitoring from independent directors.

Connectedness, Contagion, and Risk Concentration



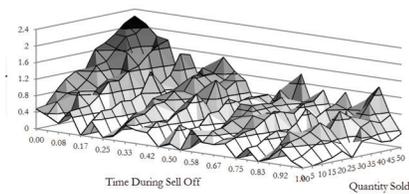
- **Contagion in Financial Networks (Paul Glasserman and H. Peyton Young).** This working paper surveyed the rapidly growing literature about interconnectedness and financial stability. The paper focused on insights in the literature on the relationship between network structure and the vulnerability of the financial system to contagion.
- **Process Systems Engineering as a Modeling Paradigm for Analyzing Systemic Risk in Financial Networks (Richard Bookstaber, Paul Glasserman, Garud Iyengar, Yu Luo, Venkat Venkatasubramanian, and Zhizun Zhang).** This working paper demonstrated the value of signed directional graphs, a modeling methodology used for risk detection in process engineering, in tracing the path of potential instabilities and feedback loops within the financial system. This approach expanded the usefulness of network models of the financial system by including critical information on the direction of influence and the points of control between the various nodes of the network.
- **Liquidity Risk, Bank Networks, and the Value of Joining the Federal Reserve System (Charles W. Calomiris, Matthew Jaremski, Haelim Park, and Gary Richardson).** The Federal Reserve was created to reduce risks related to seasonal swings in loan demand and to stabilize fluctuations in interest rates. Early on, many state-chartered banks chose not to join the system because of the cost

of the Federal Reserve's reserve requirements. This working paper focused on the decisions of state-chartered banks in New York about joining the Federal Reserve System from 1915-24. The inability to attract many state-chartered banks created indirect access to government protection (lender of last resort) without federal regulation.

- **Economic Uncertainty and Commodity Futures Volatility (Sumudu W. Watugala).** This working paper investigated the dynamics of commodity futures volatility and analyzed the impact of increased emerging market demand on commodity markets.
- **How Lead-Lag Correlations Affect the Intraday Pattern of Collective Stock Dynamics (Chester Curme, Rosario N. Mantegna, Dror Y. Kenett, Michele Tumminello, and H. Eugene Stanley).** This working paper explored how the increasing correlation among intraday stock returns affects the possibility to diversify investment risk and potentially may affect market stability.
- **An Agent-based Model for Crisis Liquidity Dynamics (Richard Bookstaber and Mark Paddrik).** This working paper presented an agent-based model for examining price impacts and liquidity dynamics during financial crises, which are often characterized by sharp reductions in liquidity followed by cascades of falling prices. The model highlights the implications of changes in market makers' ability to provide intermediation services and the decision cycles of liquidity demanders versus liquidity suppliers during a crisis.
- **Safe Assets as Commodity Money (Maya Eden and Benjamin Kay).** This working 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.

Housing and Financial Stability

- **The Effect of Negative Equity on Mortgage Default: Evidence from HAMP PRA (Therese C. Scharlemann and Stephen H. Shore).** This working paper used data from the Home Affordable Modification Program's Principal Reduction Alternative to examine the effect of principal forgiveness on mortgage default. On average, 3.1 percent of loans become delinquent and exit the program each quarter. The authors estimated the rate would have been 3.8 percent without principal forgiveness, which averaged 28 percent of the initial mortgage balance.
- **The Effects of Housing Adjustment Costs on Consumption Dynamics (Benjamin S. Kay).** This discussion paper examined how household consumption responds to infrequent and costly adjustment of housing when housing is a complement to other forms of consumption.



Status of the Efforts of the OFR in Meeting its Mission

The OFR made significant progress in FY 2015 toward meeting its unique, multipart mission related to financial data and research. This chapter documents that progress and outlines plans for continued advancement.

To meet our mission and be transparent and accountable to the public, we have developed a five-year strategic plan and launched parallel efforts in workforce planning and resource planning. We have assembled a world-class staff and built a robust technical infrastructure with powerful computing tools and multiple levels of security to safeguard sensitive data.



To advance our mission further in coming years, we are building on our strategic plan with a programmatic approach to our work. OFR programs will align our priorities with our mission and strategic plan, clearly communicate those priorities to our stakeholders, and set clear direction and milestones for achieving them.

For example, we will organize our work on central counterparties, or CCPs, in a single program covering risk assessment, our analytical framework, data collection, and evaluation of risk-mitigating policy tools. Likewise, our work on stress testing under another program will contain similar elements.



Our Accomplishments Over the Past Five Years

- **Filling critical gaps in data** for understanding the markets for repurchase (repo) agreements and securities lending by launching pilot projects in collaboration with the Federal Reserve and the Securities and Exchange Commission to collect and analyze such data and using that analysis to plan for permanent data collections;
- **Leading the establishment** of the global Legal Entity Identifier (LEI) system, a linchpin for precisely identifying parties to financial transactions, including heading the effort to include information in the system about corporate ownership and subsidiaries, and promoting wider use of LEIs by U.S. financial regulators;
- **Working with international groups, domestic regulators, and the financial services industry** to build consensus and develop standards to classify financial instruments, uniquely identify derivative products, and develop best practices for sharing financial data and making them accessible;
- **Assisting the Commodity Futures Trading Commission**, a member of the Financial Stability Oversight Council, in harmonizing and standardizing derivatives data reported to swap data repositories;
- **Creating our Financial Stability Monitor**, including a public online version, which helps identify vulnerabilities in the financial system based on five areas of risk;
- **Developing and publishing our Financial Markets Monitor** to examine themes and developments in global markets related to financial stability;
- **Supporting the FSOC and member agencies** in ongoing work to assess and monitor threats to financial stability;
- **Supporting FSOC by providing data and analysis** as inputs to the process of designating nonbank financial companies for heightened prudential oversight;
- **Publishing three annual reports and our 2015 Financial Stability Report**;
- **Publishing more than 50 OFR research products**, including briefs, working papers, and discussion papers, about financial stability data, analysis, and the evaluation of financial stability policies;
- **Creating a website** at www.financialresearch.gov to make our work more transparent and easily accessible to the public;
- **Establishing our Financial Research Advisory Committee** and engaging with it for advice on our activities on data, research, and current analysis;
- **Hosting and cohosting conferences, workshops, and seminars** to promote discussion of financial stability data, analysis, and policy; and
- **Building a robust information technology infrastructure** for securely collecting and maintaining financial data and to support the analytic and visualization tools required for analyzing and monitoring financial activity and vulnerabilities.

Strategic and Workforce Planning

In the OFR's first five years, we have evolved from a start-up organization to an Office that is leading improvements in the quality, scope, and accessibility of financial data and in assessing and monitoring threats to financial stability.

To advance our mission further in coming years, we are building on our strategic plan with a programmatic approach to our work. OFR programs will align our priorities with our mission and strategic plan, clearly communicate those priorities to our stakeholders, and set clear direction and milestones for achieving them.

To guide our work, we developed a five-year strategic plan that gives our staff a clear framework for achieving our mission and explains how our work produces value for stakeholders.

The plan, released in February 2015, evolved from our previous strategic framework and is based on the statutory mandates in the Dodd-Frank Act (see [FYs 2015-19 Strategic Plan](#) on our website).

Building on the foundation of the plan, we translate our goals and objectives into specific programs, activities, and deliverables that we strive to embed in the performance plans of our staff. The result is a roadmap for realizing our mission and holding ourselves accountable. To assure transparency and accountability to all stakeholders, we articulate those programs and activities to the public.

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.

- The OFR's monitoring tools and analyses are widely used and critical to assessing financial stability.
- Data used to monitor financial stability are comprehensive, reliable, and accessible to policymakers and the public through the OFR.
- Data providers and the public trust, acknowledge, and recognize that OFR data are protected and secure.

Goal: Standards that improve the quality and usefulness of financial data are identified and adopted.

- Recognition of the need for standards by policymakers and industry.
- The OFR is the source of expert knowledge needed to develop and implement types and formats of data reported and collected.
- Financial data standards that create efficiencies and facilitate analysis are widely used.

Goal: Leading-edge research improves financial stability monitoring and the scope and quality of financial data, and informs policy and risk management.

- The OFR is the recognized center for objective, innovative research on financial stability.
- OFR research is widely cited and used to improve policymaking, risk management, financial stability, and the scope and quality of financial data.

In our planning process, we used recognized workforce planning techniques to determine our needs for skills and staffing, and to determine the tools necessary to achieve our mission.

As we described in our recently released *2015 Annual Report to Congress on Human Capital Planning*, we used those tools to build a strong organization with a world-class staff and a robust technical infrastructure with powerful computing tools and multiple levels of security to safeguard sensitive data.

The planning process also directs our focus toward ensuring that our stewardship of the resources entrusted to us is effective and economical.

Our strategic plan is designed to last for the next several years, but our planning process must also be flexible enough to accommodate changing circumstances, including changes that can arise from financial innovation. It also must accommodate our need to reach out to FSOC member agencies, the financial services industry, and international regulators to collaborate on projects and initiatives that advance the study and measurement of potential risks to financial stability.

Core Programs: The Next Step

Our programmatic approach extends from our strategic planning process and identifies core areas of concentration that align our priorities to our mission. Each program includes an array of elements that typically include an analytical framework, assessment of risks, identification of data requirements, and evaluation of program-specific policy tools. In each case, we will link program goals to our statutory requirements. This approach, which we expect to continue and expand over the long term, conveys clearly to our stakeholders how our work ties to progress on achieving our mission.

In 2015, the OFR identified eight programs for coordinating our work on data, research, and analysis. We expect to expand that number over time. We will strengthen our work in each program by developing technology tools, gathering market intelligence, and engaging with stakeholders.

Our approach is designed to complement, not duplicate, others' work. Consequently, we will focus each of our program efforts primarily on three areas uniquely related to our mission:

1. Improving the quality, scope, and accessibility of financial data; for example, determining and filling gaps in data needed for assessing and monitoring vulnerabilities;
2. Assessing and monitoring vulnerabilities arising from the interconnections in the financial system; and
3. Conducting policy studies and evaluating tools designed to mitigate risks to financial stability.

Program Components: Monitors

1. Make a comprehensive description of the Financial Stability Monitor and its components accessible on our website at financialresearch.gov.
2. Continue to develop techniques to make the Financial Stability Monitor more forward looking, test its performance, and include additional data on quantities and prices.
3. Bring monitors from development into production for money market funds, credit default swaps, hedge funds, and cross-asset correlations and volatility.
4. Identify data gaps through the monitoring program, work to fill them, and make the data available publicly as appropriate.

Program Components: Central Counterparties

1. Analyze central counterparty (CCP) design, risks, risk management practices, and potential systemic impacts.
2. Identify and address data gaps (potentially through a pilot data collection and ultimately a permanent collection in collaboration with primary regulators) to improve the CCP data available to regulators and market participants.
3. Develop tools for monitoring CCP activities and publicly publish data or monitors to help market participants assess risk exposures to CCPs.
4. Evaluate policies designed to mitigate these risks.

In the descriptions that follow, we outline the logic and goals for each program. More details are also discussed in the next section. Our current core program areas are:

Monitors – We are developing a suite of tools to assess, measure, and monitor risks across the financial system. The OFR has launched two monitor products so far, the Financial Stability Monitor and the Financial Markets Monitor.

The Financial Stability Monitor is a high-level snapshot of vulnerabilities in the financial system based on five risks: credit, contagion, funding, macroeconomic, market, and funding and liquidity.

The Financial Markets Monitor is an overview of major developments and emerging trends in global markets related to financial stability.

We are planning additional monitors to focus on areas such as money market funds, credit default swaps, hedge funds, volatility, and cross-asset correlations. The program's ultimate goal is to have a monitoring toolkit that indicates emerging risks across the financial system and within its components. The program will involve systematic testing of the toolkit and its elements, refining the tools to be more forward looking, and periodically incorporating new data and information.

Central Counterparties – We have begun to evaluate and measure vulnerabilities in central clearing and in CCPs. The increased use of central clearing and CCPs in the derivatives markets increases price transparency and improves risk management, but it also can introduce concentration and contagion risks in replacing a network of two-way trading relationships with a centralized approach.

In addition, central clearing can have the unintended consequence of creating incentives for market participants to obscure the costs of potential defaults and liquidation. Data are lacking in scope and quality to assess and analyze those risks. Finally, the policy toolkit to address those risks is still in development and requires evaluation.

CCPs are supervised by multiple regulators. Although the OFR does not have a supervisory role, we have a unique ability to study CCPs across institutions and markets. We can also develop monitoring tools and improve the data available to regulators and market participants. Our Financial Research Advisory

Program Components: Data Quality

1. Develop and publish a financial instrument reference database — an authoritative source for precise, common definitions and descriptive data, known as metadata.
2. Continue to identify and implement data standards for markets and critical instruments, such as derivatives, repos, and mortgages, by collaborating with domestic and international authorities and industry standard-setting bodies.
3. Establish a data stewardship function to make datasets required to analyze threats complete, accurate, and timely.
4. Work toward requiring the use of the LEI and appropriate instrument standards for all reporting entities to improve data quality and promote their use on a consistent, global basis.
5. Add information to the LEI system to identify relationships among entities, such as ownership and subsidiaries.

Committee made two recommendations in July 2015 that the OFR further analyze risks in CCPs and launch a CCP data collection.

Data Quality – The financial crisis demonstrated to regulators and industry that standardizing data collected from financial services companies is necessary for effective oversight of the financial system and its parts.

Data quality is particularly important to the OFR and the FSOC because complete, accurate, and timely data are essential to identify and analyze vulnerabilities in the U.S. financial system. Data standards do not assure quality, but without standards, comparing, aggregating, and analyzing the data essential for financial stability analysis are nearly impossible. That's why the OFR has a mandate to standardize the types and formats of data we report and collect, and to assist FSOC member agencies with the development and use of data standards.

The financial services industry, unlike other industries, has been slow to agree on consistent data standards and formats required for high-quality data. Solving this “collective action problem” and speeding development of data standards requires concerted effort from the public sector. Much of our work with our FSOC counterparts and international authorities revolves around developing and promoting data standards so data collected and shared can support a wide range of analysis to understand financial system risks.

Data Scope – The OFR has a mandate to collect from any financial company the data necessary to assess to what extent a financial activity or financial market poses a threat to U.S. financial stability.

To assess data gaps and to prioritize filling them, we collaborate with our regulatory colleagues to identify key questions and the data needed to answer them. We use data inventories or catalogs to compare the needs to the available data and to prevent the duplication of existing data collection efforts.

Before building permanent data collections, we will engage with industry — the sources for financial data — and conduct pilot projects to ensure that the data collected are defined precisely and meet specific data-quality criteria.

Program Components: Data Scope

1. Assess and prioritize data needs for critical risk topics using mapping techniques and metadata catalogs.
2. Develop and implement pilot projects to ensure data are fit for the intended purpose.
3. Develop and implement rules for permanent data collections that require the use of appropriate data standards and security protocols.

Program Components: Data Accessibility

1. Move beyond the existing Interagency Data Inventory and help FSOC member agencies link their metadata catalogs or create such catalogs.
2. Create and promote a set of best practices and techniques for data sharing among regulators and between regulators and the public.
3. Promote the standardization and efficient development of memorandums of understanding that set the terms for timely and appropriate access to nonpublic data for the regulatory community.

We will require the LEI and other data standards, as they become available, in all OFR data collections.

To measure financial activity for financial stability monitoring, data scope must be both comprehensive and detailed. It must be comprehensive to analyze sources and uses of funds, the behavior of borrowers and lenders, and risks wherever they arise. It must be detailed, at times even to the transaction level, because assessing vulnerabilities involves measuring risk throughout the distribution of outcomes, not just at the mean or median. For example, an analysis of average lending terms and conditions might hide important concentrations of risk. Taking these factors into consideration, we will collect highly detailed data when they are essential for such analysis.

Working with our FSOC counterparts, we are preparing to amass new, permanent collections of bilateral repo data and securities lending data. These datasets will provide a clearer view of the functioning, risks, and vulnerabilities in two significant markets essential for securities financing, price discovery, and market making. We have been careful to align these efforts with those of other agencies.

Data Accessibility – The Dodd Frank Act requires the OFR to collect data on behalf of the FSOC, provide data to the FSOC and its member agencies, and maintain data security and confidentiality. After consulting with member agencies, we will appropriately provide data to financial industry participants and the public to increase transparency and facilitate research on the financial system. For the OFR to achieve these objectives, secure and appropriate data sharing with other officials and industry must be a key priority.

To implement this program, we are promoting the use of catalogs of metadata — data about the data. Metadata catalogs inform parties about the data before any access is granted to the actual datasets. We will build on the existing Interagency Data Inventory that catalogs basic information describing data collected by FSOC member agencies and help them link their metadata catalogs or help create catalogs as needed.

Linked metadata catalogs can provide information useful in crafting agreements to share data with other regulators in this country and globally and, as noted in the data scope program, for deciding how to fill data gaps. The linked catalogs will also help in applying consistent safeguards and controls to assure security and confidentiality. We will also create and promote

Program Components: Stress Tests

1. Compile supervisory data needed to evaluate stress-testing methodologies.
2. Develop coherent stress scenarios beyond those currently used.
3. Conduct research on methodologies for stress testing of individual firms and the U.S. financial sector as a whole.

Program Components: Risks In Changing Market Structure

1. Analyze how financial innovations and regulations alter the incentives of financial firms, trading and funding decisions, and the functioning of markets.
2. Identify gaps in data needed to monitor changes in market structure and collaborate with primary regulators to close them.
3. Develop tools to monitor changes in market structure and evaluate policies to improve market transparency by releasing aggregate information.

a set of best practices for data sharing among regulators and between regulators and the public.

Stress Tests – The Dodd-Frank Act directs the OFR to evaluate and report on stress tests. The mandate is broad — not limited to stress testing of banks. The OFR’s stress testing program has three parts, covering banks, nonbanks, and the U.S. financial system as a whole.

The bank stress testing part of the program is well underway. We have published several working papers and briefs on bank stress testing and will be extending this research.

Stress testing of nonbank financial institutions aims to address several questions. Which types of nonbank financial institutions should perform stress tests? What should those tests look like? How effective are current stress tests? What improvements should regulators consider?

Research on stress testing of the entire U.S. financial system is an essential component of the OFR’s stress testing program. Stress tests of individual institutions could shed light on the kinds of financial activities and firms that might pose risks to financial stability. Those activities and firms could warrant additional attention from the FSOC. The impact of stresses on individual firms or types of firms can spread to other parts of the financial system through financial markets or connections among firms.

Risks in Changing Market Structure – The Dodd-Frank Act broadly requires the OFR to conduct, coordinate, and sponsor research to support and improve regulation of financial markets. It also directs the OFR to investigate disruptions and failures in financial markets. We are fulfilling this mandate, in part, through our program on market structure.

A market is characterized by its structure. Who are the buyers, sellers, and market makers? How many participants are on each side of the market? How easy is it to enter the market? What information do the participants have and how do they use it? How much influence do they have on price quotes and transaction prices? How are trades executed? Clearly, all these characteristics are fluid and have implications for market outcomes.

In financial markets, market structure varies based on the assets traded and the rules governing the market. Changes in a market’s structure can have implications for financial stability. For

example, nonbank financial firms may transform into shadow banks, engaging in credit intermediation as banks do but without the same oversight as banks. High-frequency trading can alter trading speed, transparency, and market efficiency. After a merger, a larger surviving firm can have more influence on price. Changes in how prices are quoted can alter price volatility.

Assessing the systemic impact of market structure changes requires transaction-level data across markets and market participants. The OFR can meet this challenge because of its mandate to collect and standardize data across financial markets. Research under this program reflects this unique position.

Risks in Financial Institutions – The Dodd-Frank Act broadly requires the OFR to conduct, coordinate, and sponsor research to support and improve regulation of financial institutions. We fulfill this mandate through our research on financial institutions.

Our research in this area is unique because we focus on financial stability and have no direct policymaking role for particular financial institutions. This perspective frees us to consider how risks migrate across the U.S. financial system. It also positions us to evaluate the unintended consequences of regulations.

Our research matches the breadth of the mandate. It spans bank and nonbank financial institutions. Nonbanks within its scope include asset management firms, insurance companies, broker-dealers, and central counterparties.

OFR research addresses a range of questions. Which types of financial firms pose risks to the U.S. financial system as a whole? What aspects of those firms or their activities underlie those risks? Are firms engaging in shadow banking activities, and if so, how does that contribute to the risks they pose? How do financial regulations reduce the risk firms pose to the financial system? How are these firms adapting to regulatory changes? What innovations are occurring in the products or services they offer? How are the firms' internal operations changing, and what risks could those changes introduce? What are participants' business models? How are business models evolving with the introduction of new products and services? How are regulatory changes driving business models?

Program Components: Risks In Financial Institutions

1. Assess the risk financial institutions pose to financial stability that current regulations do not address.
2. Identify and fill gaps in data needed to assess systemic risks and stability policies.
3. Evaluate regulatory policies adopted to promote safety and soundness and financial stability.
4. Monitor innovations in the financial sector in response to regulatory changes.

Further Discussion of Data Quality and Scope

The OFR has a unique mandate under the Dodd-Frank Act to improve the scope, quality, and accessibility of financial data. Financial data have improved substantially since the crisis, but significant deficiencies remain. Challenges include gaps in data, poor data quality, and lack of access to data. In addition, the array of financial regulators in the states and other countries inhibit coordination.

A significant portion of our data-related work entails gathering, cleaning, and making data appropriately available for our financial stability research and the FSOC, including for its consideration of nonbanks for designation as systemically important financial institutions.

As discussed in the preceding section, data quality, scope, and accessibility will each be an OFR core program in the coming year. The following discussion describes key aspects of our work on data quality and scope.

Data Quality

High-quality data are standardized, interoperable, and housed in robust information technology systems that facilitate data reporting, sharing, and risk management.

Data standards are agreements on how to define, represent, format, and exchange data. Standards facilitate productive data sharing and improve the quality of data collected from firms, utilities, and other data repositories. We are working with industry standards groups and financial regulators to promote the development and adoption of standards for entity identifiers, instrument identifiers, product identifiers, transaction identifiers, and financial and business reporting.

The Legal Entity Identifier Project

Our most significant data quality project, the initiative to establish the global LEI system, has achieved remarkable success and is now developing standards for representing corporate ownership structures.

The LEI is a unique, 20-character code similar to a bar code that precisely identifies each legal entity of companies that participate in global financial markets. The OFR has led the global LEI initiative as it has progressed from conception to full-fledged operational system in just a few years.

The LEI system represents an unprecedented collaboration of more than 80 public authorities from more than 50 jurisdictions. By September 30, 2015, almost 400,000 LEIs had been issued to entities in 191 countries. Many U.S. and European regulators require that derivatives traders include their LEI when reporting transactions to data repositories.

We have been working for several years to persuade financial regulators in the United States and overseas to require companies to use the LEI in other types of financial reports. A Global LEI System task force, co-chaired by the OFR, is developing protocols for the system to collect and link data about the parent companies, subsidiaries, and affiliates of each legal entity.

As momentum builds and the LEI system grows, the benefits are growing as well, such as efficiencies for financial companies in internal reporting and risk management, and in collecting, cleaning, and aggregating data. We also expect to reduce companies' reporting burdens by generating efficiencies in reporting data to regulators.

The greatest benefits of the LEI will be realized when the standard is pervasive worldwide.

Swap Data Repositories

Swap data repositories (SDRs) collect and maintain records of over-the-counter derivatives trades. Financial reform sought to improve transparency in derivatives markets by requiring that data on swap transactions be reported to SDRs. Swap data are critical to understand exposures and connections across the financial system, and the repositories are designed to be high-quality, low-cost collection points. Although market participants across the world have begun to report these trades, different reporting standards by SDRs and low-quality data block a comprehensive view of the markets.

The Dodd-Frank Act divided regulatory authority over swap data repositories between the CFTC, which oversees most swaps, and the SEC, which oversees a smaller market for security-based swaps.

Regulators face significant challenges in understanding and aggregating the swap data submitted to SDRs because the requirements for reporting are not precise. In addition, SDRs have not been required to check the quality of data submissions from firms and no provision exists for rejecting incomplete or inaccurate information. Authorities in the United States and overseas are focusing on these issues to improve the quality and accessibility of the data.

In June 2015, we analyzed a sample of the swap data that the CFTC requires SDRs to publish on their websites and discovered a significant percentage of incomplete fields — a problem that better use of standards would help alleviate.

The OFR and CFTC announced a joint project in March 2014 to promote the use of data standards in swap data reporting to assure swap data quality and usefulness. An initial memorandum of understanding initiated the project to enhance the quality, types, and formats of data collected from registered SDRs. Under a second agreement, members of the OFR staff are working at the CFTC on the project.

Financial Instrument Reference Database

The inability to aggregate financial data during the financial crisis was a major hurdle to understanding the financial positions of counterparties in specific instruments. The OFR has a mandate to provide a financial

instrument reference database easily accessible to the public. These databases will contain the common definitions, descriptive data, and syntax that form reference data and the identifiers that are essential to the integration of disparate datasets for identification of risks. Common definitions of financial instruments, and the meaning and syntax of their attributes, are essential for sharing, comparing, aggregating, and exchanging data. The financial instrument reference database will provide these definitions and details, and by doing so will serve as the basis for data quality.

Financial instrument reference data are digital definitions of financial contracts. Data providers break down contract types into essential elements, such as terms and conditions, instrument class, exchange venue, clearing venue, and other attributes. The digital representation of instruments enables information sharing among systems for accounting, portfolio management, compliance, and other areas.

Although these data are valuable for risk management by financial firms, they fall short of what market regulators need to manage risks to financial stability. The current lack of standardized instrument reference data coupled with the disjointed U.S. regulatory system impede data sharing. The need to assess and monitor threats to financial stability beyond national boundaries adds further complexity.

The OFR is uniquely poised to meet these challenges. To fulfill the Dodd-Frank mandate to prepare and publish a financial instrument reference database, the OFR will apply rigorous systems engineering practices and engage a wide range of stakeholders. As we noted in the discussion of our data quality program, public officials must solve the collective action problem that continues to inhibit industry in adopting common standards. The OFR will coordinate and lead market participants, regulators, and other stakeholders to advance standards that establish a universally accepted set of concepts, names, definitions, and data-exchange specifications for the financial industry. These activities require the OFR to find and develop a body of knowledge that clarifies the relationship between instrument reference data and financial stability.

Data Scope

Data must be comprehensive and detailed to have sufficient scope. To improve understanding of the financial system and threats to its stability, regulators and policymakers may have to require more companies to submit data or expand or tailor the types of data submitted to include information about evolving markets, institutions, and instruments.

Detailed data will also be needed for a deeper view.

In addition, regulators and policymakers must recognize the burden on industry from data-collection requirements. Better data standards and more

effective data sharing among regulators promise to reduce this burden, as well as improve the ability of supervisors to monitor, analyze, and respond to financial stability concerns.

Bilateral Repo and Securities Lending Data Projects

In partnership with the Federal Reserve and the SEC, the OFR is working on significant pilot projects to improve the scope of data about repurchase agreements, or repo, and securities lending activities. Repos are financial contracts for one party to sell a security to the other with the promise to repurchase it later for a previously specified price. In securities lending, one party transfers securities to another for a set fee and time in exchange for collateral. These markets were a source of contagion during the financial crisis.

The pilot programs promise to improve our understanding of short-term funding markets instrumental in providing the liquidity that helps to keep the global financial system operating. The U.S. repo market, for example, provides more than \$3.4 trillion in funding every day. However, vulnerabilities in the repo market can also contribute to risks to financial stability.

The amount and quality of data about repo and securities lending have improved since the crisis but still do not offer a comprehensive view of risks in these markets.

In the United States, the repo market has two segments based on differences in settlement. In triparty repos, clearing and settlement occur through a settlement system operated by a clearing bank (the third party). Data on the triparty repo markets are published regularly. In bilateral repo, no third party is involved in the settlement of the transaction. Information about bilateral repos is scant. For this reason, the first pilot project focused on bilateral repo, which we estimate represents about half of the total repo market.

The bilateral repo pilot marked the first time the OFR went directly to market participants to collect financial market information. Participation in the pilot project was voluntary and participating companies have given input on what data should be gathered.

The bilateral repo pilot occurred during the first half of 2015. The securities lending pilot is underway and expected to be completed during the first quarter of 2016. As mentioned, these pilots may lead to permanent data collections (see **Core Programs: The Next Step**).

A recent OFR working paper and an OFR brief detailed the institutional structure of repo and securities lending markets, the role and motivation of market participants, potential systemic risks, and data gaps (see **Research and Data Publications — Data and Data Analytical Techniques and Market Structure**). More recently, we released an OFR brief describing the results of the bilateral repo pilot and lessons learned.

Collaboration and Outreach

Collaboration and outreach are vital for the OFR to achieve our multi-part, data-and-research mission. Although we have built an organization that delivers on that mission, collaboration is essential for looking across the global financial system.

To enhance our capabilities to produce the best possible work, the OFR frequently collaborates with a wide range of stakeholders. Our collaborators are in government, industry, and academia. They include members of the FSOC and our Financial Research Advisory Committee. We also collaborate with other U.S. financial regulators, as well as policymakers, central bank officials, and others around the world. This collaboration creates a virtual research-and-data community that can have an impact much larger than the OFR alone.

To be transparent and accountable to the public, explain our mission, and develop support for it, we also engage with members of Congress, data quality groups, industry organizations, think tanks, and the public.

An important way we share our work, make it available to the public, and promote debate and discussion among interested stakeholders is by organizing or cosponsoring events. Recent events included:

- On October 22-23, 2015, the OFR and the Center on Finance, Law, and Policy at the University of Michigan cosponsored a conference in Ann Arbor, Michigan, on “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.
- On May 8, 2015, the OFR held a workshop, “Understanding the Global Legal Entity Identifier (LEI) System,” to encourage U.S. financial regulators to require the 20-digit alphanumeric LEI code in industry submissions. The LEI is already required in derivatives trading and mortgage reporting. Expanding its mandatory use would give regulators a deeper view of financial system risks.
- On January 30, 2015, the OFR and the FSOC held our fourth annual joint conference, “Evaluating Macroprudential Tools: Complementarities and Conflicts.” Speakers and panelists included representatives of the Federal Reserve Board, FDIC, U.S. Department of the Treasury, the SEC, academia, and the financial services industry.
- On January 15-16, 2015, the OFR, the Bank of England, and the European Central Bank held the first of two workshops for central bankers and financial regulators, “Setting Global Standards for Granular Data.” Participants from around the world discussed ways to standardize and share financial data and the legal, technical, and semantic issues that must be addressed. A second workshop on October 29-30, 2015, in New York City extended and built on the

first workshop. Participants 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.

- On December 5, 2014, the OFR and the Federal Reserve Bank of Cleveland cosponsored a conference, "Measurement Challenges in Macroprudential Policy Implementation: Essential Data Elements for Preserving Financial Stability." The event brought together academics, policymakers, and market participants to discuss tools that measure vulnerabilities in the financial system and advances in systemic risk measurement.

As part of our outreach to the public, OFR senior managers and specialists deliver presentations at industry, regulatory, and academic events throughout the year. For example, senior members of the OFR staff delivered formal remarks and participated in roundtable discussions at conferences and other events to discuss the OFR, key aspects of our mission, and our important work. Events included a conference on financial statistics hosted by the International Monetary Fund in November, 2014; an operations conference and exhibition hosted by the Securities Industry and Financial Markets Association in April; a conference on shadow banking hosted by the European Systemic Risk Board in May; a financial stability conference hosted by the Brookings Institution in June; a Financial Fragility Symposium hosted by the Wharton School of the University of Pennsylvania in September; a conference on financial interconnectedness hosted by the Bank for International Settlements in October; and a conference on securities lending hosted by the Risk Management Association in October.

Members of the OFR staff also delivered presentations in other venues around the world. Economists and financial analysts in the OFR's Research and Analysis Center regularly participate in events to exchange ideas with other financial stability experts. To share our work, get valuable feedback, and learn from other experts, the OFR research staff participated as invited speakers or panelists in more than 70 conferences, seminars, and workshops related to our mission in FY 2015.

In addition, more than 30 outside experts from government, academia, and international organizations gave presentations at the OFR as part of our Research Seminar Series. At those seminars, members of the OFR staff exchange ideas and debate theories with the presenters. Titles of the seminars in FY 2015 included, "Shadow Insurance," "Are Large Banks Riskier?," "Credit Risk Retention of Asset-Backed Securities," "Credit Default Swap Spreads and Systemic Financial Risk," "Impact of the Dodd-Frank Act on Credit Ratings," "Crisis Transmission in the Global Banking Network," and "Cascading Failures in Interdependent Networks: Theory and Applications."

The OFR Data Center was also active in outreach efforts, delivering remarks and participating in panels on subjects tied to the OFR's data-related mandate. For example, the OFR's Acting Chief Data Officer moderated a panel in May at the North American Financial Information Summit in New York on, "Addressing the Challenges of Aggregating, Managing and Reporting Risk Data: Responding to the Implications of the Basel Committee on Banking Supervision's Principles for Effective Risk Data Aggregation and Reporting." More than 500 senior financial data professionals attended the event.

As head of the global body overseeing the LEI program, the OFR's Chief Counsel delivered remarks on the LEI and other standards at several events in the United States and around the world.

We meet frequently with members of Congress and their staffs to explain our work on research and data. We gave substantive briefings on timely and relevant issues pending before Congress and made presentations to Congressional offices about areas of concern in the financial system whenever requested.

In addition, the OFR has regular contact with representatives of the financial services industry, data standards groups, academia, and regulators. These meetings are opportunities to discuss our work and seek valuable input. During the fiscal year, much of our analysis benefited from this regular outreach to industry practitioners and academics.

Collaboration with Global Counterparts

Today's financial markets are global, and the financial crisis showed how a problem can rapidly jump national boundaries to affect trading in other areas and asset classes. The OFR holds leadership roles in several international groups involved with financial data standards or financial stability issues. In addition to providing our unique expertise, we have the opportunity to discuss the groups' priorities and help shape their agendas on data standards, data quality, and other issues. Here are some examples of how the OFR is working with international groups to achieve our mission:

- A senior OFR researcher is a member of the Data Experts Group created by the international Financial Stability Board to develop standards and processes for global data collection of securities lending and repo agreements, a key part of the financial system plumbing. In November 2015, the group issued a report recommending how national or regional regulators can use specific data elements to collect and aggregate the data for a clearer view of interconnectedness across jurisdictions and the growing concentrations of risk in a particular market segment or group of counterparties.
- The OFR's Chief Counsel is completing a third and final year as chairman of the Regulatory Oversight Committee that oversees the

global legal entity identifier system. This international committee rolled out the LEI program on behalf of G-20 (Group of 20) governments, set up a nonprofit foundation to manage the system, and continues to focus on broad policy standards. The G-20 is a forum of finance ministers and heads of central banks from 19 countries and the European Union.

- Three senior staff members in the OFR Data Center are members of a working group on the harmonization of data on over-the-counter derivatives organized by the Committee on Payments and Market Infrastructures and International Organization of Securities Commissions. The working group released an August 2015 report asking for public comment on its plan for structuring a unique transaction identifier to improve the transparency of the global derivatives market. The group also is working on a proposal for a unique product identifier and ways to identify the critical data elements for aggregating global derivatives data.
- An associate director in the OFR's Data Center has a seat on the board of Accredited Standards Committee X9, an organization that develops standards, and a senior standards specialist chairs the organization's subcommittee on securities standards.
- An associate director in the OFR's Research and Analysis Center led a liquidity stress testing work group on behalf of the Basel Committee on Banking Supervision in FY 2015. The group published a November 2015 paper examining ways to improve bank supervisors' stress tests to move beyond traditional counterparty analysis to more sophisticated approaches that consider a bank's asset and funding linkages and how changes in behavior could destabilize markets.
- The OFR Director organized a panel discussion on "Addressing Global Data Availability Challenges" at the Eurofi Financial Forum in Luxembourg on September 10, 2015. The panel addressed three questions: (1) What are the critical gaps and inconsistencies in the data needed for financial stability monitoring and how can they be addressed? (2) How can the quality and integrity of the data be improved while reducing duplication and costs for the industry? (3) How can the data be shared appropriately among policymakers and market participants in a secure and confidential manner? Panelists included representatives from the European Central Bank, the Bank of England, the European Securities and Markets Authority, the International Organization of Securities Commissioners, and the financial services industry.

Collaboration with U.S. Financial Regulators

The OFR works closely with the FSOC and its member agencies. We continue to lead the FSOC Data Committee, leading discussions among member agencies about best practices for data sharing and data reporting efficiency. The OFR also provides monthly data and analysis to the FSOC.

As mentioned, we conducted two pilot projects to collect data from volunteer companies on bilateral repo and securities lending transactions in partnership with the Federal Reserve and the SEC. We are working with the SEC to be sure our data collections complement, rather than duplicate, each other.

We also continue to assist the CFTC 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. We also analyzed existing swap data to determine the best approach for aggregating data to calculate risk exposures and liquidity.

We continue to work with U.S. regulators to include the LEIs of mortgage originators and servicers in mortgage transactions and data collections and to include LEIs in a universal loan identifier. We also continue to collaborate with the Consumer Financial Protection Bureau on the development of a universal loan identifier and on mortgage data standards. During 2015, the OFR helped plan an interagency workshop about integrating the fragmented data produced by the U.S. mortgage finance system.

Financial Research Advisory Committee

The OFR's Financial Research Advisory Committee is an important forum for engagement between the OFR and key stakeholders. The purpose of the committee is to advise the OFR by commenting on our current work and recommending financial stability issues the Office should address. Established in 2012, the full committee meets in public twice each year. Its three subcommittees meet more frequently to discuss gaps in research, data and technology, and financial services and risk management. The subcommittees also develop proposals for the full committee to consider recommending to the OFR.

The committee, organized under the rules of the Federal Advisory Committee Act, has 31 members drawn from academia, think tanks, industry, data standards organizations, associations, and other areas. Members of the committee are recognized experts or practitioners in

the fields of data, information standards, economics, accounting, corporate governance, law, statistical analysis, financial market analysis, and risk management.

Committee recommendations cover a wide range of financial stability topics. Virtually all of these recommendations have either been implemented or are being planned for implementation. For example, the committee has recommended that to evaluate stress tests, the OFR gain access to the data used for the Federal Reserve's stress testing exercises collected on Form Y-14. We made that request and, in a public notice in September, the Federal Reserve announced its intention to share the data.

At its most recent public meeting in July 2015, the committee recommended that the OFR continue to assess and improve the quality of data available to evaluate U.S. central clearing of swaps and also collect data about central counterparty operations, which are taking on more financial system risk. We are following up on that recommendation through our CCP program (see **Core Programs: The Next Step**).

Earlier in 2015, a FRAC subcommittee recommended that the OFR design a research program to assess the interplay of different regulatory capital standards on bank behavior, particularly in times of stress. An OFR brief published in July described preliminary analysis of these issues (see **Research and Data Publications — Financial Institution Risks and Regulation**).

OFR Website

To make our data and research work more accessible to the public, we launched a website in February at financialresearch.gov. The new website allows anyone interested in our work to find information easily. The site also underscores the independence of the OFR's research and analysis. The website displays a wide range of OFR products and information,

including blogs from the Director and other senior managers, press releases, conference information, public speeches by senior leaders, and all OFR publications — annual reports, briefs, working papers, discussion papers, strategic plans, human capital reports, and monitors.

The website also contains information about data standards and the Interagency Data Inventory, a catalog of data that FSOC member agencies buy from vendors, collect from industry, or derive from other data. This inventory is tied to the OFR program on Data Accessibility (see **Core Programs: The Next Step**).



Budget and Workforce

Under the Dodd-Frank Act, the OFR budget, the FSOC budget, and certain expenses related to the orderly liquidation authority of the FDIC are funded through industry assessments.

The Department of the Treasury finalized a rule in 2012 that enabled the OFR to collect 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. Since our initial assessment in 2012, total assessable assets have increased from \$17.8 trillion to \$20.6 trillion. For the most recent assessment (September 2015), the fee rate was about \$2,200 per \$1 billion of assets held by the assessed companies.

We are managing our expenditures prudently as the OFR grows to ensure that all spending is closely tied to our strategic plan objectives and reflects good stewardship of the funds entrusted to us. For efficiency, we continue to use reimbursable administrative support services from Treasury's Departmental Offices, personnel benefits services through the Office of the Comptroller of the Currency, and services related to human resources and procurement from the Bureau of the Fiscal Service's Administrative Resource Center.

In FY 2015, the OFR spent about \$85 million (see Figure 20). Our estimated budget for FY 2016 is \$99 million. OFR budget details appear annually in the President's Budget proposal.

Figure 20. OFR Funds Obligated in FY 2015 By Quarter
(\$ thousands)

	Q1	Q2	Q3	Q4
Compensation	7,909	6,914	7,174	7,039
Benefits	2,039	2,385	2,437	2,647
Labor Total	9,948	9,299	9,611	9,686
Travel	108	153	118	75
Rents, Communications, Utilities	1	1	1	3,809
Printing and Reproduction	2	5	20	4
Other Services	7,157	3,071	8,341	6,463
Supplies and Materials	1,044	2,939	2,914	1,161
Equipment	1,041	1,391	2,001	4,352
Nonlabor Total	9,353	7,560	13,395	15,864
TOTAL	\$19,301	\$16,859	\$23,006	\$25,550

Source: OFR analysis

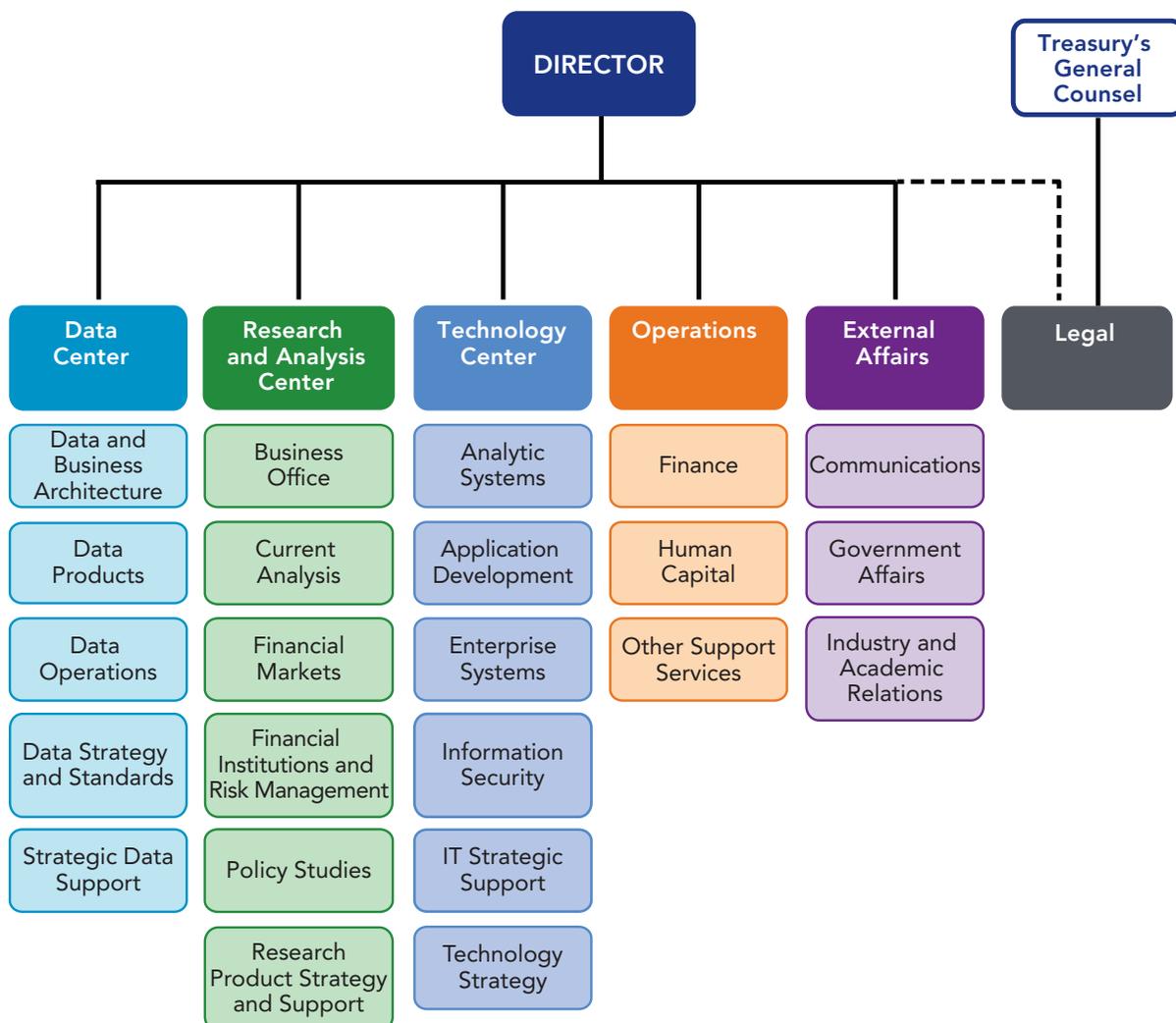
Workforce

We have built a diverse, talented workforce to carry out the OFR's mission. At the end of FY 2015, we had 201 employees (not including reimbursable and detailed staff members). Attracting and retaining diverse talent continues to be challenging because of competition for potential employees with the same specialized skills from business and academia, the Federal Reserve System, and other agencies covered by the Financial Institutions Reform, Recovery, and Enforcement Act. We have partly addressed this challenge by adopting tools to increase flexibility in our compensation policy while maintaining prudent stewardship of our expenditures. The OFR has also established work arrangements with outside academics and a partnership with the National Science Foundation to support research on financial stability.

At the end of FY 2015, we filled all senior management positions. We are now placing a high priority on filling the remaining mid-level management positions and building teams to deliver value for our stakeholders.

Most OFR employees are based in our headquarters in Washington, D.C. We also have an office in New York City to support interactions with the financial community there. The OFR has a small number of work arrangements with contributors outside of Washington, D.C., and New York to support research collaboration with academics.

Figure 21. OFR Organization by Division



Note: OFR General Counsel reports to the Department of Treasury's Office of General Counsel

Information Security

Keeping sensitive data safe and secure is a high priority for the OFR. During the past five years, we have built a secure, world-class analytic environment and technology infrastructure to support and safeguard large amounts of data.

To guard against potential access by unauthorized individuals, we strictly adhere to a data categorization and sensitivity classification methodology and conduct routine access reviews and security assessments. Our access control allows security groups and policies to be applied at a detailed level, ensuring a high degree of oversight. As required by the statute, all employees with access to nonpublic data are subject to post-employment restrictions to assure that data will be kept secure. Finally, we have created a strong OFR security culture — one in which security is a primary concern of all employees.

The OFR's information security program is responsible for ensuring that the analytic environment has effective security controls and procedures equal to the level of risk posed by the information systems, tools, and data the Office holds. The program is guided by the following principles:

- Ensuring compliance with applicable Treasury policies and other federal policies.
- Implementing the supplemental controls necessary for appropriate security.
- Maintaining compliance with Publication 199 (*Standards for Security Categorization of Federal Information and Information Systems*) of the Federal Information Processing Standards (FIPS) issued by the National Institute of Standards and Technology (NIST). The standards cover categorization, sensitivity, and classification of all systems and information.
- Granting access to systems and information as needed and only to the extent necessary to accomplish the mission.
- Providing multiple layers of security controls.
- Promoting a culture of security awareness so everyone in the OFR workforce maintains a focus on information security.

The OFR analytic environment contains information systems and tools for conducting analytical analysis on data stored by the OFR. All aspects of the OFR's information security program comply with the Federal Information Security Management Act, known as FISMA. In addition, all OFR systems have undergone a security assessment and accreditation process and received formal authorization to operate. To achieve and maintain this authorization, the environment is subject to rigorous security controls, audits, and continuous monitoring.

The security assessment and accreditation process conforms to NIST Special Publication 800-37 (*Guide for Applying the Risk Management Framework to Federal Information Systems*), which requires independent

audits for compliance with security controls specified in NIST SP 800-53 Revision 4 (*Security and Privacy Controls for Federal Information Systems and Organizations*). The security controls are continuously monitored and assessed for effectiveness internally, as well as by independent third parties, to ensure the confidentiality, integrity, and availability of the environment. All new information systems and tools added to the environment undergo a battery of security assessments to ensure they meet or exceed the security requirements for processing, storing, or transmitting data.

Users' access to the analytic environment is managed through documented procedures based on a need to know. 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*).

Data processed, stored, and transmitted within the environment must receive a data classification level, following 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 ensure data are kept secure throughout their lifecycle. We review the classification process at multiple levels to ensure accurate FIPS categorization, including an assessment for identification of personally identifiable information and risk to personal privacy. After we determine an OFR data classification for a dataset, it is brought into the environment according to a process with multiple layers of security controls.

Once data are inside the analytic environment, OFR users must request permission for access and the request is reviewed at multiple levels to verify a valid need for access and to confirm that access adheres to terms of any applicable agreements related to the data. Data access is subject to periodic auditing and is granted only on a per-user basis.

The Information Security Program promotes information security awareness to enhance the security posture of the OFR. A security briefing is part of the orientation process for new employees and contractors. All OFR staff members must pass rigorous security training tests annually. We also post security tips on the OFR's intranet, on printed signs throughout our offices, and in the staff newsletter.

The privacy program, an essential component of the Information Security Program, governs the safeguarding of personally identifiable information, including the appropriate collection, maintenance, use, dissemination, and destruction of such information.

Promoting transparency and accountability about the OFR's collection, use, and safeguarding of this information is essential to build and maintain public trust.

The OFR Privacy Program

- Ensures compliance with applicable laws, regulations, policies, guidance, and best practices for information privacy.
- Educates, trains, and promotes awareness of information privacy processes, practices, and responsibilities among OFR employees.



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