OFR
OFFICE OF FINANCIAL RESEARCH

VIEWPOINT

Size Alone is Not Sufficient to Identify Systemically Important Banks

17-04 | October 26, 2017

Some banks have been subject to enhanced regulation since the 2007-09 financial crisis because the failure of any one of them could pose risks to the financial system. Many regulations use the amount of bank assets to identify and categorize such firms, but size alone does not equate to risk to financial stability. An alternative approach, used to identify global systemically important banks (G-SIBs), relies on multiple measures, not just size. This analysis suggests that using such a multifactor approach to identify non-G-SIB U.S. banks for enhanced regulation — one focused on systemic importance — would be an improvement on the asset-size thresholds now used.

The Dodd-Frank Wall Street Reform and Consumer Protection Act, Section 115, created new standards "to prevent or mitigate risks to the financial stability of the United States that could arise from the material financial distress, failure, or ongoing activities of large, interconnected financial institutions." The purpose was to require heightened prudential standards for any bank whose failure could pose risks to financial stability.

Under the Dodd-Frank Act, an asset-size threshold is used to determine banks that should be subject to heightened prudential regulation. However, the OFR's analysis of systemic importance data reveals that size alone may not be optimal to identify such banks. Some large banks may not be systemically important; and conversely, some smaller banks might be. Bank size alone does not equate to risks a firm may pose to financial stability.

According to the OFR's analysis, an alternative approach is preferable, one that uses multiple factors to capture a bank's systemic importance. Currently, a multifactor approach to risk assessment is used by U.S. bank regulators to identify global systemically important banks (G-SIBs). A G-SIB is defined as a financial institution whose distress or disorderly failure would cause significant disruption to the wider financial system

and economic activity. The G-SIB methodology could be extended and revised to identify large U.S. banks that are not G-SIBs, but should nonetheless be subject to enhanced regulation.

In this OFR viewpoint, we examine alternative methodologies and criteria for identifying systemically important banks, drawing on and extending work the OFR has published over the past five years.

First, the viewpoint describes the existing size-based thresholds regulators use to identify banks subject to tougher standards; these include stress testing, capital and liquidity minimums, and resolution planning. Next, it describes the multifactor approach regulators use to identify G-SIBs. This multifactor framework is based on a global standard.

The viewpoint also considers alternative systemic measures that use market data and balance-sheet information. These measures can be valuable as a check of the divergence between regulatory and market perceptions of systemic risk. They generally confirm the systemic importance of the eight U.S. G-SIBs. Like the multifactor framework used for identifying G-SIBs, some of these alternative measures are intended to indicate a firm's systemic impact if it were to fail. Others measures also factor in the probability that a firm will fail.

The analysis in this viewpoint suggests two adjustments that could improve the G-SIB multifactor methodology for identifying G-SIBs and other possible systemically important banks:

1. Better incorporate "substitutability" risks, which are risks arising from a lack of substitutes for a firm's unique services that are central to the functioning of financial markets.
2. Better account for the global footprints of foreign banking organizations operating in the United States.

Current Thresholds for Enhanced Regulatory Standards

The Dodd-Frank Act directed the Federal Reserve to establish enhanced prudential standards for any bank holding company with total consolidated assets of $50 billion or more. Regulators have since put in place stricter, or "enhanced," requirements for banks that are systemically important. G-SIBs face the most stringent standards.

U.S. bank regulators generally use asset-size thresholds as a starting point to identify banks for enhanced standards.

U.S. bank regulators generally use asset-size thresholds as a starting point to identify banks for enhanced standards.

U.S. bank regulators generally use asset-size thresholds as a starting point to identify banks for enhanced standards. Today, effectively three thresholds for enhanced prudential standards apply to U.S. banks: (1) assets of more than $50 billion, (2) assets of more than $250 billion or foreign exposures of more than $10 billion, and (3) G-SIBs (see **Figure 1**).

In some cases, other factors in addition to size are considered, such as derivatives exposure. Regulators are considering proposals to change the thresholds.

Some current regulations measure size by total exposures, which includes total assets, a broader measure of derivative exposures, and other off-balance-sheet items, such as undrawn loan commitments. Total exposures may better capture a bank's systemic importance than on-balance-sheet assets alone because off-balance-sheet obligations can also stress a bank during a crisis.

The largest U.S. banks by total assets tend to be the largest by total exposures (see **Figure 2**). However, some banks rank higher by total exposures than by total assets. For example, Wells Fargo & Co. is larger than Citigroup Inc. based on assets, but Citigroup is larger based on exposures.

Figure 1. Thresholds that Trigger Enhanced Regulation of Large Banks

	Enhanced Prudential Standard	Risk Topic
G-SIB	Qualified financial contracts	Interconnectedness
	Enhanced supplementary leverage ratio; G-SIB capital buffer	Capital adequacy
	Total loss absorbing capacity	Resolution
$250 billion	Supplementary leverage ratio; advanced approaches banks; countercyclical capital buffer	Capital adequacy
	Liquidity coverage ratio	Liquidity
$50 billion	Comprehensive capital analysis and review stress tests	Capital adequacy
	Resolution plans	Resolution
	Modified liquidity coverage ratio	Liquidity
	Dodd-Frank Act, Section 165	Multiple*

Note: G-SIB stands for global systemically important bank.
* Includes foreign banks' U.S. branches and agencies in scope.

Sources: Final Rules, Federal Register 76, No. 211, Nov. 1, 2011, 67323 – 67340; Federal Register 76, No. 231, Dec. 1, 2011, 74631 - 74648; Federal Register 78, No. 198, Oct. 11, 2013, 62018 - 62291; Federal Register 79, No. 59, Mar. 27, 2014, 17240 - 17338; Federal Register 79, No. 84, May 1, 2014, 24528-24541; Federal Register 79, No. 187, Sep. 26, 2014, 57725-57751; Federal Register 79, No. 197, Oct. 10, 2014, 61440-61541; Federal Register 80, No. 157, Aug. 14, 2015, 49082-49116; Federal Register 81, No. 210, Oct. 31, 2016, 75624-75670; Federal Register 82, No. 14, Jan. 24, 2017, 8266-8315 .

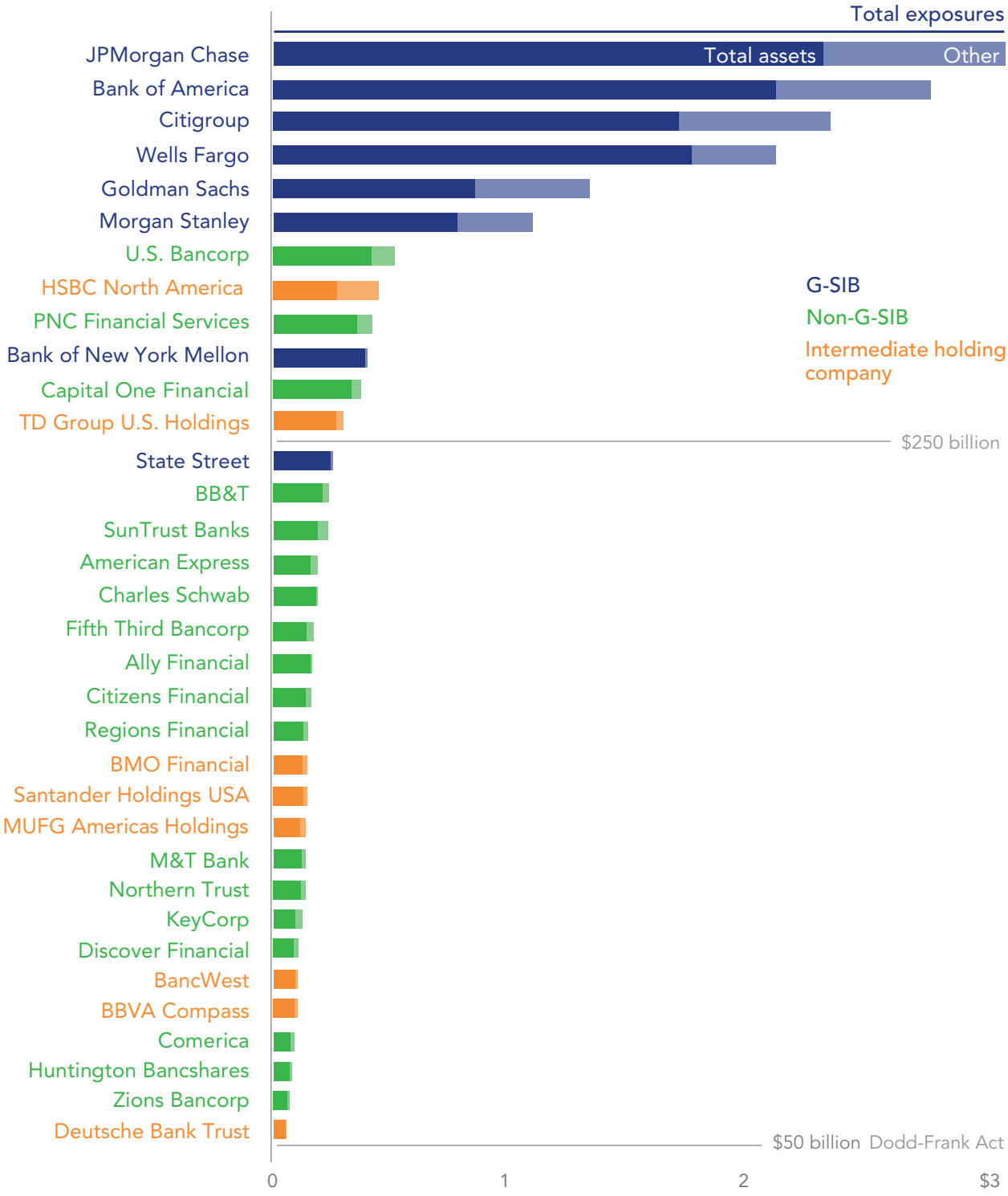
Applying enhanced standards to foreign banks operating in the United States is complex given differences in the ways foreign banks structure their U.S. operations. Regulations require that U.S. subsidiaries of foreign banks be consolidated in U.S. intermediate holding companies. In most cases, these companies are U.S. legal entities and regulated like U.S. bank holding companies.

Foreign banks also operate branches and agencies in the United States. Unlike U.S. banks owned by foreign companies, foreign bank branches generally cannot accept domestic retail deposits. Foreign bank agencies have additional restrictions on their activities. State regulators supervise most foreign banks' U.S. branches and agencies. Only one enhanced standard applies to foreign banks' U.S. branches and agencies (see Federal Reserve System, 2014). This standard uses asset-size thresholds.

Regulators use a multifactor approach to identify G-SIBs. Thresholds using multiple metrics can give a more nuanced view of a bank's systemic importance than asset-size thresholds. Global regulators who are members of the Basel Committee on Banking Supervision agreed in 2011 to develop a methodology for identifying G-SIBs and to require G-SIBs to hold more

Regulators use a multifactor approach to identify G-SIBs.

Figure 2. Largest U.S. Bank Holding Companies and Intermediate Holding Companies by Total Assets and Exposures ($ trillions)



Notes: Data as of Dec. 31, 2015. G-SIB stands for global systemically important bank. Other includes a broader measure of derivatives exposures and off-balance-sheet items used to calculate total exposures.

Sources: Federal Reserve Forms Y-15 and Y-9C, OFR analysis

capital as a buffer against losses and meet other enhanced standards. To identify G-SIBs, the Basel Committee calculates a systemic importance score for each bank based on five categories of systemic importance: (1) size, (2) interconnectedness, (3) substitutability, (4) complexity, and (5) cross-jurisdictional activity (see FSB, 2011).

Twelve systemic importance indicators determine the scores in the five categories. Size is measured by total exposures, not assets. Each indicator is scored on a scale from zero percent to 100 percent by taking a bank's reported value and dividing it by the total value of a panel of 75 banks (see **Figure 3**). A bank's score in each category contributes 20 percent to its overall score.

In 2015, we published an OFR brief that described the Basel G-SIB methodology and discussed some of the factors that drive banks' scores (see Allahrakha, Glasserman, and Young, 2015).

The Federal Reserve adopted, with modification, the Basel G-SIB methodology for determining capital surcharges for the eight U.S. G-SIBs. The Federal Reserve uses the higher of two surcharges: one calculated using the Basel Committee's method and the other using its own method. The Federal Reserve's method replaces substitutability indicators with metrics for each U.S. G-SIB's reliance on short-term funding. Excessive reliance on short-term funding can leave a bank vulnerable to runs by creditors during times of stress, which was a source of contagion during the financial crisis (see Tarullo, 2015).

Based on data released by the Federal Reserve, the method that includes short-term funding appears to be the binding regulation for the largest U.S. banks. In other words, most U.S. G-SIBs will have a higher capital surcharge under the Federal Reserve's rule than they would under the Basel G-SIB methodology. The Basel Committee recently proposed changes to the G-SIB identification methodology that would account for dependence on short-term funding (see Basel Committee, 2017, and **Proposed Changes to G-SIB Designation Methodology**).

The Basel methodology applies G-SIB capital surcharges to banks with systemic importance scores of 130 basis points or higher. In a recent report, Federal Reserve researchers concluded that the choice of 130 basis points "can misclassify" G-SIBs (see Passmore and von Hafften, 2017). They suggest that a systemic importance score of 52 basis points or higher would produce higher confidence of correctly identifying G-SIBs.

Basel Committee's Five Systemic Importance Categories:

1. Size
2. Interconnectedness
3. Substitutability
4. Complexity
5. Cross-jurisdictional activity

Proposed Changes to G-SIB Designation Methodology

The Basel Committee is considering several changes to the G-SIB designation framework. These proposed changes could have an impact on the Federal Reserve's determination of capital surcharges for U.S. banks (see Basel Committee, 2017). The proposals include a short-term wholesale funding indicator and changes to the substitutability category.

Introducing an indicator for short-term wholesale funding could be a positive step. Banks that rely on short-term wholesale funding could be more affected by the freezing of credit markets or asset fire sales.

The proposed changes to the substitutability category would have mixed effects. One proposal would remove the cap on the weight of the substitutability indicators, which could increase the capital surcharge for two large U.S. custodian banks, Bank of New York Mellon and State Street, as well as for JPMorgan Chase. This proposed change is a positive step toward calibrating the true systemic footprint of banks because of the crucial role that some banks play in financial markets.

Another proposal related to the substitutability category would reduce the weighting of the "underwritten transactions in debt and equity markets" indicator and introduce a new "trading volume" indicator. Bank of America, JPMorgan Chase, and Wells Fargo reported the highest underwritten transactions in 2015. Inclusion of the new trading volume indicator may not bring the methodology closer to accurately quantifying substitutability in banks. Other measures could be more effective indicators of substitutability. For example, regulators could consider measures of a bank's market concentration in trading or settlement.

For U.S. banks' systemic importance scores as calculated under the Basel method, see **Figure 3**. Data on short-term wholesale funding needed to calculate systemic importance scores under the Federal Reserve's own method are not yet publicly available for all banks that report their systemic importance indicators to the Federal Reserve.

Size Is Not Always A Good Proxy for Systemic Importance, Except for the Largest Banks

Six of the eight U.S. G-SIBs are also the six largest U.S. bank holding companies, measured by assets or exposures (see **Figure 3)**. The other two G-SIBs — Bank of New York Mellon and State Street — are smaller than some other U.S. bank holding companies and intermediate holding companies, but rank high on the substitutability indicator in the G-SIB framework.

The results of using an asset-size threshold and G-SIB multifactor approach also diverge for some large U.S. banks that are not G-SIBs (see **Figure 4)**. Northern Trust has assets of less than $150 billion, but a much higher systemic importance score using the G-SIB multifactor approach than Capital One, PNC, or U.S. Bancorp, each of which has assets of more than $250 billion. Northern Trust's relatively high score stems from its payments activity and assets under custody (see **Figure 3**).

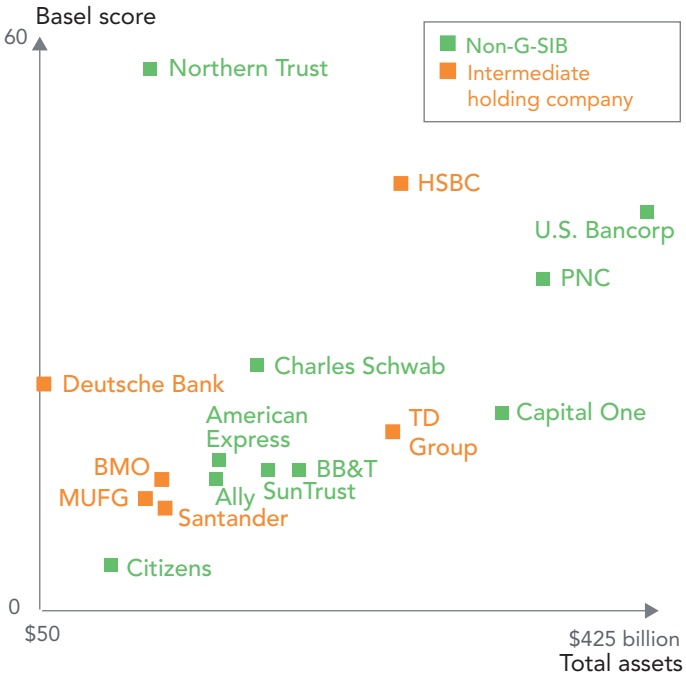
Two intermediate holding companies each have U.S. assets of more than $250 billion — HSBC North America and TD Group Holdings. These

Figure 3. Systemic Importance Scores Under the Basel Methodology (basis points)

Bank Holding Company	Size	Interconnected-ness			Substitutability			Complexity			Cross-Jurisdictional Activity		2015 Systemic Importance Score
Global Systemically Important Bank (G-SIB) Non-G-SIB Intermediate Holding Company	Total exposures score	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	
JPMorgan Chase	394	363	415	425	1160	1413	699	798	839	489	278	353	464
Citigroup	300	338	414	336	1107	831	536	735	465	512	409	426	430
Bank of America	354	291	185	359	444	8	730	659	647	284	185	158	345
Goldman Sachs	170	329	130	249	50	74	498	702	314	410	182	162	252
Wells Fargo	271	215	160	419	143	147	669	95	442	434	62	79	250
Morgan Stanley	140	247	62	172	47	106	512	427	453	253	136	182	212
Bank of NY Mellon	51	91	278	50	801	1686	11	17	77	0	47	112	160
State Street	32	34	174	63	320	1521	0	21	123	39	42	75	148
Northern Trust	17	53	19	13	169	435	0	6	21	0	15	31	56
HSBC North America	57	50	65	46	11	2	84	110	25	62	20	0	44
U.S. Bancorp	65	17	14	105	33	86	36	3	36	58	2	19	41
PNC Financial Services	53	24	14	58	11	6	27	5	60	140	4	2	34
Charles Schwab	24	18	0	35	1	178	0	0	68	0	4	2	25
Deutsche Bank Trust	7	13	38	0	268	0	0	0	0	0	1	0	23
Capital One Financial	47	25	2	83	3	0	4	2	24	15	5	1	20
TD Group U.S. Holdings	37	16	5	5	2	1	0	3	82	19	15	1	18
American Express	24	9	8	97	1	0	0	1	9	0	13	7	15
BB&T	30	2	5	50	3	3	17	1	15	28	1	0	14
SunTrust Banks	29	3	3	31	3	4	25	3	8	35	1	1	14
BMO Financial	18	28	16	18	22	10	13	0	18	1	3	4	13
Ally Financial	20	8	11	83	1	0	0	1	23	1	1	0	13
MUFG Americas Holdings	17	15	10	15	4	9	0	2	22	29	2	1	11
Fifth Third Bancorp	21	3	4	28	5	17	11	1	19	7	2	0	11
Santander Holdings USA	18	3	25	19	0	0	0	1	19	29	1	0	10
M&T Bank	17	3	5	29	7	6	1	0	4	1	0	0	7
KeyCorp	16	2	2	20	4	6	13	1	5	5	1	0	7
Discover Financial	13	11	0	54	1	0	0	0	1	0	0	0	7
Huntington Bancshares	10	2	2	14	2	6	2	1	11	35	1	0	7
Regions Financial	18	1	3	18	3	1	3	1	13	5	0	0	7
Citizens Financial	20	5	5	14	8	0	0	1	2	0	1	1	7
BBVA Compass	13	1	4	12	1	0	9	1	9	1	1	1	5
Comerica	11	7	6	10	1	4	2	0	3	1	1	1	5
BancWest	13	2	3	9	2	0	0	0	3	1	0	1	4
Zions Bancorp	8	2	3	7	2	0	0	0	2	2	0	0	3

Note: Data as of Dec. 31, 2015. Entries are sorted from highest to lowest systemic importance score.
Sources: Basel Committee on Banking Supervision, Federal Reserve Form Y-15, OFR analysis

Figure 4. Systemic Importance Scores and Total Assets ($ billions) for Large Banks that are Not U.S. G-SIBs



Notes: Data as of Dec. 31, 2015. G-SIB stands for global systemically important bank. Intermediate holding companies are U.S. operations of foreign banks. MUFG stands for Mitsubishi UFJ Financial Group.

Sources: Basel Committee on Banking Supervision, Federal Reserve Forms Y-15 and Y-9C, OFR analysis

two firms are similar in size, but have very different systemic importance scores, 44 for HSBC and 18 for TD. Intermediate holding companies are not subject to the U.S. G-SIB surcharge, but they report systemic importance data.

The G-SIB multifactor approach may understate some systemic risks. Like asset-size thresholds, the G-SIB multifactor approach is subject to regulators' discretion. For example, OFR research has previously noted weaknesses in the G-SIB approach to substitutability (see Allahrakha, Glasserman, and Young, 2015 and OFR, 2016).

Substitutability indicators could be strengthened in the current G-SIB methodology because, unlike other factors, the weight of the substitutability indicators is capped. Although the cap does not prevent the identification of any bank as a G-SIB, it lowers overall G-SIB scores for several large U.S. banks.

The indicators used to determine a bank's substitutability are payments activity, assets held in custody, and total underwriting activity. Better indicators of substitutability could be developed, such as an indicator that measures the concentration of a bank in clearing and settlement services or trading. In general, measures of concentration of banks' activities can be more useful than dollar values in evaluating a bank's substitutability and systemic importance.

Substitutability indicators could be strengthened.

Concentration of critical activities in a handful of banks can raise financial stability concerns. For example, settlement of government securities trades is now provided by two banks and JPMorgan Chase & Co. announced in July 2016 that it will stop offering the service later this year. Once JPMorgan Chase exits the market, the Bank of New York Mellon will be the only settlement service provider (see Burne, 2016). However, the change will not increase Bank of New York Mellon's systemic importance score nor its G-SIB capital surcharge.

It should. Concentrating government securities settlement services in one provider raises systemic risk concerns because of the potential impact on the financial system if that firm falters or fails. In 1985, Bank of New York Mellon, then known as the Bank of New York, received a $23 billion discount-window loan from the Federal Reserve after an operational failure left the firm unable to redeliver securities it had received as an intermediary from other institutions (see Ennis and Price, 2015 and OFR, 2016, 69-71).

Another weakness is that U.S. branches and agencies of foreign banks do not report systemic importance data. Each U.S. bank holding company and intermediate holding company with more than $50 billion in assets is required to disclose its systemic importance indicators quarterly to the Federal Reserve on Form Y-15. Systemic importance scores are then calculated annually using data from the Basel Committee on international peers. In 2015, the latest year for which those data are currently available, 34 U.S. bank holding companies and intermediate holding companies filed the Y-15 report.

Another weakness is that U.S. branches and agencies of foreign banks do not report systemic importance data.

However, systemic importance data are not gathered for foreign banks' U.S. branches and agencies. The absence of Y-15 data for large U.S. branches and agencies of foreign banks impedes the evaluation of the overall systemic importance of the U.S. operations of foreign banks. Six foreign G-SIBs — Barclays, Credit Suisse, Deutsche Bank, HSBC, Mitsubishi UFJ Financial Group, and UBS — have U.S. intermediate holding companies that each hold $150 billion or more in consolidated assets as of Sept. 30, 2016. Three of them also have more than $50 billion each in additional assets in U.S. branches and agencies that are not reflected in the Y-15 data.

In total, 13 branches and agencies of foreign banks in the United States each have more than $50 billion in assets as of Sept. 30, 2016. Ten of the 13 belong to foreign G-SIBs — Bank of Tokyo Mitsubishi, Bank of China, BNP Paribas, BPCE (Banques Populaires and Caisses d'Epargne), Credit Agricole, Deutsche Bank, Mizuho, Societe Generale, Sumitomo, and UBS. Some of these branches and agencies rely on significant amounts of short-term funding.

Unlike intermediate holding companies, U.S. branches and agencies are not subject to enhanced U.S. standards for minimum capital holdings and Federal Reserve stress testing. However, the Federal Reserve included the U.S. assets of foreign bank branches and agencies in the asset-size threshold for enhanced prudential standards established in 2014 for managing risk, maintaining minimum liquidity levels, and running company stress tests.

During the financial crisis, U.S. branches and agencies of several foreign banks received considerable liquidity support from the Federal Reserve. In some cases, this support exceeded the Federal Reserve's support for Lehman Brothers before it failed (see Kamakura, 2011).

European regulators have already extended the G-SIB methodology to smaller banks. In Europe, a bank that does not meet the G-SIB criteria may still be subject to additional capital requirements if it is categorized as an "other systemically important institution." European regulators use a modified version of the G-SIB framework to identify such banks.

European regulators have already extended the G-SIB methodology to smaller banks.

In April 2016, the European Banking Authority published the list of 173 European banks identified by their national regulators as other systemically

important institutions (see EBA, 2016). Of those, 131 are required to hold additional capital as buffers against shocks. The Federal Reserve similarly has the discretion to identify additional U.S. banks as systemically important but has not done so.

Alternative Measures for Identifying Systemic Risk

Some systemic risk measures combine market data and balance-sheet data.

Researchers have developed measures of bank systemic risk that incorporate the views of market participants. Market-based measures can be useful for assessing whether market participants and regulators agree on the relative systemic importance of individual domestic banks.

Some systemic risk measures combine market data and balance-sheet data. Three widely used measures consider systemic risk from different points of view: (1) conditional value-at-risk (CoVaR), (2) the distress insurance premium (DIP), and (3) SRISK, which is short for systemic risk.

CoVaR was developed by researchers at the Federal Reserve Bank of New York and Princeton University to measure a financial services company's contribution to systemic risk (see Adrian and Brunnermeier, 2016). It is calculated as the difference between the value-at-risk (VaR) of the financial system when a company is distressed and the value-at-risk of the system when the firm is in its regular, median state. (VaR measures how much a market variable might fall during a specific time period.) CoVaR is designed to identify large banks that are too interconnected to fail (see Benoit and others, 2013). Financial institutions score high on this measure when they are large, have high leverage (high market value of assets relative to market equity), and have large maturity mismatches (funding of long-term assets with short-term liabilities). Size, as measured by total assets, is the most important of these factors.

DIP measures the hypothetical contribution a financial institution would make to an "insurance premium" that would protect the whole financial system from distress. Researchers at the Federal Reserve Bank of New York developed DIP (see Huang, Zhou, and Zhu, 2012). As with CoVaR, the size of the bank holding company and its use of leverage are key variables. The amount of its assets and liabilities relative to industry totals are also important factors.

SRISK measures the capital that a firm would be expected to need during a financial crisis. Researchers at New York University developed this approach (see Acharya and others, 2017 and Brownlees and Engle, 2017). SRISK is a function of a firm's size, leverage, and an estimate of the firm's equity loss during a market decline.

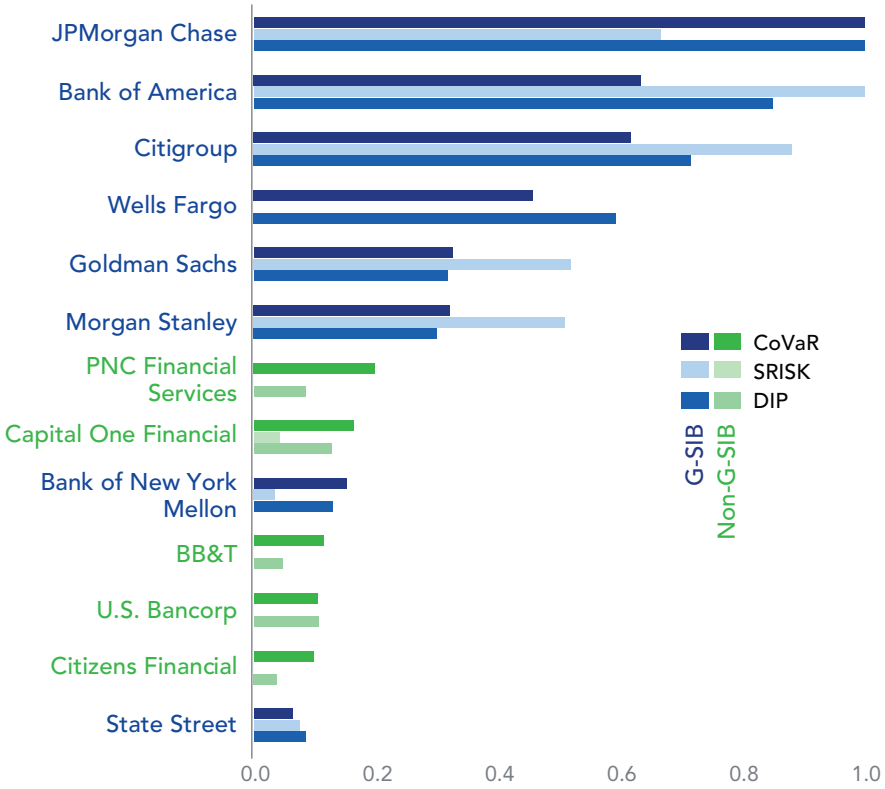
The three measures are presented in **Figure 5** for U.S. G-SIBs and other bank holding companies with relatively high scores under CoVaR, DIP, and

SRISK. The four U.S. G-SIBs with the highest CoVaR and DIP scores in **Figure 5** rank the same by those measures as by total exposures (see **Figure 2**). However, several non-G-SIBs — BB&T, Capital One, Citizens Financial, PNC, and U.S. Bancorp — rank ahead of one or more G-SIBs on at least one of the three alternative measures.

Morgan Stanley's CoVaR and DIP scores are about the same as those of Goldman Sachs, although Morgan Stanley is a smaller bank based on total assets and exposures. One potential explanation, as shown in **Figure 3**, is that Morgan Stanley has more cross-jurisdictional liabilities. This analysis suggests that size alone, measured by total assets or exposures, misses other ways bank failures could amplify financial instability.

Several large U.S. banks have scores of zero for SRISK in **Figure 5**, despite their relative size based on total assets and exposures. These scores apparently reflect the relatively low levels of volatility in the prices of these banks' stocks. But this volatility is not a factor in regulatory approaches to determining systemic importance.

Figure 5. U.S. Banks with Highest Market-based Systemic Risk Scores (normalized)



Note: Data as of Sept. 16, 2016. G-SIB stands for global systemically important bank. DIP (distress insurance premium), CoVaR (conditional value-at-risk), and SRISK are measures of systemic risk. Entries are listed from highest to lowest CoVaR. For purposes of comparison, the normalized systemic risk measures were calculated as fractions of the highest score for each measure at that time.

Sources: Bloomberg Finance L.P., Markit Group Ltd., the Volatility Laboratory of New York University's Stern Volatility Institute, OFR analysis

Market-based measures have limitations. For example, they are unlikely to detect systemic importance related to substitutability. Also, these measures cannot be calculated for the U.S. intermediate holding companies or branch operations of foreign banks, which do not have standalone company stocks.

Other studies assess investors' perceptions of systemic risk by tracking banks' cost of funding. Banks that investors believe would be rescued in a crisis often have lower funding costs. Credit default swaps (CDS) are contracts that protect against the risk of default by a borrower. CDS prices, called spreads, are proxies for a bank's cost of funding. Low CDS spreads may suggest the market believes the government would step in to prevent a bank from defaulting on its obligations.

Other studies assess investors' perceptions of systemic risk by tracking banks' cost of funding.

OFR researchers developed a contagion index based on connectivity, leverage, and size.

A 2015 OFR working paper analyzed the pricing of bank CDS spreads to determine if market participants offered cheaper funding to banks with assets above a certain threshold (see Cetina and Loudis, 2015). The authors found that CDS pricing suggests market participants believe the "too-big-to-fail" effect for banks begins in the range of $50 billion to $150 billion. The analysis controlled for differences in banks' credit quality and CDS contract liquidity.

Contagion Index

Banks, hedge funds, broker-dealers, pension funds, and other participants in the U.S. financial system may be linked by payment obligations for loans, repurchase agreements, swaps, derivatives, and other financial instruments. An OFR working paper defined the financial connectivity of a single company as the proportion of its liabilities held by other financial institutions (see Glasserman and Young, 2015). The company's outside leverage is equal to its total assets associated with nonfinancial entities divided by its net worth.

The paper presented the contagion index, which measures the systemic importance of a financial institution with this formula:

Financial Connectivity × Net Worth × (Outside Leverage - 1)

The index helps show how a highly leveraged company's losses can be amplified through the financial system.

OFR researchers developed a contagion index based on connectivity, leverage, and size (see OFR, 2013, pg. 9-10; Glasserman and Young, 2015; and Allahrakha, Glasserman and Young, 2015). Connections among large banks can transmit the effects of loan losses and liquidity shocks during times of stress. The contagion index measures the potential spillovers to the rest of the financial system if a bank defaults. It combines measures of a bank's connectivity, leverage, and size (see **Contagion Index**).

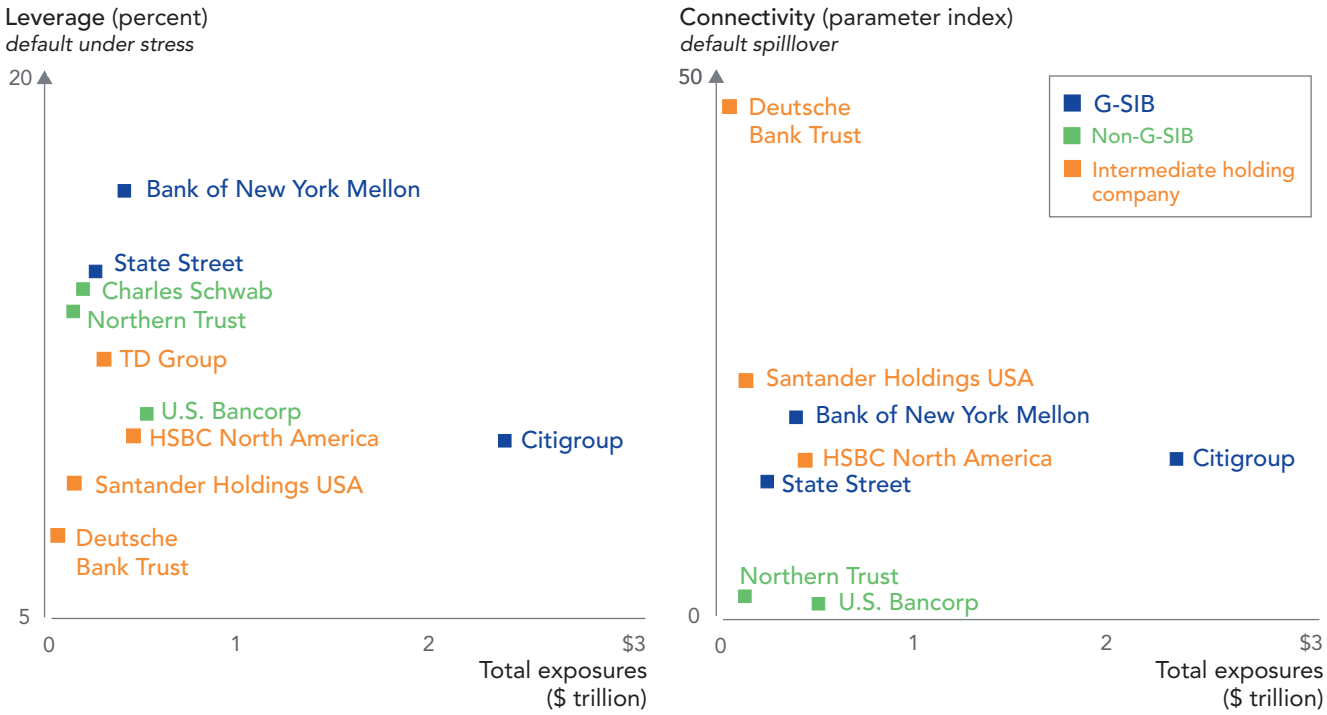
Connectivity is measured as the portion of a bank's liabilities held by other financial institutions. All else being equal, the default of a more connected bank would have a larger impact on the banking system than the default of a less connected bank. The defaulting bank's shortfall would spill over to other financial institutions, potentially leading to additional defaults.

The largest G-SIBs do not have the most connectivity or highest leverage (see **Figure 6**), and high leverage is not consistently associated with more interconnectedness. The higher a bank's leverage, the more likely the bank is to default under stress. The larger or more interconnected the bank, the greater the potential spillovers if it defaults.

Banks that are not G-SIBs rank differently on the contagion index than under the G-SIB methodology (see **Figure 7**). These differences indicate that a $50 billion asset size threshold for enhanced regulation is an overly simplistic gauge of a bank's systemic importance.

The contagion index is also useful in comparing the risk of U.S. intermediate holding companies with G-SIBs and bank holding companies. By including intermediate holding companies' obligations to affiliates outside the United States, the index accounts for the possibility that these

Figure 6. Comparison of Connectivity and Leverage Relative to Total Exposures for Select U.S. Banks ($ trillions)



Note: Data as of Dec. 31, 2015. G-SIB stands for global systemically important bank.
Sources: Federal Reserve Forms Y-15 and Y-9C, and OFR analysis

obligations could be drawn upon and import financial stress that starts overseas. One intermediate holding company, HSBC North America, ranks high relative to a U.S. G-SIB, State Street, on the contagion index.

Systemic Importance Measures Vary for Large Banks that are Not G-SIBs

A key policy question is how to measure the systemic importance of large banks that are not G-SIBs. Different measures highlight different vulnerabilities based on each bank's unique characteristics.

For a ranking of the 27 U.S. bank holding companies with more than $50 billion in assets each, according to each measure of systemic importance or risk as of the end of 2015, see **Figure 8**. The U.S. G-SIBs and other banks that each hold more than $250 billion in assets rank high in systemic importance or risk across multiple measures. Banks in this size category generally have high connectivity with other financial institutions and significant off-balance-sheet exposures.

Figure 7. Ranking of U.S. Bank Holding Companies and Intermediate Holding Companies (IHCs) by Asset Size, Systemic Importance Score, and Contagion Index

Bank Holding Companies Ranked by Assets ($ billions)			Systemic Importance Score	Contagion Index
1	JPMorgan Chase	2,521	1	2
2	Bank of America	2,199	3	3
3	Wells Fargo	1942	5	4
4	Citigroup	1818	2	1
5	Goldman Sachs	880	4	5
6	Morgan Stanley	814	6	7
7	U.S. Bancorp	454	11	16
8	Bank of New York Mellon	374	7	6
9	PNC Financial Services	369	12	19
10	Capital One Financial	345	15	30
11	TD Group U.S.	339	16	29
12	HSBC North America	304	10	8
13	State Street	256	8	9
14	BB&T	223	18	18
15	Credit Suisse Holdings	223		
16	Barclays Holdings	222		
17	Charles Schwab	209	13	
18	SunTrust Banks	205	19	17
19	Deutsche Bank Trust	203	14	11
20	UBS Americas	163		
21	Ally Financial	157	21	28
22	American Express	153	17	12
23	MUFG Americas Holdings	151	22	20
24	Citizens Financial	147	30	13
25	BNP Paribas USA	147		
26	Fifth Third Bancorp	143	23	21
27	RBC USA	143		
28	Santander Holdings USA	139	24	10
29	KeyCorp	136	26	25
30	BMO Financial	130	20	22
31	M&T Bank	127	25	15
32	Regions Financial	125	29	32
33	Northern Trust	120	9	23
34	Huntington Bancshares	101	28	27
35	Discover Financial	91	27	31
36	BBVA Compass Bancshares	89	31	14
37	Comerica	74	32	24
38	CIT Group	66		
39	Zions Bancorp	61	33	26

Note: Data as of Dec. 31, 2015 for the systemic importance score and contagion index. Data as of Sept. 30, 2016 for total assets. G-SIB stands for global systemically important bank.

Sources: Basel Committee on Banking Supervision, Bloomberg Finance L.P., Federal Reserve Forms Y-9C and Y-15, Federal Financial Institutions Examination Council, OFR analysis

Figure 8. Rankings of U.S. Bank Holding Companies by Various Systemic Measures

Bank Holding Companies Ranked by Assets ($ billions)			Systemic Importance Score	Contagion Index	SRISK	DIP	CoVaR	Bailout Funds Received
1	JPMorgan Chase	2,521	1	2	3	1	1	3
2	Bank of America	2,199	3	3	1	2	2	1
3	Wells Fargo	1,942	5	4		4	4	4
4	Citigroup	1,818	2	1	2	3	3	2
5	Goldman Sachs	880	4	5	4	5	5	6
6	Morgan Stanley	814	6	7	5	6	6	7
7	U.S. Bancorp	454	10	12		9	11	9
8	Bank of New York Mellon	374	7	6	8	7	8	16
9	PNC Financial Services	369	11	15		11	7	8
10	Capital One Financial	345	13	23	7	8	9	11
11	State Street	256	8	8	6	10	13	20
12	BB&T	223	15	14		15	10	15
13	Charles Schwab	209	12			12	16	
14	SunTrust	205	16	13	9	14	15	10
15	Ally Financial	157	17	22		13	25	5
16	American Express	153	14	9		16	27	14
17	Citizens Financial	147	24	10		18	12	
18	Fifth Third Bancorp	143	18	16	16	19	19	13
19	KeyCorp	136	20	19		21	20	17
20	M&T Bank	127	19	11		22	14	25
21	Regions Financial	125	23	25	10	20	18	12
22	Northern Trust	120	9	17	14	17	21	21
23	Huntington Bancshares	101	22	21	12	24	26	23
24	Discover Financial Services	91	21	24		23	17	24
25	Comerica	74	25	18	11	26	23	19
26	CIT Group	66			13	25	22	18
27	Zions Bancorp	61	26	20	15	27	24	22

Note: Data as of Dec. 31, 2015 for the systemic importance score and contagion index. Data as of Sept. 30, 2016 for total assets and as of Sept. 16, 2016 for DIP, CoVaR and SRISK. Bailout funds received reflect the combination of a number of government relief programs in 2007-09, consolidated by U.S. Treasury (2017). G-SIB stands for global systemically important bank. DIP stands for distress insurance premium, CoVaR stands for conditional value-at-risk, and SRISK measures the capital that a firm is expected to need if there is another financial crisis.

Sources: Basel Committee on Banking Supervision, Bloomberg Finance L.P., Federal Reserve Forms Y-9C and Y-15, Federal Financial Institutions Examination Council, Markit Group Ltd., the Volatility Laboratory of New York University's Stern Volatility Institute, OFR analysis

Rankings of bank holding companies that each hold assets of $50 billion to $250 billion have more variation. Some banks in this range rank just above or below a G-SIB by one of the systemic importance or risk measures. However, banks in this size category vary considerably in their interconnectedness, off-balance-sheet exposures, and business models.

Conclusion

Since the financial crisis of 2007-09, U.S. bank regulators have largely used asset size to identify banks that merit more stringent regulation. They have introduced enhanced standards on capital, liquidity, counterparty credit, resolution, and other areas effectively based on three thresholds: (1) any bank with $50 billion in total assets, (2) any bank with $250 billion in total assets, and (3) any bank identified as a G-SIB. G-SIBs are identified using a multifactor approach that goes beyond size.

U.S. G-SIBs consistently rank high by most measures of systemic importance. These banks are large and have complex operations and organizational structures. They are also linked to many other banks and nonbanks. G-SIBs appropriately face the most stringent regulations.

But for large banks that are not G-SIBs, asset-size thresholds are too simplistic to assess systemic importance. For this second tier of banks, a modified version of the G-SIB multifactor approach could help determine the appropriate level of enhanced regulation. European regulators are taking such an approach, a more nuanced way to identify how to subject the banking operations of non-G-SIBs to enhanced standards.

Modifications would be needed to overcome two shortcomings of the multifactor approach. The first shortcoming involves substitutability. The current G-SIB approach may understate the systemic importance of some banks that provide critical services. The regulation establishing extra capital surcharges for U.S. G-SIBs either caps or eliminates substitutability measurements. Although the Basel Committee has proposed some modifications, they still do not address the concentration of critical services in a bank that substitutability indicators need to capture. More work on substitutability indicators is needed.

The second shortcoming is that the existing multifactor approach may understate the risks posed by the U.S. operations of some foreign G-SIBs.

The operations of foreign banks' U.S. branches and agencies are not required to disclose systemic importance indicators annually on Federal Reserve Form Y-15, even though some of these firms' footprints and operations are significant. Some foreign G-SIBs have U.S. intermediate holding companies and branches, but the combined risks of these operations are considered in only one regulation implementing enhanced prudential standards.

However, several U.S. intermediate holding companies rank near U.S. G-SIBs in their systemic importance when viewed through the lens of the contagion index, which measures spillovers from potential defaults.

References

Acharya, Viral V., Lasse H. Pedersen, Thomas Philippon, and Matthew Richardson. "Measuring Systemic Risk." *Review of Financial Studies,* 30, no.1 (2017): 2-47. https://academic.oup.com/rfs/article/30/1/2/2682977/Measuring-Systemic-Risk (accessed Oct. 25, 2017).

Acharya, Viral, Robert Engle, and Matthew Richardson. "Capital Shortfall: A New Approach to Ranking and Regulating Systemic Risks." *The American Economic Review,* 102, no. 3 (May 2012): 59-64, May 2012. www.aeaweb.org/articles?id=10.1257/aer.102.3.59 (accessed Oct. 25, 2017).

Adrian, Tobias, and Markus K. Brunnermeier. "CoVaR." The American Economic Review, 106, no. 7 (July 2016): 1705-1741. www.aeaweb.org/articles?id=10.1257/aer.20120555 (accessed Oct. 25, 2017.

Allahrakha, Meraj, Paul Glasserman, and H. Peyton Young. "Systemic Importance Indicators for 33 U.S. Bank Holding Companies: An Overview of Recent Data," OFR Working Paper no. 15-01, Feb. 12, 2015. www.financialresearch.gov/briefs/files/2015-02-12-systemic-importance-indicators-for-us-bank-holding-companies.pdf (accessed Oct. 25, 2017).

Benoit, Sylvain, Gilbert Colletaz, Christophe Hurlin, and Christophe Pérignon. "A Theoretical and Empirical Comparison of Systemic Risk Measures." HEC Paris Research Paper no. FIN-2014-1030, Oct. 28, 2012, revised Jan. 20, 2013. hal.inria.fr/file/index/docid/746272/filename/Systemic_Risk_October_2012.pdf (accessed Oct. 25, 2017).

Billio, Monica, Mila Getmansky, Andrew W. Lo, and Loriana Pelizzon. "Econometric Measures of Connectedness and Systemic Risk in the Finance and Insurance Sectors," *Journal of Financial Economics,* 104, no. 3 (June 2012): 535-539, June 2012. www.sciencedirect.com/science/article/pii/S0304405X11002868 (accessed Oct. 25, 2017).

Basel Committee on Banking Supervision, "Consultative Document: Global systemically important banks – revised assessment framework," March 2017. www.bis.org/bcbs/publ/d402.pdf (accessed Oct. 25, 2017)

Board of Governors of the Federal Reserve System. "Calibrating the GSIB Surcharge," July 20, 2015. www.federalreserve.gov/aboutthefed/boardmeetings/gsib-methodology-paper-20150720.pdf (accessed Oct. 25, 2017).

Board of Governors of the Federal Reserve System. "Federal Reserve Board Announces Finalized Stress Testing Rules Removing Noncomplex Firms from Qualitative Aspect of CCAR Effective for 2017." Press release, Jan. 30, 2017. www.federalreserve.gov/newsevents/press/bcreg/20170130a.htm (accessed Oct. 25, 2017).

Brownlees, Christian T., and Robert Engle. "SRISK: A Conditional Capital Shortfall Measure of Systemic Risk," *Review of Financial Studies* 30, no. 1 (2017): 48-79. https://academic.oup.com/rfs/article-lookup/doi/10.1093/rfs/hhw060 (accessed Oct. 25, 2017).

Burne, Katy. "JPMorgan to Exit Part of its Government Securities Business," *Wall Street Journal,* July 21, 2016. www.wsj.com/articles/j-p-morgan-to-exit-part-of-its-government-securities-business-1469135462 (accessed Oct. 25, 2017).

Cetina, Jill, and Bert Loudis. "The Influence of Systemic Importance Indicators on Bank Credit Default Swap Spreads," Journal of Risk Management in Financial Institutions 9, no. 1 (Winter 2016): 17-31. Previously published as), OFR Working Paper no. 15-09, May 13, 2015. www.financialresearch.gov/working-papers/files/OFRwp-2015-09_Influence-of-Systemic-Importance-Indicators-on-Bank-Credit-Default-Swap-Spreads.pdf (accessed Oct. 25, 2017).

Ennis, Huberto and David Price. "Discount Window Lending: Policy Trade-offs and the 1985 BoNY Computer Failure," Economic Brief no. 15-05, Federal Reserve Bank of Richmond, May 2015. www.richmondfed.org/~/media/richmondfedorg/publications/research/economic_brief/2015/pdf/eb_15-05.pdf (accessed Oct. 25, 2017).

European Banking Authority. "EBA Discloses First List of O-SIIs in the EU," press release, April 25, 2016. www.eba.europa.eu/-/eba-discloses-first-list-of-o-siis-in-the--1 (accessed Oct. 25, 2017).

Federal Deposit Insurance Corporation and the Board of Governors of the Federal Reserve System. "Agencies Announce Determinations and Provide Feedback on Resolution Plans of Eight Systemically Important, Domestic Banking Institutions." Joint press release, April 13, 2016. www.federalreserve.gov/newsevents/press/bcreg/20160413a.htm (accessed Oct. 25, 2017).

Federal Deposit Insurance Corporation and the Board of Governors of the Federal Reserve System. "Agencies Announce Determinations on October Resolution Plan Submissions of Five Systemically Important Domestic Banking Institutions." Joint press release, Dec. 13, 2016. www.federalreserve.gov/newsevents/press/bcreg/20161213a.htm (accessed Oct. 25, 2017).

Federal Reserve Bank of New York. "Tri-party Repo Infrastructure Reform: A White Paper," May 17, 2010. www.newyorkfed.org/medialibrary/media/banking/nyfrb_triparty_whitepaper.pdf (accessed Oct. 25, 2017).

Federal Reserve System. *Enhanced Prudential Standards for Bank Holding Companies and Foreign Banking Organizations.* Final Rule, Washington: Board. Federal Register 79, no. 59, March 27, 2014. www.gpo.gov/fdsys/pkg/FR-2014-03-27/pdf/2014-05699.pdf (accessed Oct. 25, 2017).

Financial Stability Board. "Policy Measures to Address Systemically Important Financial Institutions," Nov. 4, 2011. www.fsb.org/wp-content/uploads/r_111104bb.pdf?page_moved=1 (accessed Oct. 25, 2017).

Financial Stability Board. "FSB Publishes 2016 G-SIB List," Nov. 21, 2016. www.fsb.org/2016/11/fsb-publishes-2016-g-sib-list/ (accessed Oct. 25, 2017).

Glasserman, Paul and Bert Loudis. "A Comparison of U.S. and International Global Systemically Important Banks," OFR Brief no. 15-07, Aug. 4, 2015. www.financialresearch.gov/briefs/files/OFRbr-2015-07_A-Comparison-of-US-and-International-Global-Systemically-Important-Banks.pdf (accessed Oct. 25, 2017).

Glasserman, Paul and H. Peyton Young. "How Likely is Contagion in Financial Networks?" *Journal of Banking and Finance,* 50, no. C (2015): 383-399 (accessed March 24, 2017). Previously published as OFR Working Paper no. 13-09, June 21, 2013. www.financialresearch.gov/working-papers/files/OFRwp0009_GlassermanYoung_HowLikelyContagionFinancialNetworks.pdf (accessed Oct. 25, 2017).

Huang, Xin, Hao Zhou, and Haibin Zhu. "Systemic Risk Contributions," *Journal of Financial Services Research,* 42, no. 1-2 (October 2012): 55-83 http://link.springer.com/article/10.1007/s10693-011-0117-8 (accessed Oct. 25, 2017).

Kamakura Corporation blogs by Donald R. van Deventer. "Case Studies in Liquidity Risk: Dexia Credit Local New York Branch," June 6, 2011, and www.kamakuraco.com/Blog/tabid/231/EntryId/295/Case-Studies-in-Liquidity-Risk-Dexia-Credit-Local-New-York-Branch.aspx (accessed Oct. 25, 2017). "Case Studies in Liquidity Risk: Depfa Bank PLC New York Branch," June 18, 20118, 2011. www.kamakuraco.com/Blog/tabid/231/EntryId/298/Case-Studies-in-Liquidity-Risk-Depfa-Bank-PLC-New-York-Branch.aspx (accessed Oct. 25, 2017).

Office of Financial Research. *2013 Annual Report to Congress,* Dec. 17, 2013. www.financialresearch.gov/annual-reports/files/office-of-financial-research-annual-report-2013.pdf (accessed Oct. 25, 2017).

Office of Financial Research. *2016 Financial Stability Report,* Dec. 13, 2016. www.financialresearch.gov/financial-stability-reports/files/OFR_2016_Financial-Stability-Report.pdf (accessed Oct. 25, 2017).

Paddrik, Mark, Sriram Rajan, and H. Peyton Young. "Contagion in the CDS Market," OFR Working Paper no. 16-12, Dec. 1, 2016. www.financialresearch.gov/working-papers/files/OFRwp-2016-12_Contagion-in-the-CDS-Market.pdf (accessed Oct. 25, 2017).

Passmore, Wayne and Alexander H. von Hafften. "Are Basel's Capital Surcharges for Global Systemically Important Banks Too Small?" FEDS Notes, Feb. 27, 2017. www.federalreserve.gov/econresdata/notes/feds-notes/2017/are-basels-capital-surcharges-for-global-systemically-important-banks-too-small-20170223.html (accessed Oct. 25, 2017).

Tarullo, Daniel. "Opening Statement on Global Systemically Important Banking Organization Capital Surcharge Final Rule by Governor Daniel K. Tarullo," Federal Reserve Board of Governors meeting, July 20, 2015. www.federalreserve.gov/aboutthefed/boardmeetings/tarullo-remarks-gsib-20150720.pdf (accessed Oct. 25, 2017).

U.S. Department of the Treasury. "TARP Transactions Report – Investments", Jan. 10, 2017. www.treasury.gov/initiatives/financial-stability/reports/Pages/TARP-Investment-Program-Transaction-Reports.aspx (accessed Oct. 25, 2017).