WORKING PAPER NO. 14-36
ENHANCING PRUDENTIAL STANDARDS
IN FINANCIAL REGULATIONS

Franklin Allen
The Wharton School of the University of Pennsylvania
and Imperial College London

Itay Goldstein
The Wharton School of the University of Pennsylvania

Julapa Jagtiani
Federal Reserve Bank of Philadelphia

William W. Lang
Federal Reserve Bank of Philadelphia

December 3, 2014

RESEARCH DEPARTMENT, FEDERAL RESERVE BANK OF PHILADELPHIA
Ten Independence Mall, Philadelphia, PA 19106-1574 • www.philadelphiafed.org/research-and-data/

Enhancing Prudential Standards in Financial Regulations*

Franklin Allen
The Wharton School of the University of Pennsylvania and Imperial College London

Itay Goldstein
The Wharton School of the University of Pennsylvania

Julapa Jagtiani
Federal Reserve Bank of Philadelphia

William W. Lang
Federal Reserve Bank of Philadelphia

December 3, 2014

The financial crisis has generated fundamental reforms in the financial regulatory system in the U.S. and internationally. Much of this reform was in direct response to the weaknesses revealed in the precrisis system. The new "macroprudential" approach to financial regulations focuses on risks arising in financial markets broadly, as well as the potential impact on the financial system that may arise from financial distress at systemically important financial institutions. Systemic risk is the key factor in financial stability, but our current understanding of systemic risk is rather limited. While the goal of using regulation to maintain financial stability is clear, it is not obvious how to design an effective regulatory framework that achieves the financial stability objective while also promoting financial innovations. This paper discusses academic research and expert opinions on this vital subject of financial stability and regulatory reforms. Specifically, among other issues, it discusses the impact of increasing public disclosure of supervisory information, the effectiveness of bank stress testing as a tool to enhance financial stability, whether the financial crisis was caused by too big to fail (TBTF), and whether the Dodd-Frank Wall Street Reform and Consumer Protection Act (DFA) resolution regime would be effective in achieving financial stability and ending TBTF.

Keywords: financial stability, financial regulations, systemic risk, too big to fail, stress testing, resolution plan, mortgage finance
JEL Classifications: G01, G18, G21, G23, G28

---

*This paper is an introduction to the regulatory issues discussed at the conference held at the Federal Reserve Bank of Philadelphia on April 8–9, 2014. The conference was jointly organized by the Federal Reserve Bank of Philadelphia, the Wharton Financial Institutions Center, and the *Journal of Financial Services Research*. Please direct correspondence to Julapa Jagtiani, Federal Reserve Bank of Philadelphia, Supervision, Regulation & Credit Department, Ten Independence Mall, Philadelphia, PA 19106; 215-574-7284; e-mail: julapa.jagtiani@phil.frb.org. The views in this paper are the authors' and do not necessarily reflect the views of the Federal Reserve Bank of Philadelphia or the Federal Reserve System. This paper is available free of charge at www.philadelphiafed.org/research-and-data/publications/working-papers.

I. Introduction

The Federal Reserve Bank of Philadelphia, the Wharton Financial Institutions Center, and the *Journal of Financial Services Research* jointly held a conference on enhancing prudential standards in financial regulations on April 8–9, 2014. Despite the extensive regulation and supervision of U.S. banking organizations, the U.S. and the world financial systems were shaken by the largest financial crisis since the Great Depression, largely precipitated by events within the U.S. financial system. The Great Recession that followed the financial crisis has generated substantial changes in financial regulation within the U.S. as well as internationally.

Prevention of systemic risk and the maintenance of financial stability are the central goals of recent reforms of financial regulation, including the Dodd–Frank Wall Street Reform and Consumer Protection Act (DFA) enacted in the U.S. in July 2010. This shifted the emphasis of financial regulation away from the monitoring of risk taking at an individual institution to a "macroprudential" approach. The new approach focuses on risks arising in financial markets broadly as well as the potential impact on the financial system that may arise from financial distress at one or more systemically important financial institutions.

Federal Reserve Governor Daniel Tarullo clearly articulated this new approach in a 2014 speech:

> Beyond the basic reaction that prudential regulation needed to be stronger and less subject to arbitrage, considerable support grew for the formerly minority view that regulation also needed to be firmly grounded in a macroprudential perspective explicitly directed at the stability of the financial system as a whole, not just at each regulated firm individually.[1]

While the goal of using regulation to maintain financial stability is clear, it is less obvious how to design a regulatory framework that achieves this objective while also promoting an efficient and innovative financial sector. The objective of the conference was to engender a robust exchange and discussion of leading scholars, regulators, and market participants on this vital subject of financial stability and regulatory reforms.

[1] Governor Daniel Tarullo (February 25, 2014) also pointed out that the recent financial crisis had prompted increased attention on the relationship between monetary policy and financial stability. Similarly, then-Governor Jeremy C. Stein (March 21, 2014) supported the idea of explicitly incorporating financial stability considerations into a monetary policy framework. Moreover, Federal Reserve Chair Janet Yellen (July 2, 2014) noted that, in many ways, the pursuit of financial stability is complementary to the goals of price stability and full employment.

The DFA has been a landmark piece of legislation — the most sweeping reform of U.S. financial regulations since the Great Depression. While the DFA is a specific U.S. regulation, the Basel Committee on Banking Supervision has also enacted reforms intended to refocus financial regulation on containing systemic risk and maintaining financial stability. The DFA made promotion of financial stability an explicit goal for the Federal Reserve and created the Financial Stability Oversight Council as an interagency body responsible for oversight of U.S. financial stability. The DFA also expanded the scope of bank-like regulation to systemically important nonbank financial institutions and markets. The new regulatory regime includes enhanced prudential standards for systemically important financial institutions (SIFIs) that include requirements for stress testing, expanded regulatory reporting, and increased public disclosure of supervisory assessments of SIFIs. The new regulations also aimed to end the too-big-to-fail (TBTF) policy by giving regulators new authorities to resolve failing SIFIs.

The following are fundamental questions/concerns in the process of regulation reform:

- Can we anticipate systemic risk events and can regulatory reform effectively combat systemic risk? How can we determine whether a financial institution or a group of financial institutions are systemically important? Will the current changes in financial regulation be effective in enhancing financial stability? Are they sufficient or should monetary and fiscal policy tools be used as well?
- Is increasing the scope, intensity, and complexity of financial regulation the right approach or should we simplify regulation, increase transparency, and place greater reliance on market discipline?
- The new financial regulatory regime includes greater public disclosure by SIFIs as well as greater disclosure of supervisory assessments. For example, there is substantial disclosure of the results from supervisory stress tests. Does increased public disclosure of supervisory information enhance financial stability or generate greater instability?
- Stress testing has become a central component of the supervision of SIFIs. Are stress tests an effective method for enhancing financial stability? Would a stress-testing regime have prevented the mortgage and financial crises?

- Concern about financial instability resulting from the failure of a SIFI led to the bailout policies known as TBTF. Many economists claim that TBTF policies created moral hazard problems — incentives for excessive risk taking — that were the causal factor for the financial crisis. Was TBTF, in fact, a causal factor of the crisis? Are the new resolution authorities contained in DFA sufficient to end TBTF and contain the systemic impact of the failure of one or more SIFIs?
- The fall in housing prices and the associated large scale defaults in mortgages were the proximate cause of the financial crisis. Housing and housing finance play a central role in the economy, and many financial crises have been associated with downturns in housing. What reforms in housing and housing finance are necessary to promote economic growth and financial stability? What should be the future of Freddie Mac and Fannie Mae?

The remainder of this paper reviews how the research and presentations at the conference addressed these questions.

II. Understanding Systemic Risk and the Role of Policy in Enhancing Financial Stability[2]

Systemic risk is the key factor in financial stability. However, our current understanding of systemic risk is rather limited. While recent discussions of systemic risk have emphasized the role of instability generated by financial distress at large interconnected financial institutions, systemic risk has arisen in many other ways and even when there are no systemically important financial institutions.[3] Enhancing regulation of SIFIs may not be sufficient to contain systemic risk. A better understanding of the sources of systemic risk as well as the types of systemic risk is necessary to design effective financial stability policies.

[2] The session on systemic risks and the DFA resolution plan was moderated by Julapa Jagtiani, who is special advisor in bank supervision and regulation at the Federal Reserve Bank of Philadelphia.

[3] There were no TBTF banks in the 1920s and 1930s, and yet, systemic risk prevailed, resulting in the Great Depression. There are also many kinds of systemic risks, such as those caused by panics, falling asset prices (such as the bursting of real estate bubbles or other asset price bubbles), contagion, or rising interest rates.

At the conference, Franklin Allen[4] stated that while systemic risk is often thought to be a result of exogenous shocks (e.g., war, natural disaster), systemic risk is often caused by endogenous economic factors, with central bank and government policies often inadvertently playing a role.

Our limited understanding of systemic risk makes identifying incipient financial crises difficult. For example, many economists point to the rapid rise of housing prices internationally as an obvious sign of a financial bubble that was bound to crash and cause systemic instability. We certainly see this in the extreme booms and busts in housing prices in Ireland, Spain, Greece, and to a lesser extent in the U.S. (see Figure 1). However, Figure 1 also shows that countries such as the U.K. and Sweden saw similar increases in house prices with no major downturn. We are still uncertain if a collapse in housing prices may occur in these countries in the near future. Our ability to identify incipient crashes in financial markets remains quite limited.

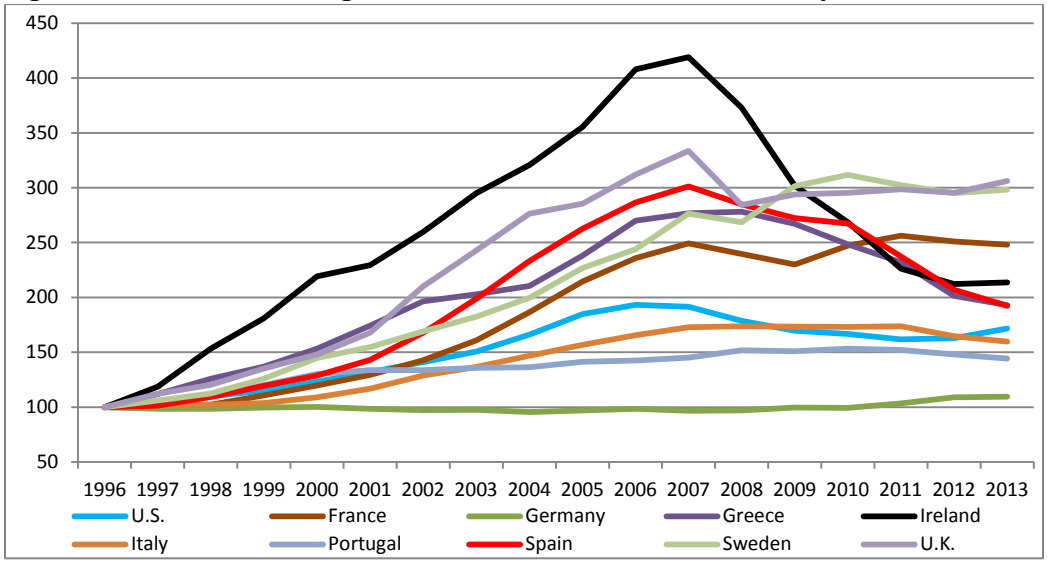
Allen also pointed out that the causes of systemic risk have been varied. While financial distress at systemically important institutions is sometimes the cause of systemic risk, there are many other causes. Banking panics have occurred where there are no SIFIs. Economic research points to the possibility of multiple equilibria in financial markets that can generate bank panics and runs. Systemic risk can also arise as a result of collapsing asset prices with economies that are particularly vulnerable to large falls in housing prices.[5] Foreign exchange mismatches have generated international banking crises, such as in the 1997 Asian crisis.

Weaknesses in the structure of the financial architecture can amplify shocks as in the recent crisis. Government policies can be another causal factor. For example, policies that keep interest rates too low for too long can promote high leverage and financial fragility in the financial sector. Given the varying types and causes of systemic risk, Allen suggested that effective financial stability policies would require the coordinated use of multiple policy tools including regulation, monetary policy, and fiscal policy.

[4] Franklin Allen is the Nippon Life professor of finance at the Wharton School of the University of Pennsylvania and codirector of the Wharton Financial Institutions Center. He is also the executive director of the Brevan Howard Centre and Professor of Finance and Economics at Imperial College London.

[5] See, for example, Herring and Wachter (1999).

Figure 1: Nominal Housing Prices in the U.S. and Various European Countries



How should a financial system be structured to mitigate systemic risk and maintain financial stability? One question that arises concerns the role of financial networks in mitigating or propagating financial instability. On the one hand, more interconnected financial networks could mean more stability because the losses can be transferred and divided among the banks. In this case, the interconnection serves as a cushion to absorb any negative idiosyncratic shocks.[6] On the other hand, a more interconnected structure could mean more stability because the losses can be transferred and divided among the banks. In this case, the interconnection serves as a cushion to absorb any negative idiosyncratic shocks.

Alireza Tahbaz-Salehi[7] presented his research titled "Systemic Risk and Stability in Financial Networks," which studies a three-period model using a network framework (more commonly used in electrical engineering) to analyze the resiliency of different financial network structures to shocks. Acemoglu, Ozdaglar and Tahbaz-Salehi (2013) find that the optimal financial network structure depends on the severity of the shock. For small shocks, a more interconnected structure implies greater stability because losses of a distressed bank are passed to a larger number of counterparties, guaranteeing a more efficient use of the excess liquidity in the system. This result is consistent with Allen and Gale (2000). However, for larger

[6] See Freixas, Parigi, and Rochet (2000).
[7] Alireza Tahbaz-Salehi is an assistant professor (in Decision, Risk and Operations) at Columbia Business School.

shocks above a specified threshold, a more interconnected structure is more fragile and prone to systemic failures. These findings reinforce Haldane (2009):

> Interconnected networks exhibit a knife-edge, or tipping point, property. Within a certain range, connections serve as a shock-absorber. The system acts as a mutual insurance device with disturbances dispersed and dissipated [. . .] But beyond a certain range, the system can flip the wrong side of the knife-edge. Interconnections serve as shock-amplifiers, not dampeners, as losses cascade. The system acts not as a mutual insurance device but as a mutual incendiary device.

In response to the crisis, governments around the globe are acting to reduce systemic risks posed by financial distress at SIFIs. Regulatory reform in the U.S. and internationally is creating enhanced prudential requirements on those institutions deemed to be SIFIs. This necessitates accurate measures of systemic risk and accurate identification of those financial institutions, banks, and nonbanks that have a systemic impact. [8]

Paul Kupiec[9] presented Guntay and Kupiec (2014), which explores weaknesses in current methods for measuring the systemic risk impact of individual firms and the implications of these measures for identifying SIFIs. The paper cites two central flaws in the current approaches.[10] First, the systemic risk measures are nonparametric estimators with no ability to perform formal statistical hypothesis testing. Second, the measures confound systematic risk with systemic risk. The authors find that much of the current cross-sectional variation in these measures is due to systematic risk (market beta) rather than systemic risk. Guntay and Kupiec consider a parametric approach that allows for estimation of systematic and idiosyncratic risk. Combining this approach with the existing systemic risk measures allows the authors to separate out the systemic risk component and to perform formal statistical hypothesis testing.

[8] A list of SIFIs has been created by the Basel Committee and is updated in November each year based on the institution's size, complexity, and interconnectedness. Under the DFA, SIFIs are subject to enhanced capital standards, such as countercyclical capital buffers, liquidity requirements, increased capital charges for exposures to large financial institutions, large exposure rules, etc.

[9] Paul H. Kupiec is a resident scholar at the American Enterprise Institute (AEI). He is also a member of the Shadow Financial Regulatory Committee. Previously, Kupiec was director of the Center for Financial Research at the Federal Deposit Insurance Corporation (FDIC).

[10] See also Acharya, Engle, and Richardson (2012).

III. Financial Regulatory Architecture: Is Expanding Scope and Complexity the Right Approach?

Regulatory reform in response to the financial crisis has generated stronger capital and liquidity standards as well as other tougher regulatory standards for banking organizations. Regulatory reform has also significantly expanded the scope of bank-like regulation to encompass more firms and more activities, and regulations have become increasing complex.

Why did regulatory reform result in an expanded scope of regulation? The growth of shadow banking and the activity of shadow banks are considered key factors in propagating the crisis.[11] In response to tougher regulation, some financial firms move activities to the unregulated sector. Moreover, the inability of regulators to connect the dots has been in part blamed on lack of understanding of the interrelationships between the regulated and unregulated sector. Regulatory reform aimed to address this problem by casting the net wider, encompassing more financial firms and markets as well as creating stronger coordination among financial regulators on financial stability issues through the creation of the Financial Stability Oversight Council.

The expanded scope of regulation was accompanied by greater complexity of regulation. In part, greater complexity is a natural outgrowth of expanding the types of firms and activities covered by regulation as well as the increased complexity of financial markets. Regulatory arbitrage was also an important factor in the financial crisis. Regulatory arbitrage occurs when financial organizations change the form of a particular activity to avoid regulations without fundamentally changing the risks of the activity. Many developments in securitization markets were driven in large part by attempts to avoid capital regulations. Activities were structured to receive off-balance-sheet accounting treatment even where there was no shedding of risks. The drive to reduce the ability of financial firms to engage in regulatory arbitrage is another factor in the increased complexity of regulations.

However, some have argued that the increased complexity of regulation is excessively distortionary and will prove to be ineffective. Charles Plosser[12] discussed these issues in his

[11] See Pozsar, Adrian, Ashcraft, and Boesky (2013) for a comprehensive discussion and review of this topic.
[12] Charles Plosser has been president and chief executive officer of the Federal Reserve Bank of Philadelphia since August 2006.

speech during the conference. He pointed to the significant increase in costs related to regulatory compliance as a result of the DFA, Basel II, and Basel III and questioned whether these regulations will prove to be effective over the longer run.

Plosser argued that financial markets are constantly innovating, and there are limits to the ability of regulations to keep up with these innovations. The attempt to do so creates a vicious circle in which financial innovations occur in response to regulations, regulators then respond with more complex rules, and this in turn leads to new financial innovations. The end result is high costs associated with regulatory compliance and regulatory arbitrage with ineffective regulations that cannot feasibly keep up with market innovations.

Plosser (2014) proposes an alternative approach of simpler and more transparent financial regulations, which are easier to understand, easier to implement, and could be consistently enforced. He advocated that "simpler and more transparent regulatory approaches often work better."[13] Simplicity allows market participants to understand how regulators are likely to behave and thereby reduces uncertainty. It also allows regulators to credibly commit to implementing the regulations in a consistent manner, thereby increasing their effectiveness and fostering financial stability.

Plosser's emphasis on simplicity and transparency is related to his views that financial stability cannot rely solely on the ability of regulators to understand and combat risks but that market forces play a critical role. An effective regulatory regime will provide appropriate incentives for market discipline and will leverage information generated by the market. Private markets have the resources and, if too-big-to-fail policies are ended, the incentives to accurately price risk taking by financial firms. More accurate pricing of risk enhances financial stability by reducing moral hazard incentives. In addition, more accurate pricing would enhance the value of market signals to regulators. Simple and transparent regulations would further improve the quality of market signals by reducing the noise associated with uncertainty.

Plosser noted that a credible resolution regime was an essential component of an effective financial regulatory system. He has concerns about whether the resolution regime under the DFA would be credible and effective. The expansive discretionary power given to the

[13] The full speech is available online at http://www.philadelphiafed.org/publications/speeches/plosser/2014/04-08-14-frbp.cfm. Plosser's speech is consistent with the views expressed by Haldane (2012).

FDIC under Title II of the DFA undermines the credibility of the resolution regime, as it is vulnerable to the inevitable political pressures to bail out uninsured creditors of failing institutions. Plosser advocates developing a new bankruptcy mechanism suitable for all financial firms, whether systemically important or not, to alleviate most of the potential problems caused by the discretionary and targeted nature of Title II.

Plosser also supported incorporating contingent debt that would convert to capital in response to specific market indicators of financial distress.[14] Such automatic recapitalization would help prevent firms from failing in the first place and reduce the impact of any failures that did occur. In addition, managers would have a strong incentive to avoid taking on risks that might lead to such events, as they would dramatically dilute existing shareholders.

IV. Does Increased Public Disclosure of Supervisory Information Enhance Financial Stability?

Plosser advocates increasing the transparency of supervisory information. The view that more transparency and public disclosure is beneficial, including disclosure of supervisory findings, is common among economists. However, regulators have often resisted public disclosure, citing potential harmful effects. One major concern is that the disclosure of problems at some financial institutions might result in an over-reaction by the market and precipitate runs of uninsured creditors that propagate financial instability.

Does the disclosure of supervisory information enhance financial stability or undermine financial stability? Many economists and policymakers point to the disclosure of the first supervisory stress test in the U.S., the 2009 Supervisory Capital Assessment Program (SCAP), as evidence of the benefits of public disclosure. The disclosure of SCAP results revealed significant details about the activities of large banking organizations as well as supervisory assessments of the capital adequacy of those firms. While there was considerable concern and debate among policymakers over the release of the SCAP results, SCAP disclosures are generally credited with reducing uncertainty and increasing market confidence in the U.S. financial sector.[15] As a result,

[14] See Calomiris and Herring (2013) for a discussion on how to design contingent convertible debt requirements.
[15] Ben Bernanke (2010) said, "The release of detailed information enhanced the credibility of the exercise by giving outside analysts the ability to assess the findings, which helped restore investor confidence in the banking system.

regulators continued to disclose the results of the annual stress tests as part of the Comprehensive Capital Assessment and Review (CCAR) process.

Recent economic research has questioned the benefits of these disclosures and more generally questioned the notion that increased transparency is always beneficial. Goldstein and Sapra (2013) review the recent literature considering costs and benefits of disclosure. While the benefits of disclosure are well understood, possible risks include:

- The potential for propagating runs and coordination failures
- Reduced incentives for market participants to invest in obtaining information
- The distortion of incentives of regulated entities to "pass the stress test"

Itay Goldstein[16] presented his research, Goldstein and Leitner (2013), which considers an optimal disclosure policy of a regulator who has information about banks' ability to overcome future liquidity shocks. The paper considers the tradeoff between the necessity for disclosing information to avoid preventing a market breakdown (collapse of trade) and the potential that disclosing too much information destroys risk-sharing opportunities — the Hirshleifer (1971) effect. The authors find that no disclosure is optimal during normal times. However, during stress periods, partial disclosure is optimal. They relate their findings to disclosures of stress test results and argue that ongoing disclosure of these results in normal times is suboptimal.

Til Schuermann[17] also supported less disclosure of stress test results in normal times. Schuermann stated that the SCAP disclosures were useful given the special circumstances during the crisis that included government capital injections for those firms deemed to have insufficient capital under stress. Extensive ongoing disclosures will generate efforts by banks to mimic the models and results of the regulators. More aggregated exposures would provide less

---

In a demonstration of greater confidence, nearly all of the SCAP firms that were judged to need additional capital were able to raise that capital in the public markets through new issues or by voluntary conversions of preferred to common shares."

[16] Itay Goldstein is the Joel S. Ehrenkranz Family professor of finance at the Wharton School of the University of Pennsylvania. He is also the Ph.D. program coordinator. Previously, he was an assistant professor of finance at Duke University.

[17] Til Schuermann is a partner at Oliver Wyman. Previously, he was a senior vice president at the Federal Reserve Bank of New York, where he was head of Financial Intermediation in Research and head of Credit Risk in Bank Supervision. He also played a leadership role in the design and execution of the SCAP (bank stress test), and the subsequent CCAR programs.

incentive to game but still allow market participants to ask hard questions when firms' overall capital assessments are far different from regulatory assessments.

V. Evaluating Stress Testing as a Tool to Enhance Financial Stability[18]

Large banks that failed during the crisis often met the regulatory definition of "well capitalized" and rated higher than satisfactory by bank regulators in the year prior to their failure. Clearly, the regulatory system failed to maintain sufficient capital in the system to prevent the collapse of the financial system. Regulators needed to do something significantly different to create a more resilient financial system and to regain the public trust. Regulatory reform enacted new, enhanced prudential standards for those institutions deemed to be SIFIs. One of the cornerstones of the new standards was supervisory capital stress testing.

These stress tests assess whether SIFIs have sufficient capital conditional on a stressed macroeconomic scenario. Stress tests are a major component of the Federal Reserve's CCAR program.

> The Federal Reserve's annual Comprehensive Capital Analysis and Review (CCAR) is an intensive assessment of the capital adequacy of large, complex U.S. bank holding companies (BHCs) and of the practices these BHCs use to manage their capital. This process helps ensure that these BHCs have sufficient capital to withstand highly stressful operating environments and be able to continue operations, maintain ready access to funding, meet obligations to creditors and counterparties, and serve as credit intermediaries.[19]

One significant question regarding stress testing is the appropriate measure of capital — whether regulations should be based on accounting data alone or market data as well. As noted previously, regulatory accounting measures of capital were clearly inaccurate; failing firms were often well capitalized using accounting measures. An alternative approach is using market-based measures of regulatory capital.[20] Advocates for this approach point to the forward-

[18] The session on bank stress testing was moderated by Haluk Ünal, who is a professor of finance at the Robert H. Smith School of Business, University of Maryland; special advisor to the Center for Financial Research of the FDIC; and senior fellow at the Wharton Financial Institutions Center.

[19] "Comprehensive Capital Analysis and Review 2014: Assessment Framework and Results," Federal Reserve Board, 2014.

[20] See Bulow and Klemperer (2013) and Bond, Goldstein, and Prescott (2010) for more on the role of market-based measure (rather than accounting-based) for capital requirements.

looking nature of market prices. Opponents of this approach point to potential instability generated by volatile measures of regulatory capital. However, it may be possible to address the issue of volatility by tailoring the regulatory response to market-based measures of capital. For example, market-based measures could be used to enforce regulations requiring conservation of capital (e.g., restricting dividends and stock buybacks) rather than for bank closure decisions.

Stress test modeling requires dynamic projections of revenue, income/losses, balance sheet assets and liabilities, and regulatory capital ratios conditional on macroeconomic factors. The process includes projections of significant subcomponents of revenue and losses (e.g., residential mortgages, trading revenue) as well as projections of the total capital ratios. The projections include the entire quarterly path for income, losses, and capital. If banking organizations do not maintain sufficient capital throughout every quarter of the two-year window, they are subject to restrictions on dividends or other types of capital distributions and may be subject to other regulatory actions.

In addition to this supervisory benchmark — an independent supervisory assessment based on models developed within the Federal Reserve — the CCAR process requires banking organizations to produce their own assessment, which estimates the required capital under stress conditions. Banks must not only produce estimates using the Federal Reserve stress scenario but also produce estimates through their own bank-designed stress scenarios that they have customized to their individual risks.

The supervisory stress models are *bottom-up* models developed based on detailed industry data including loan level data for most of the loan book.[21] The models are then applied to each bank's individual data. As part of the process, large banks are now required to provide regulators with much more detailed data than had been required in the past. As a result of these new reporting requirements, the quality of bank data reports has been dramatically enhanced. This improves a bank's ability to understand and measure risks at the firm while enhancing supervisors' ability to understand risks at the firm and risks across the banking industry.

[21] The Kapinos and Mitnik (2014) paper cited here shows how informative a top-down (rather than the current bottom-up approach) stress testing could be.

The bottom-up approach to stress testing is very resource intensive and time consuming for banking organizations and for supervisors. Kapinos and Mitnik (2014)[22] examine the question of whether top-down stress-testing models can produce useful results. A top-down approach could be a useful alternative to lower the costs and time required to conduct the bottom-up estimates. These bottom-up models may serve as a useful benchmark to test the robustness of the bottom-up approach currently used by regulators. Finally, they could also be a useful benchmark model for smaller banks not subject to supervisory stress tests.

Kapinos and Mitnik use Call Report data to predict income line items for banks subject to the DFA requirement to produce their internal stress test results (but these banks are not subject to the supervisory stress tests). These are generally banks with assets between $10 billion and $50 billion. Utilizing preprovision net revenue (PPNR) and net charge-off (NCO) data, they build loss models and find that the top-down models performed well for the 2008 crisis period. They also find that allowing for bank heterogeneity is important for obtaining robust estimates.

Stress tests are now a central component of banking supervision. Are supervisory stress tests an effective tool for enhancing resilience of the financial system? Would the financial crisis have been averted if they had been conducted prior to the financial crisis? These questions were addressed at the conference by William Lang,[23] who argued that supervisory stress tests are an extremely effective supervisory tool *if properly understood and utilized*. However, by themselves, stress tests are limited, and it is unlikely that stress tests by themselves would have prevented the financial crisis.

Lang argued that stress tests by themselves would not have accurately captured the mortgage-related risks because much of those risks were "repackaged" precisely to avoid detection by standard risk-measurement approaches. This occurred in the mortgage market through concentrations of risk in asset-backed collateralized debt obligations (CDOs) and other structured finance products rather than on-balance-sheet loans. While the process for avoiding

[22] Pavel Kapinos, who presented his study at the conference, is a financial economist at the banking research section of the FDIC.

[23] William W. Lang is executive vice president and lending officer overseeing bank supervision and discount window lending for the Federal Reserve Bank of Philadelphia. Lang is also the founder of the Federal Reserve CCAR Model Validation Unit.

risk detection will differ in the future, dynamic markets will generate risks that are structured to escape detection.

Gorton (2008) explains the genesis of the mortgage crisis by stating that CDOs were too complex to be effectively analyzed by market participants. Lang and Jagtiani (2010) argue that this opacity made these instruments attractive to business managers precisely because they enabled managers to increase their activities without triggering risk alerts.

Does this imply that risk modeling, including stress tests, is ineffective? Lang argued that risk models are a necessary and effective component of the supervisory process. However, quantitative analysis (including stress tests) will be most effective when used as part of a decision process. Statistical models are highly valuable in focusing supervisory attention on significant blind spots that require obtaining additional information. Lang emphasized that focusing on the questions raised by stress models as to emerging risks was as important as focusing on the final capital estimates produced by those models.

VI. Did TBTF Cause the Financial Crisis and Will Regulatory Reform End TBTF?[24]

The policy of TBTF has been a central issue for economists and policymakers for many years, and the term became popularized with the government's support of large financial firms during the recent crisis. However, the term *TBTF* is not always well defined, and the role of the policy as a causal factor in the crisis is a subject of debate.

George Kaufman[25] discussed various definitions of *TBTF* and noted that alternative definitions have different regulatory and policy implications such as too complex to fail, too important to fail, too interconnected to fail, too big to liquidate, or too big to prosecute.[26] Generic TBTF represents different things to different players with different beneficiaries and losers and uncertainty about "who" precisely is being bailed out, by whom, why, and at what cost.

[24] The session on TBTF was moderated by Loretta Mester, president and chief executive officer of the Federal Reserve Bank of Cleveland.
[25] George G. Kaufman is the cochair of the Shadow Financial Regulatory Committee. He is also the John Smith Professor of finance and economics at Loyola University Chicago.
[26] For more details of his discussion, see Kaufman (2014).

Kaufman noted that while much of the public discussion of TBTF has focused on providing protection to taxpayers, the real issue goes beyond the source of funds used for a bailout. The possibility of a creditor bailout creates a moral hazard problem, no matter where the bailout funds originate. Ron Feldman, who also presented at the conference, added that the empirical evidence was mixed regarding moral hazard.

Richard Herring[27] pointed out that a fundamental issue around TBTF in the U.S. is the ambiguity concerning when the government will engage in TBTF policies. Herring stated that in many countries there is no ambiguity about the willingness of governments to rescue large banking organizations. In contrast, U.S. policymakers have articulated a policy of constructive ambiguity to create doubt about government protections and thus mitigate moral hazard. However, this policy may contribute to market uncertainty and instability. During the financial crisis, some firms such as AIG and Bear Stearns received government support, while some comparable firms such as Lehman Brothers did not. Herring argued that such uncertainty contributed to the chaotic market conditions following the Lehman failure.

For many years, economists have pointed to the potential for moral hazard and excessive risk taking resulting from TBTF policies, and there is general agreement that TBTF represents a government subsidy for financial firms.[28] However, empirical analyses differ as to the size of the subsidy. Brewer and Jagtiani (2013) estimate a significant subsidy for those banks that became TBTF through mergers and acquisitions. Deniz Anginer[29] presented his research — Acharya, Anginer, and Warburton (2014) — which examines the relationship between credit spreads and risk taking. The results indicate that TBTF institutions have lower spreads than other institutions and that TBTF institutions have spreads that are less sensitive to risk. In contrast, Randall Kroszner (2014)[30] cast doubt in his presentation about the reliability of

[27] Richard J. Herring is the Jacob Safra Professor of international banking and professor of finance at the Wharton School of the University of Pennsylvania, where he is also founding director of the Wharton Financial Institutions Center.

[28] See, for example, Stern and Feldman (2009 and 2004).

[29] Deniz Anginer is a financial economist at the World Bank. Previously, he worked as a consultant for Oliver Wyman.

[30] Randall S. Kroszner is the Norman R. Bobins professor of economics at the University of Chicago's Booth School of Business. He also served as a Governor of the U.S. Federal Reserve from 2006 to 2009.

findings in the literature on TBTF and credit risk spreads. He shows that large nonbanking firms seem to experience similar funding advantages obtained at large TBTF banks.

In his presentation, Ron Feldman[31] pointed out that the evidence for moral hazard as a cause of the crisis was weak. He noted that even studies of credit spreads that found a TBTF subsidy generally found that spread differentials were small prior to the financial crisis. If moral hazard was the precipitating cause of the crisis, then we would expect to see a funding advantage to SIFIs prior to those firms becoming distressed.

In addition, the government's implicit subsidy had been viewed primarily as a subsidy to large banking organizations. It is unlikely that market participants believed that investment banks such as Bear Stearns and insurers such as AIG were covered by an implicit guarantee. Yet, many of these financial institutions were at the heart of the crisis. This echoes Franklin Allen's concerns discussed previously that ending TBTF will not prevent systemic crises by itself.

Feldman argued that while TBTF subsidies may not have been the cause of the crisis, nevertheless the fundamental goals of the DFA with respect to SIFIs remained valid. These goals include stronger capital and liquidity requirements based on the degree of systemic importance of the institution, strong supervisory programs including stress testing, and resolving distressed SIFIs while maintaining financial stability.

Arthur Murton[32] described the DFA resolution plan process and expressed his view that the plan would be effective in eliminating TBTF problems. Title 1 of the DFA requires that large banking organizations and nonbank SIFIs to submit resolution plans, or "living wills," that show how they would be resolved under the U.S. bankruptcy code. SIFIs are typically very complex, with hundreds, and in some cases thousands, of interconnected entities. Unwinding these very complex companies is a major challenge for the normal bankruptcy process. Fleming and Sarkar (2014) detail the lengthy bankruptcy process to resolve Lehman Brothers. They show that the complexity of the company slowed down resolution and magnified losses. The goal of living

[31] Ron Feldman is executive vice president and senior policy adviser at the Federal Reserve Bank of Minneapolis. He is the senior officer in charge of Supervision, Regulation & Credit. Feldman has coauthored with Gary Stern (previous president and chief executive officer of the Federal Reserve Bank of Minneapolis) a book *Too Big to Fail: The Hazards of Bank Bailouts*, published by the Brookings Institution Press (2004).

[32] Art Murton is the director of the FDIC's Office of Complex Financial Institutions and oversees contingency planning for resolving and the resolution of systemically important financial companies.

wills is to reduce the organizational complexity of SIFIs and to allow speedy resolution through bankruptcy. However, many are skeptical that the bankruptcy process can act swiftly enough to prevent fire sales of assets and liquidity disruptions due to unresolved claims.

To address concerns that the bankruptcy process may be an ineffective process to resolve SIFIs, the DFA created the Orderly Liquidation Authority (OLA) under Title II, which provides the FDIC backup authority to place a SIFI into receivership if resolution through bankruptcy would have serious adverse effects on U.S. financial stability. Using a Single Point of Entry (SPOE) strategy under Title II, the FDIC would place the failed/failing top-tier parent company into receivership and keep subsidiaries operating to avoid any market interruption.[33] To be effective, Title II requires that the top-tier holding company maintains a sufficient amount of equity and unsecured debt for the recapitalization, without either threatening short-term funding liabilities or necessitating injections of capital from the government.[34]

Will the new resolution regime be effective in protecting financial stability and in ending TBTF? This was a subject of considerable debate at the conference. Sandra Lawson[35] believes that the TBTF problem has ended and that the discussion around resolution plans should not focus on the most difficult issue (cross border resolution) but rather on SIFI's ability to absorb losses. Her study shows that loss absorbency among U.S. G-SIFIs has risen sharply since the

[33] The following is a quick summary of the FDIC resolution process: 1) Receivership — Transfer assets to newly created bridge financial company, replace officers, appoint new board of directors. 2) Funding — Well-capitalized bridge company — with funding from private market — if market funding not immediately obtained, the FDIC could utilize Orderly Liquidity Fund (OLF), which is a LOC that the FDIC has from the Treasury, on a short-term transitional basis. Taxpayer losses are prohibited. 3) Claims — SHS's equity, sub debt, and substantial portion of unsecured debt of HC are left in receivership — loss in this order. 4) Termination of Bridge Co. — terminated upon FDIC approval of enforceable restructuring plan — will then be owned by outside creditors. 5) International coordination plays an important role in the resolution process — the FDIC has been working closely with the U.K. regulators and the European Union.

[34] The SPOE strategy is intended to minimize market disruption by isolating the failure and associated losses in a SIFI to the top-tier holding company while maintaining operations at the subsidiary level so that the resolution would be confined to one legal entity (the holding company) and would not trigger the need for resolution or bankruptcy across the operating subsidiaries, multiple business lines, or various sovereign jurisdictions. The FDIC is still in the process of determining the required (optimal) amount of debt holding to ensure sufficient funding for the operations of the critical functions and a successful recapitalization.

[35] Sandra Lawson is a managing director at Goldman Sachs and the director of the Global Markets Institute, the firm's public policy research center.

crisis — bank capital (first line of defense) has improved in both quantity and quality (under the Basel II and Basel III).[36]

George Kaufman argued that TBTF has not ended because there is still an agency problem (moral hazard) at large financial institutions. The DFA Living Will under Title I and the OLA resolution regime under Title II are steps in the right direction, but they have not eliminated the agency problem. The public needs to be convinced that large financial firms will not get bailouts for the moral hazard problems to be eliminated. However, given the past history of government rescues, it is likely that there will be considerable market skepticism until the regime has actually been implemented. Moreover, even if a single SIFI were to be successfully resolved, it would still need to be tested in a situation where there was distress at a number of SIFIs. Thus, establishing credibility is unlikely to occur without another major financial disruption.

The DFA established stronger regulatory requirements for SIFIs to combat systemic risk. These stronger regulatory requirements might be expected to create incentives for banks to downsize. However, Richard Herring presented empirical evidence that U.S. banking markets have become increasingly concentrated after the financial crisis, with the largest banking organizations gaining market share. It remains to be seen if SIFIs eventually shrink in response to tighter regulatory requirements over the longer run, but to date, the trend has been for large organizations to get larger.

VII. Reforming the Housing Finance System[37]

The coverage of the conference would be incomplete without discussion on mortgage and housing finance issues since the U.S. mortgage crisis was the epicenter of the global financial crisis. Federal Reserve Chair Janet Yellen discussed the relationship between the mortgage crisis and financial crisis in a speech on July 2, 2014:

[36] Lawson (2014) finds that the chance of well-capitalized banks' tier 1 capital falling below 4 percent was once in 41 years during the precrisis period but now once every 56 years.

[37] The mortgages and housing finance reform session was moderated by David Musto, who is the Ronald O. Perelman professor in finance, and chairperson of the finance department, at the Wharton School of the University of Pennsylvania.

> Although it was not recognized at the time, risks to financial stability within the U.S. escalated to a dangerous level in the mid-2000s. During that period, policymakers — myself included — were aware that homes seemed overvalued by a number of sensible metrics and that home prices might decline, although there was disagreement about how likely such a decline was and how large it might be. What was not appreciated was how serious the fallout from such a decline would be for the financial sector and the macroeconomy. Policymakers failed to anticipate that the reversal of the house price bubble would trigger the most significant financial crisis in the United States since the Great Depression because that reversal interacted with critical vulnerabilities in the financial system and in government regulation.

James Barth[38] provided a general perspective on the U.S. housing and mortgage market. His analysis indicated that the U.S. market is unique in a number of respects. In particular, U.S. consumers spend approximately 31 percent of their income on housing expenditures, a larger share than most other countries. U.S. houses have become significantly larger as U.S. households have grown smaller. Barth pointed to the substantial government subsidization of home purchases, through tax benefits and subsidization of the government-sponsored enterprises (GSEs), as the principal cause of these trends. Despite that, he noted most of the effects of the subsidy can be seen in the size of homes with relatively modest increases in the homeownership rate. He also noted that the growth in private label securitization had only a transitory impact on the homeownership rate. Barth argued that the U.S. government should reduce or eliminate subsidization of homeownership.

Ronel Elul[39] presented his research on mortgage securitization, which examines opacity in mortgage securitization. Elul (2014) finds evidence of adverse selection in mortgage securitizations with poorer performance of securitized mortgages relative to securitized mortgages and that information on the quality of mortgages is opaque to investors. His results suggest that increased transparency would improve market efficiency.

[38] James R. Barth is the Lowder eminent scholar in finance at Auburn University, a senior rellow at the Milken Institute, and a fellow at the Wharton Financial Institutions Center.

[39] Ronel Elul is a senior economic advisor and economist in the Research Department of the Federal Reserve Bank of Philadelphia. He is also an adjunct associate professor of finance at the Wharton School of the University of Pennsylvania.

Susan Wachter[40] presented her research, which examines the connection between transparency in the mortgage market and price volatility in the housing market, focusing on transparency related to geographic risk. Pavlov, Wachter, and Zevelev (2014) find that increasing transparency in the financial market is associated with increasing local house price volatility and increasing losses to MBS investors. Their paper finds that more transparency, in their case transparency about geographic risk, tends to reduce demand for the securities and increase volatility in the housing market.

The GSEs, such as Fannie Mae and Freddie Mac, played an important role in the mortgage crisis, which led to the financial crisis. The GSEs purchased mortgages from banks and other mortgage lenders, packaged them into mortgage-backed securities (MBSs), and provided guarantees of principal and interest payments on these MBSs. Market participants believed that the GSEs had the implicit backing of the federal government, and thus, GSE guarantees and debt obligations were treated as obligations guaranteed by the U.S. government. The 2008 crisis proved that the "implied" taxpayer backing of the GSEs was real, with the government eventually placing Freddie and Fannie into conservatorship on September 6, 2008.

Although mortgages were at the center of the financial crisis, reform of the housing finance system was not a part of the DFA. Joseph Tracy[41] discussed his proposal for reform developed with other staff members at the Federal Reserve Bank of New York. One goal of the proposal is to replace implicit government guarantees with explicit government guarantees covering tail risks in the housing market. Tracy argued that governments have demonstrated their desire to absorb tail risk and that greater *ex ante* transparency is preferable to implicit subsidies. The proposal would establish one or more lender cooperatives to replace the GSEs. The proposal would maintain the benefits of economies of scale and scope of the current system by creating a small number of securitizers for standardized mortgage products. However, the proposal would require higher capital levels and stress testing to address problems of regulatory arbitrage. Moreover, it includes a vintage-based reinsurance approach

[40] Susan M. Wachter is the Richard B. Worley professor of financial management, a professor of real estate and finance at the Wharton School, and codirector of the Penn Institute for Urban Research.
[41] Joseph Tracy is an executive vice president and special advisor to the president at the Federal Reserve Bank of New York. Previously, he was director of Research.

to better align public and private incentives. The pricing structure is designed so that the government owns the tail risk but only the tail risk.

Despite the demonstrated weaknesses in our housing finance system, there has been no fundamental reform in response to the mortgage crisis. This is in part due to the economic complexity of the issue but also due to political complexities of reform. The conference discussion indicated some important key principals that should guide reform, including the transparency of the government's role, the elimination of implicit subsidies, and improved risk-based pricing to better align public and private incentives. This issue will be a major public policy question in the U.S. as Congress considers alternative reform proposals.

VIII. Concluding Remarks

The financial crisis has generated fundamental reforms in the financial regulatory system in the U.S. and internationally. Much of this reform was in direct response to the weaknesses revealed in the precrisis system. However, future crises are likely to be different than prior crises, and market risks will arise in response to the incentives created by the new regulatory architecture.

This paper addresses fundamental questions related to financial reform and maintaining financial stability. These questions discussed previously will be important subjects for economic analysis as well as public policy debate over the coming years. Regulatory reform is still in its early stages and is incomplete in some important areas. There will be intense academic and public interest in determining the impact of the reform efforts and whether they are achieving the goal of enhancing financial stability. The papers in this volume represent an important contribution to that ongoing analysis.

References

Acemoglu, Daron, Asuman Ozdaglar, and Alireza Tahbaz-Salehi (2013). "Systemic Risk and Stability in Financial Networks," NBER Working Paper 18727.

Acharya, Viral, Deniz Anginer, and Joe Warburton (2014). "The End of Market Discipline? Investor Expectations of Implicit State Guarantee," New York University Working Paper.

Acharya, Viral, Robert Engle, and Matthew Richardson (2012). "Capital Shortfall: A New Approach to Ranking and Regulating Systemic Risks" *American Economic Review*: *Papers & Proceedings* 102(3): 59–64.

Allen, Franklin, and Douglas Gale (2000). "Financial Contagion," *Journal of Political Economy* 108(1), 1–33.

Bernanke, Ben (2010). "The Supervisory Capital Assessment Program — One Year Later," Speech given at the Federal Reserve Bank of Chicago 46th Annual Conference on Bank Structure and Competition, Chicago, May 6.

Bond, Philip, Itay Goldstein, and Edward Prescott (2010). "Market-Based Corrective Actions," *Review of Financial Studies*, 23(2), 781–820.

Brewer, Eli, and Julapa Jagtiani (2013). "How Much Did Banks Pay to Become Too-Big-to-Fail and to Become Systemically Important?" *Journal of Financial Services Research* 43, 1-35.

Bulow, Jeremy, and Paul Klemperer (2013). "Market-Based Bank Capital Regulation," Stanford University Working Paper No. 2132, September.

Calomiris, Charles, and Richard Herring (2013). "How to Design a Contingent Convertible Debt Requirement," *Journal of Applied Corporate Finance* 25(2), 39-62.

Elul, Ronel (2014). "Securitization and Mortgage Default," Working Paper, Federal Reserve Bank of Philadelphia.

Federal Reserve (2014). "Comprehensive Capital Analysis and Review 2013: Assessment Framework and Results," March.

Fleming, Michael, and Asani Sarkar (2014). "The Failure Resolution of Lehman Brothers," Federal Reserve Bank of New York *Economic Policy Review*, March 31.

Freixas, Xavier, Bruno Parigi, and Jean-Charles Rochet (2000). "Systemic Risk, Interbank Relations, and Liquidity Provision by the Central Bank," *Journal of Money, Credit and Banking* 32(3), 611-38.

Goldstein, Itay, and Haresh Sapra (2013). "Should Banks' Stress Test Results Be Disclosed? An Analysis of the Costs and Benefits," *Foundations and Trends in Finance* 8(1), 1-54.

Goldstein, Itay, and Yaron Leitner (2013). "Stress Tests and Information Disclosure," Federal Reserve Bank of Philadelphia, Working Paper 13-26.

Gorton, Gary (2008). "The Subprime Panic," Yale ICF Working Paper 08-25, September 30, 2008.

Guntay, Levent, and Paul Kupiec (2014). "Taking the Risk out of Systematic Risk Measurement," Working Paper, Federal Deposit Insurance Corporation and the American Enterprise Institute.

Haldane, Andrew (2012). "The Dog and The Frisbee," Speech given at the Federal Reserve Bank of Kansas City's 36th Economic Policy Symposium titled "The Changing Policy Landscape," Jackson Hole, Wyoming, August 31.

Haldane, Andrew (2012). "On Being the Right Size," Speech given at the Institute of Economic Affairs' 22nd Annual Series, The 2012 Beesley Lectures, at the Institute of Directors, London, October 25.

Haldane, Andrew (2009). "Rethinking the Financial Network," Speech given at the Financial Student Association, Amsterdam, April 28.

Herring, Richard, and Susan Wachter (1999). "Real Estate Booms and Banking Busts: An International Perspective," Wharton Financial Institutions Center Working Paper 99-27.

Hirshleifer, Jack (1971). "The Private and Social Value of Information and the Reward to Inventive Activity," *The American Economic Review* 61(4), 561–574.

Kapinos, Pave,l and Oscar Mitnik (2014) "Can Top-Down Banking Stress Tests Be Informative?" Working Paper, Federal Deposit Insurance Corporation.

Kaufman, George (2014). "Too Big to Fail in Banking: What Does It Mean?" *Journal of Financial Stability* (forthcoming).

Kroszner, Randall (2014). "A Review of Bank Funding Cost Differentials," Working Paper, University of Chicago.

Lang, William W., and Julapa Jagtiani (2010). "The Mortgage and Financial Crises: The Role of Credit Risk Management and Corporate Governance," *Atlantic Economic Journal* 38(3), 295–316.

Lawson, Sandra (2014). "TBTF From an Economic Perspective," Goldman Sachs Global Markets Institute, January 24.

Pavlov, Andrey, Susan Wachter, and Albert Zevelev (2014). “Transparency in the Mortgage Market,” Working Paper, The Wharton School.

Plosser, Charles (2014). “Simplicity, Transparency, and Market Discipline in Regulatory Reform,” speech given at the conference on Enhancing Prudential Standards in Financial Regulations, Federal Reserve Bank of Philadelphia, April 8.

Pozsar, Zoltan, Tabias Adrian, Adam Ashcraft, and Hayley Boesky (2013). “Shadow Banking,” Federal Reserve Bank of New York *Economic Policy Review*, December, 1–16.

Stein, Jeremy (2014). “Incorporating Financial Stability Considerations into a Monetary Policy Framework,”speech given at the International Research Forum on Monetary Policy, Washington, D.C., March 21.

Stern, Gary, and Ron Feldman (2009). “Addressing TBTF By Shrinking Financial Institutions: An InitiaL Assessment,” *The Region*, Federal Reserve Bank of Minneapolis, June, 8–13.

Stern, Gary, and Ron Feldman (2004). “Too Big to Fail: The Hazards of Bank Bailouts,” Brookings Institution Press.

Tarullo, Daniel (2014). “Monetary Policy and Financial Stability,” speech given at the 30th Annual National Association for Business Economics Economic Policy Conference, Arlington, VA, February 25.

Yellen, Janet (2014). “Monetary Policy and Financial Stability,” speech given at the 2014 Michel Camdessus Central Banking Lecture, International Monetary Fund, Washington, D.C., July 2.