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Enhancing Prudential Standards in Financial Regulations

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Abstract 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 pre-crisis 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 article 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, effectiveness of bank stress testing as a tool to enhance financial stability, whether the financial crisis was caused by TBTF, and whether the 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

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.

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1 Introduction

This special issue of the *Journal of Financial Services Research* presents selected papers from a conference on "Enhancing Prudential Standards in Financial Regulations" in April 2014. The conference was jointly sponsored by the Federal Reserve Bank of Philadelphia, the Wharton Financial Institutions Center, and the *Journal of Financial Services Research*. Papers accepted into the special issue were required to go through the journal's standard peer review process. The papers appearing in this volume address critical questions related to understanding the causes of systemic financial instability as well as questions related to the design of financial regulation to mitigate systemic risk.

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 that financial distress at one or more systemically important financial institutions may have on the financial system."

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.

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 U.S.-specific regulation, the Basel Committee on Banking Supervision has also enacted reforms intended to refocus financial regulation on containing systemic risk and maintaining financial

[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.

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 policy of too-big-to-fail (TBTF) by giving regulators new authority to resolve failing SIFIs. The fundamental questions/concerns in the process of regulation reforms are described below.

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 create moral hazard problems (e.g. 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?

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 regulations be effective in enhancing financial stability? Are they sufficient, or should monetary and fiscal policy tools be used as well?

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? 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?

Finally, 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 papers in the special issue along with other presentations at the conference addressed these questions.

2 Did TBTF cause the financial crisis, and will regulatory reform end TBTF?

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.

One of the principle articles of faith in the TBTF discussion is that those companies considered TBTF have a lower funding cost due to the implicit government guarantee.[2] This argument is important for two reasons. First, it suggests that market discipline is less effective as investors do not appropriately price risk at TBTF firms. Second, it provides a rationale of why firms may choose to become large even if there are no economies of scale or scope.

The empirical analyses in the literature have differed significantly in relation to the size of the subsidy. For example, Brewer and Jagtiani (2013) estimate a large subsidy for those banks that became TBTF through mergers and acquisitions. Randall Kroszner (2016, in this special issue) reviews the existing evidence and casts doubt about the reliability of the conclusions that the lower costs of funds at large banks is due to TBTF subsidies. Kroszner provides a simple taxonomy that categorizes empirical literature on TBTF subsidies into five categories: bond and CDS Spreads, credit ratings, deposits (looking at risk premiums on uninsured deposits), equity prices, and others.

The author then discusses key challenges faced by these studies: interpretation (or identification) of funding cost differences between large and small banks, the choice of time period, the choice of the sample, and the significant differences in the funding structures of large and small banks (e.g. the relative reliance market funding at large banks). In summary, Kroszner argues that existing studies are not convincing given the challenges outlined.

Kroszner suggests two particularly promising approaches for research. He notes that differential funding costs for larger firms exist outside of the banking industry. Thus, finding such a differential in banking is not necessarily evidence of implicit government support. He argues that a "difference in difference" approach might be able to address this identification problem. This would ask whether differentials in banking are greater than other sectors controlling for relevant risk factors.

The author also suggests using "natural experiments" that occur primarily as a result of changing regulation. For example, the paper discusses the expiration of the unlimited deposit insurance guarantee on non-interest bearing transactions accounts as a natural experiment. If larger bank depositors are still protected by implicit government support, then an expiration of this deposit insurance should have led to a flow of deposits from smaller to larger banks. This did not occur and raises doubts about the underlying TBTF hypothesis, at least with regard to the perception of depositors. Kroszner points to these types of natural experiments as a promising approach for future research.

Carmassi and Herring (2016, in this special issue) focus on the issue of corporate complexity as a fundamental factor in generating systemic risk and creating incentives for the policy of TBTF. Reducing complexity is one of the principle goals of the new resolution authorities contained in the DFA.

To study how complexity has evolved within the financial system, the authors focus on the number of legal entities controlled by the top-level corporation in each of the 29 banks designated as Global Systemically Important Banks (G-SIBs) by the Financial Stability Board in November 2013. The paper presents a time-series overview of the size and complexity of these G-SIBs and analyzes how regulations, tax incentives, and merger activity affect complexity. Interestingly, they find no general correlation between asset size and complexity. However, complexity is highly related to asset growth when growth is the result of merger activity and when complexity resulting from mergers is long lasting. They argue that there is no causal link between size and complexity and that policies aimed only at reducing

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

asset size are unlikely to reduce complexity. They suggest that regulators consider how post-merger integration plans are designed to reduce complexity prior to approving a merger. More generally, the authors advocate for the importance of resolution planning regulations (living wills) as a lever for requiring reduced complexity at large banking organizations with the goal of reducing the systemic impact of bank financial distress and eliminating the policy of TBTF.

Deniz Anginer presented his research—Acharya et al. (2015)—that is an example of the type of credit spread study discussed by Kroszner (2016). The paper examines the relationship between credit spreads and risk taking. Their results indicate that TBTF institutions have lower spreads than other institutions and that TBTF institutions have spreads that are less sensitive to risk.

Other speakers at the conference also addressed various aspects of TBTF. George Kaufman 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.[3] 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.

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.

In his presentation, Feldman 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 one 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.

Feldman argued that while TBTF subsidies may not have been the cause of the crisis, 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 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 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 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 wills is to reduce the organizational complexity of SIFIs and to allow speedy resolution

[3] For more details of his discussion, see Kaufman (2014).

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 in operation to avoid any market interruption.[4] 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.[5]

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 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 SIFIs' ability to absorb losses. Her study shows that loss absorbency among U.S. G-SIFIs has risen sharply since the crisis—bank capital (first line of defense) has improved in both quantity and quality (under the Basel II and Basel III).[6]

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, the data in Carmassi and Herring (2016, in this special issue) indicate that G-SIBs, including U.S. G-SIBs, have become increasingly larger and more complex after the

[4] 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.

[5] 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.

[6] Lawson (2014) finds that the chance of well-capitalized banks' tier 1 capital falling below 4 % was once in 41 years during the pre-crisis period, but is now once every 56 years.

financial crisis. 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 grow larger.

3 Evaluating stress testing as a tool to enhance financial stability

Large banks that failed during the crisis often met the regulatory definition of "well capitalized" and were 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.[7]

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.[8] Advocates for this approach point to the forward-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 2-year window,

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

[8] See Bulow and Klemperer (2013) and Bond et al. (2010) for more on the role of market-based measure (rather than accounting-based) for capital requirements.

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 assessments, which estimate 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.[9] 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.

The bottom-up approach to stress testing is very resource intensive and time consuming for banking organizations and for supervisors. Kapinos and Mitnik (2016, in this special issue) 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 top-down 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 that are not subject to supervisory stress tests.

Kapinos and Mitnik use Call Report data to predict various capital measures for banks (insured depository institutions) with assets of at least $10 billion that are subject to the Dodd-Frank Act stress-testing (DFAST) requirement. The DFAST requirements are generally less stringent and less detailed than those associated with the CCAR that apply to bank holding companies with assets of at least $50 billion. Utilizing pre-provision net revenue (PPNR) and net charge-off (NCO) data, they build forecasts for different regulatory capital measures conditional on the macroeconomic scenarios provided by the Federal Reserve for the CCAR exercise. They find that the top-down models performed well for the 2008 crisis period. Furthermore, they find that accounting for bank heterogeneity in the models could result in a more accurate description of the adverse impact of macroeconomic stress on regulatory capital.

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 the supervisory stress tests had been conducted prior to the financial crisis? These questions were addressed at the conference by William Lang, who argued that supervisory stress tests could be 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

[9] Kapinos and Mitnik (2016, in this special issue) show how informative a top-down (rather than the current bottom-up approach) stress testing could be. Their paper was originally circulated in 2014 under the title "Can Top-Down Banking Stress Tests Be Informative?"

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 financial products rather than on-balance-sheet loans. While the process for avoiding risk detection will differ in the future, dynamic markets will generate risks that are structured to escape detection.

Gorton (2009) 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 related to emerging risks was as important as focusing on the final capital estimates produced by those models.

4 Understanding systemic risk and the role of policy in enhancing financial stability

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, even when there are no systemically important financial institutions.[10] Enhancing regulation of SIFIs may not be sufficient to contain systemic risk. A better understanding of the sources, types, and methods of measuring systemic risk are all necessary to design effective financial stability policies.

Guntay and Kupiec (2016, in this special issue) explore 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 the lack of formal hypothesis testing as a central flaw in the literature on Conditional Value at Risk (CoVaR) and Marginal Expected Shortfall (MES) methods for measuring systemic risk.[11]

To address this shortcoming, the authors construct hypothesis test statistics for CoVaR and MES that they use to detect systemic risk at the institution level and apply their tests to daily stock returns data for over 3500 firms during 2006–2007. The tests indicate that CoVaR and MES methods often disagree about which firms are systemic and identify many more real-side firms than financial firms. They also find that the two measures may fail to detect systemic risk when return distributions are skewed. The authors conclude that CoVaR and MES are not reliable measures of systemic risk.

In his conference speech, Franklin Allen 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

[10] 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.

[11] See also Acharya et al. (2012).

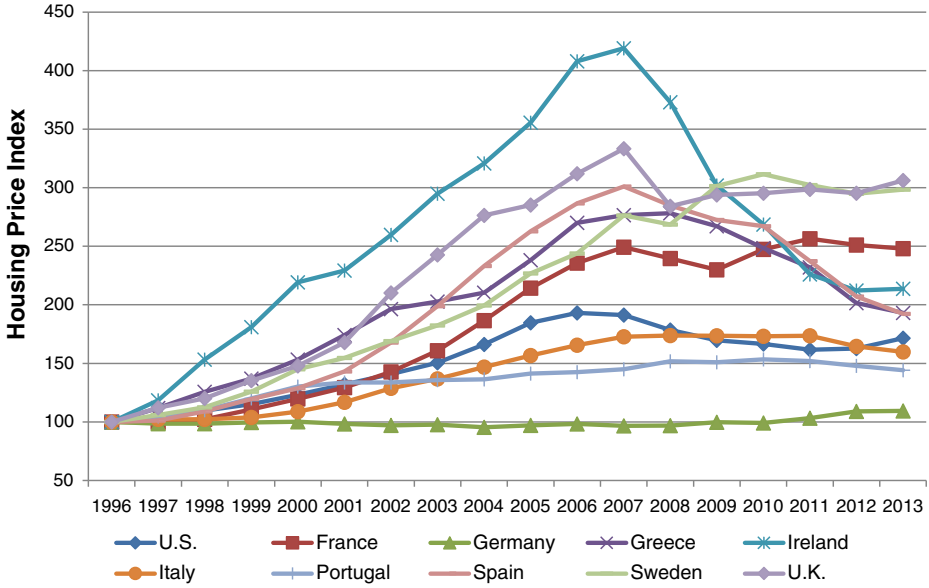

Fig. 1 Nominal home prices in the U.S. and European countries period: 1996–2013

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 Fig. 1). However, Fig. 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 limited.

Allen also pointed out that there have been various causes of systemic risk. 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.[12] 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 seen 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.

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

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.[13] On the other hand, a more interconnected structure could also mean more instability, because large losses can be transmitted to other banks, thus exposing the entire financial system to systemic failures.

Alireza Tahbaz-Salehi presented his joint work, Acemoglu et al. (2015), which examines 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. They 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 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. [14]

5 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.[15] 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

[13] See Freixas et al. (2000).

[14] 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.

[15] See Pozsar et al. (2013) for a comprehensive discussion and review of this topic.

blamed on a 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 discussed these issues in his 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 innovative, 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)[16] proposed an alternative approach of simpler and more transparent financial regulations, which would be easier to understand, easier to implement, and could be consistently enforced. He advocated that "simpler and more transparent regulatory approaches often work better." 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 and 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 TBTF policies are ended, the incentives to accurately price risks taken 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.

[16] At the time of the conference, Charles Plosser was President and Chief Executive Officer of the Federal Reserve Bank of Philadelphia (August 2006 to February 2015). Plosser's speech is consistent with the views expressed by Haldane (2012a, b). The full speech is available online at http://www.philadelphiafed.org/publications/speeches/plosser/2014/04-08-14-frbp.cfm.

Plosser noted that a credible resolution regime was an essential component of an effective financial regulatory system. He had concerns about whether the resolution regime under the DFA would be credible and effective. The expansive discretionary power given to the 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 advocated for 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.[17] 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.

6 Does increased public disclosure of supervisory information enhance financial stability?

Plosser also advocated for 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.[18] As a result, regulators continued to disclose the results of the annual stress tests as part of the 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) reviewed 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, and the distortion of incentives of regulated entities to "pass the stress test."

[17] See Calomiris and Herring (2013) for a discussion on how to design contingent convertible debt requirements.
[18] 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. In a demonstration of greater confidence, nearly all of the SCAP firms that were judged to need additional capital were able to raise the capital in the public markets through new issues or by voluntary conversions of preferred to common shares."

Itay Goldstein presented his research, Goldstein and Leitner (2015), 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 may be suboptimal.

Til Schuermann 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 disclosures would provide less incentive to game but still allow market participants to ask hard questions when firms' overall capital assessments are far different from regulatory assessments.

7 Reforming the housing finance system

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 the financial crisis in a speech on July 2, 2014:

> 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.

The crisis raised fundamental issues about housing price dynamics and the housing finance system. Two papers in this special issue directly address these issues. Ronel Elul (2016, in this special issue) finds evidence of adverse selection in the mortgage-backed securities market (MBS). The paper examines loan-level data for securitized and non-securitized mortgages. The data cover approximately two-thirds of all U.S. mortgages originated in 2005 and 2006. The author finds poorer performance of securitized mortgages relative to the performance of portfolio mortgages, after controlling for observable risk characteristics. This suggests potential adverse selection effects in the MBS market.

In a somewhat surprising result, Elul finds that the adverse selection effects in the securitization market were strongest in prime mortgage markets. They find that, other things equal, a typical prime loan becomes delinquent at a 20 % higher rate if it is privately securitized as compared to loans held in portfolio. For subprime mortgages, the impact of private securitization is concentrated in low or no-documentation loans.

Elul's findings have important implications for the regulations of mortgage markets as attempts to ensure that MBS issuers that have more "skin-in-the-game" are motivated by addressing potential moral hazard. The paper also suggests potentially interesting research to investigate the private information that lenders might have used to select better loans.

Susan Wachter presented her paper co-authored with Pavlov et al. (2016, in this special issue) that examines the connection between transparency in the mortgage market and price volatility in the housing market. The paper focuses on transparency related to geographic risk. Greater geographic transparency implies increased geographic differentiation in prices. The model in the paper shows that this increased transparency can limit risk-sharing with the result of increasing local house price volatility. In addition, losses for securities investors increase, thus resulting in reduced demand for MBS.

The authors investigate whether competitive lenders would optimally choose to provide opaque lending, thus reducing volatility in the real estate markets. They find that lenders have incentives to increase transparency when a geographic region suffers a negative shock. Thus, an opaque competitive equilibrium is not stable and lender behavior tends to magnify regional shocks in the housing market. The authors propose market and regulatory mechanisms that make the opaque competitive equilibrium stable and insurance opportunities possible.

The conference session on housing markets had several additional presentations. James Barth 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 % 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 principle 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.

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 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 Mac and Fannie Mae 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 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 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.[19]

Despite the demonstrated weaknesses in our housing finance system, there has been no fundamental reform in response to the mortgage crisis. This is partially due to the economic complexity of the issue but also due to the political complexities of reform. The conference discussion indicated some important key principles that should guide reform, including the transparency of the government's role, the elimination of implicit subsidies, and the improvement of 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.

8 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 pre-crisis 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.

The papers in this special issue address fundamental questions related to financial reform and maintaining financial stability. These questions discussed above 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.

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