

Regulatory Reform: A Scorecard

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The financial crisis of 2007-09 revealed many deficiencies in the financial system. In response, authorities have implemented a wide range of regulatory reforms. We survey the reforms and offer our views on where there could be further improvements. While capital requirements and levels are far higher, they are not high enough. New liquidity requirements are useful, but need simplification. Shifting derivatives transactions to central counterparties has improved resilience, but also created indispensable financial market utilities that lack credible resolution and recovery regimes. And systemic (macroprudential) regulation lacks the metrics, policy tools, governance structure, and international cooperation needed to be effective.

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1. Introduction

The financial system in the United States and Europe is far more resilient today than it was a decade ago, and the likelihood of another system-wide crisis is now lower. Because of post-crisis regulatory reforms, banks have more loss-absorbing equity capital than they had in 2007 and face stringent liquidity requirements. In addition, the biggest among them must meet rigorous stress tests. The banking system has absorbed the most vulnerable shadow banks that posed systemic risk, while other shadow banks and financial market utilities face closer oversight. There is a superior resolution mechanism for systemic intermediaries. And financial market infrastructure has improved: a majority of over-the-counter derivatives are now centrally cleared.

This new environment substantially lowers the probability that financial organizations, especially those that are large and complex, will become a burden on the taxpayer.

The 2007-09 crisis revealed a myriad of limitations of our financial system. These include problems with incentives; flaws in techniques used to measure, price and manage risk and in the corporate governance structures used to monitor it; and failings of the regulatory system. Jointly, these weaknesses allowed the entire financial industry to book profits too early, too easily and without proper risk adjustment.¹

Addressing these deficiencies has led to a set of complex and wide ranging reforms. Following the Systemic Risk Council (2017a, 2017b), we will organize these into five broad categories: capital, liquidity, resolution, central clearing and systemic regulation.

To state our conclusions at the outset:

Capital: Regulators have raised capital requirements markedly, albeit from a trivial and woefully inadequate level. In response, banks have doubled their buffers against prospective losses. But, current levels are still not high enough.

Liquidity: Liquidity requirements need refinement. The new regime has two standards: the *liquidity coverage ratio* (LCR), aimed at insuring a bank's assets are liquid; and the *net stable funding ratio* (NSFR), requiring liabilities be long term. Our knowledge and experience with these measures is in its infancy. We need to continue to work on their design and their implementation. In our view, there should be only one requirement, not two. The LCR can do the job on its own.

Resolution: There has been substantial progress, and a number of key parts are in place (including a thoughtful *single-point-of-entry* strategy for addressing the failure of a systemic intermediary). However, some of the tools (like *living wills*) need considerable modification, while an improved bankruptcy mechanism for systemic intermediaries would be a useful complement to the system. Finally, the new framework remains untested, leaving room for skepticism about its effectiveness, especially in a crisis involving multiple, cross-border failures.

¹ See Chapter 1 of the BIS Annual Report (2009) for a detailed discussion.

Central clearing: Aimed at improving market resilience, there has been substantial progress in shifting derivatives trading to central clearing parties. With this success comes risk. These *financial market utilities* (FMUs) are now very large. Unless we plan to treat them as public utilities, they require clear and practical resolution and recovery regimes that have not been articulated.

Systemic Regulation: Systemic risk assessments and (macroprudential) regulation are at a very early stage of development. While stress tests are a critical part of the policymakers' toolkit, we have not yet settled on tools or on metrics for threat assessments, governance, and the management of cross-border spillovers. Completing this task must remain high on our agenda.

The remainder of this essay is in six sections. The first five cover each of these pillars of the reform agenda. In the final section, we discuss unfinished business and evolving challenges.

2. Capital Requirements

Walter Wriston, Citicorp's chief for nearly two decades until 1984, claimed that bankers were so good at managing risks that banks did not need much, if any, capital.² Over 30 years, Wriston's views carried the day. As a result, capital requirements, especially those put forth as part of the Basel II framework, were extremely low.³

The global financial crisis put that view to rest. Today, there is nearly universal agreement that banks should be able to absorb large unforeseen losses that would otherwise threaten financial stability, so they need to finance themselves with substantial equity. Yet, even today, due to the combination of explicit and implicit government guarantees, the widespread tax subsidy, and the familiar debt overhang problem (Myers (1977), banks take on too much debt.

What is the right amount of equity?

In this section, we make three points. First, because of a combination of changes in the definition of capital, changes in risk coverage and an increase in the required ratio of the two, *capital requirements* are many times higher than they were before the crisis (when they were pitifully low). Second, not just requirements, but capital levels have increased substantially, even before full implementation of Basel III. Third, as high as the standards are, they are not high enough. The alternative of *Total Loss Absorbing Capacity* (TLAC) is, at best, a second-class alternative that may not serve its primary purpose during a crisis.

Before getting to that, note that we have *two* capital requirements: one is *risk weighted*, and the other is not. Why? Capital is a form of insurance. Common sense dictates that risky drivers, for example, are more likely to cause accidents, so they should pay more for their insurance. As an incentive, self-insurance (deductibles, copays and the like) should also be used to compel banks to bear more of the systemic risk they create (and to internalize the externality arising from their distress).

² Grant (1996).

³ After roughly a decade of negotiations, the Basel II capital framework was agreed in the mid-2000s. See the chronology at <http://www.bis.org/publ/bcbsca.htm>.

Hence, a bank that engages in risky activity should have more capital as a buffer against what are likely to be more frequent and larger losses. In practice, however, measuring risk is difficult. In fact, as the Basel Committee on Banking Supervision (2013b) found, assessment of the exact same portfolio of held-to-maturity (banking book) assets by different banks results in risk-weighted assets estimates that vary by as much as 50%.⁴ The policy response to this humbling fact is the *leverage ratio*—a measure that treats all exposures (both on- and off-balance sheet) equally—which has been intended as a backup in the event that measures of *risk-weighted capital* fail. Put differently, the leverage ratio reflects regulators' own doubts about risk weights and concerns that they may unintentionally encourage systemic risk-taking.

Naturally, only one of these two requirements will bind at a time. Which it depends on two things: the average risk weight of a bank's assets (the ratio of risk-weighted assets to total assets) and the degree of off-balance sheet activity. The lower the average risk weight, and the higher the off-balance sheet exposure, the more likely it is that the leverage ratio binds. These features characterize the operations of investment banks and mortgage banks. By contrast, the risk-weighted capital requirement is more likely to bind on retail banks and specialized lenders, both of which tend to have relatively high-risk assets and fewer off-balance sheet exposures.⁵

Do we really need both? If, as Greenwood, Hanson, Stein and Sunderam (2017) suggest, we were to adjust the risk weights appropriately, then we may not. Keep in mind that a leverage ratio is nothing more than a risk-weighted capital ratio with all the risk weights set to one. As a result, unless it were set at a high level, using a leverage ratio alone gives banks the incentive to acquire riskier assets at a relatively low risk charge. If the rationale for this simpler measure is that there is uncertainty about our measures of risk, shouldn't we be working to build a better set of risk weights?⁶ Or, using standard statistical methods, isn't the right answer to raise existing capital requirements by a factor representing the limits of our precision?

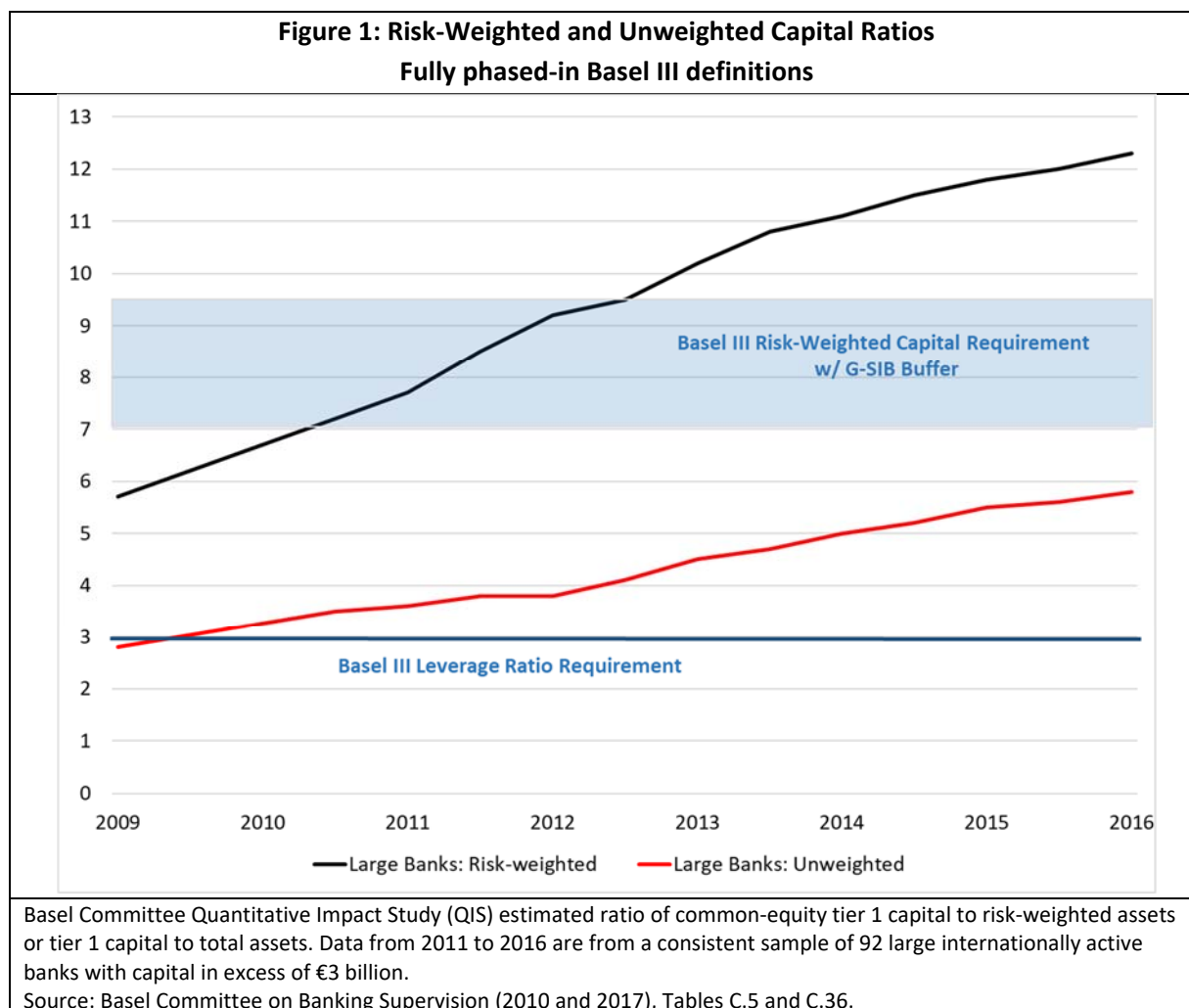
Table 1: Comparing Basel III and Basel II Risk-weighted Capital Requirements for the Largest Systemic Banks: Impact of Basel III Capital Definition	
Basel III range	8% to 10%
Basel II Baseline	4%
Adjustment for hybrid capital	-2%
Adjustment for goodwill, intangibles, deferred tax assets, etc.	-1%
Adjustment for changes in risk weights	-¼%
Effective Basel II converted to a Basel III basis	< ¾%
Source: Basel Committee on Banking Supervision (2010) and authors' calculations.	

⁴ See the discussion in Cecchetti and Schoenholtz (2015a).

⁵ For U.S. banks, this ratio is generally in the range of 1.5 to 2.0. For others, such as those in Sweden, it can be as high as four. See Sveriges Riskbank (2015).

⁶ See Schnabl (2017).

Turning to some details about the reforms, in 2010, the Group of Governors and Heads of Supervision, the oversight body of the Basel Committee on Banking Supervision (BCBS), endorsed a sharp rise in capital requirements (Basel III) compared to abysmal pre-crisis standards (Basel II).⁷ Basel III, which applies to internationally active banks, requires capital of 8% to 10% of risk-weighted assets for the largest systemic banks. Using the tighter Basel III definition of capital, we estimate that the effective pre-crisis Basel II requirement was less than ¼% of risk-weighted assets (see Table 1 above)!



So, when policymakers say things like “[t]he system is safer because banks are now much more resilient, with capital requirements for the largest global banks that are ten times higher than before the crisis”⁸, they should be understood in this perspective. That is, because the earlier definition of capital was so lax, the risk coverage so inadequate, and the belief in public bailouts so pervasive, banks financed themselves virtually without equity prior to the change.

Not only have requirements gone up, capital levels have, too. According to the BCBS’s quantitative impact assessments, from the end of 2009 to the end of 2016, capital ratios based on the new stricter

⁷ The press release is available at <https://www.bis.org/press/p100912.htm>.

⁸ See Carney (2017).

definitions have risen significantly. The numbers in Figure 1 are striking. Since end-2009, capital (as measured by *common equity tier 1*, the most effective loss absorber of the various capital categories) has risen by 6.6 percentage points of risk-weighted assets for the largest banks in the world. Furthermore, not only do end-2016 risk-weighted capital ratios on average clearly exceed those that Basel III requires for 2019, but there are virtually no banks in the sample that have capital shortfalls on this measure relative to the fully-phased in requirements.

On average, banks worldwide have much more capital than they did before the crisis on both a risk-weighted and an unweighted basis. But, is it enough? Or, as some (like the U.S. Treasury) have argued, have we gone too far, and the requirements are now a drag on growth?⁹

Taking the second question first, there is virtually no evidence that higher capital requirements have reduced either lending or real growth. In fact, quite the opposite: strong banks lend to healthy borrowers, weak banks do not. The evidence is three-fold. First, those countries with better capitalized banking systems in 2006, prior to the start of the crisis, experienced stronger lending growth during and after the crisis.¹⁰ That is, higher capital did not slow the economy. Second, Gambacorta and Shin (2016) established that better capitalized banks experience lower funding costs, higher growth of debt funding, and higher growth of lending volumes. And third, there is the evidence from Japan and Europe. Caballero, Hoshi, and Kashyap (2008) describe how, in the 1990s, regulatory forbearance delayed a thorough recapitalization of Japan's banks for more than a decade. Consequently, undercapitalized banks made loans to keep insolvent borrowers afloat. In their study of the impact of the ECB's recent actions, Acharya et al. (2016) conclude that accommodative monetary policy had a similar impact. That is, weakly capitalized euro-area banks had an incentive to evergreen loans to "low-quality" firms.¹¹

The conclusion that higher capital requirements improve the health of the economy—both for the resilience of the system and for quality of lending—leads immediately to the question of whether the required level is high enough. Here there are clearly differences of view. At one extreme, narrow banking advocates call for depository institutions to finance anything but riskless assets with 100% equity capital. Others, like Nobel Prize winner Eugene Fama, have called for equity capital of up to 50%.¹² Admati and Hellwig (2013) argue that banks should operate with equity capital of 20% to 30% of their total assets, unadjusted for risk. The work of Dagher et al. (2016), as well as the Minneapolis Plan of the Federal Reserve Bank of Minneapolis (2017), suggest levels somewhat below this—that is, an unweighted leverage ratio in the range of 15%—but still far above the current regulatory minimum.¹³

Our interpretation of requirements for additional long-term debt that can be converted into equity—*total loss absorbing capacity* (TLAC) and *Minimum Requirement for Own Funds and Eligible Liabilities* (MREL)—is that everyone knows the capital requirements are insufficient. That is, the probability of a shock that would wipe out a bank's net worth is high enough, and the social impact large enough, that

⁹ See U.S. Treasury (2017a), p. 6.

¹⁰ See Cecchetti and Schoenholtz (2014b).

¹¹ For a more detailed discussion, see Cecchetti and Schoenholtz (2016d).

¹² See Hebner (2013).

¹³ For a discussion of the costs and benefits of increases in bank capital see the discussions in Cecchetti and Schoenholtz (2016b and 2016c) and the recent survey in Haldane (2017).

authorities felt the need to impose a greater self-insurance requirement.¹⁴ Considered in combination, capital and TLAC result in a buffer that is over 20% of risk-weighted assets. Given that total assets are often more than twice risk-weighted assets, and in some cases considerably more, this still seems inadequate. And, as the Minneapolis Plan emphasizes, it remains questionable whether policymakers will bail in TLAC debt in a crisis, casting doubt on the time consistency of TLAC as a means to limit too big to fail.

We are the first to admit that we do not know the optimal level of equity capital requirements. But, our judgment is that it is far above current levels, and could be as high as the proposal in the Minneapolis Plan. Given this, we believe that policymakers can move capital requirements gradually higher (relying primarily on retained profits) until they observe one of two negative consequences: meaningful constraints on the supply of credit that cannot be offset by modest adjustments in monetary policy; or a migration of intermediation outside of the regulatory perimeter that increases, rather than reduces, systemic risk. In the absence of these distortions, capital requirements can safely be raised with limited social cost.

3. Liquidity

Charles Goodhart (2011) reports that the original intention was for the Basel Capital Accord to have a sibling: a liquidity accord. It did not.¹⁵ As a result, banks became overly dependent on a combination of central bank liquidity and short-term wholesale funding. Their assets were insufficiently liquid relative to their liabilities, something that became painfully apparent at the onset of the crisis.

Over the course of the past decade, the Basel Committee has responded with the development of two liquidity requirements. The first, the liquidity coverage ratio (LCR), is aimed at ensuring a sufficient quantity of liquid assets; and the second, the net stable funding ratio (NSFR), aims at controlling the level of maturity transformation. We will briefly describe each of these.¹⁶

To help understand the LCR, it is useful to start with a quote from the agreed international standard itself:¹⁷

“The objective of the LCR is to promote the short-term resilience of the liquidity risk profile of banks. It does this by ensuring that banks have an adequate stock of unencumbered¹⁸ high-quality liquid assets (HQLA) that can be converted easily and immediately in private markets into cash to meet their liquidity needs for a 30 calendar day liquidity stress scenario. The LCR will improve the banking sector’s ability to absorb shocks arising from

¹⁴ For a description of TLAC, see Financial Stability Board (2015).

¹⁵ This is not true of individual jurisdictions, nearly all of which had reserve requirements, and a number of which had liquidity requirements as well. For example, from 1951 to 1971, U.K. clearing banks were required to hold liquid assets equivalent to 28% of deposits (see Davies and Richardson (2010)).

¹⁶ While we do not do it explicitly here, we can think of all of the capital and liquidity requirements as obligating banks to hold a weighted average of assets plus off-balance sheet exposures that is either greater than or less than a weighted average of liabilities. The requirements differ in their weighting schemes and on the direction of the inequality.

¹⁷ Basel Committee on Banking Supervision (2013a).

¹⁸ The term *unencumbered* means that the assets are not pledged as collateral for a loan.

financial and economic stress, whatever the source, thus reducing the risk of spillover from the financial sector to the real economy.”

Reading this, we can see that the idea behind the LCR is to compel banks to hold an amount of liquid assets (like U.S. Treasury securities) that it can easily sell to meet the deposit outflows and the takedown of loan commitments that might occur during a crisis. The goal is to ensure that banks can meet their obligations without relying on fire sales of their illiquid assets—something that has a negative impact on everyone else—or on borrowing from the central bank. That is, the central bank should be the lender of *last resort*, not the lender of *first resort*.¹⁹

Turning to the NSFR, again we quote from the rules text:²⁰

“The NSFR will require banks to maintain a stable funding profile in relation to the composition of their assets and off-balance sheet activities. A sustainable funding structure is intended to reduce the likelihood that disruptions to a bank’s regular sources of funding will erode its liquidity position in a way that would increase the risk of its failure and potentially lead to broader systemic stress. The NSFR limits overreliance on short-term wholesale funding, encourages better assessment of funding risk across all on- and off-balance sheet items, and promotes funding stability.”

The purpose of the NSFR is to limit the degree of this maturity mismatch, requiring banks with long-term assets to have long-term liabilities, and only allowing those with short-term assets to issue short-term liabilities. Again, the details of the computation are complex, but the idea is simple: banks should not do what they did prior to the crisis, which was to rely on short-term funding to support large volumes of long-maturity assets.

In looking at these, it is natural to ask why we need *two* liquidity requirements, rather than one. For capital, as we saw earlier, the answer is that the leverage ratio and the risk-weighted capital ratio bind at different times and on different types of banks. Is the same true of the LCR and the NSFR? Almost surely not.²¹

To see why the two requirements are likely to be redundant, start with a simple example. Assume that we are looking at a bank with assets that are either liquid or illiquid and liabilities that are either runnable or stable. Assume also that there are no off-balance sheet exposures.

¹⁹ For a discussion of the economics of liquidity regulation, especially its relationship to central bank lending, see Stein (2013).

²⁰ Basel Committee on Banking Supervisions (2014b).

²¹ The remainder of this section, which considers the form of liquidity regulation embodied in Basel III, draws on Cecchetti and Kashyap (forthcoming). For a discussion of optimal liquidity regulation, see Diamond and Kashyap (2016).

In this simple case, the bank's balance sheet looks like this:

Figure 2: Simple Bank Balance Sheet	
Assets (A)	Liabilities (L)
<i>Liquid</i>	<i>Runnable</i>
<i>Illiquid</i>	<i>Stable</i>

Each of these assets and liabilities corresponds to a category in the one of the two regulations. Liquid assets are the high-quality liquid assets (HQLA)—primarily central bank deposits and short-term domestic sovereigns—in the LCR. Illiquid assets are the long-term loans and securities that require stable funding in the NSFR. Runnable liabilities are the funding sources that generate outflows for the LCR. And, finally, stable liabilities are the available stable funding in the NSFRs.

In this simple case, the two liquidity requirements look like this:

$$LCR: \quad Liquid \geq Runnable \Rightarrow Liquid - Runnable \geq 0$$

$$NSFR: \quad Stable \geq Illiquid \Rightarrow Stable - Illiquid \geq 0$$

Now, note that the bank also has a balance sheet identity. This means:

$$\begin{aligned} \text{Balance Sheet Identity: } Liquid + Illiquid &= Runnable + Stable \\ &\Rightarrow Liquid - Runnable = Stable - Illiquid \end{aligned}$$

From this, we can see that, in this very simple case, the two requirements are the same!²²

Obviously, the assumptions needed to reach this conclusion are not very realistic. First, we cannot easily partition a bank's balance sheet into the four categories in Figure 2. There are assets that are neither HQLA nor fully require stable funding, and there are liabilities that neither generate outflows as defined by the LCR nor qualify as stable funding. An example of the first is a full-recourse mortgage, which has a risk weight of 35%: this is not HQLA but has a required stable funding factor of only 0.65. An example of the second is an unsecured wholesale funding with maturity between 1 and 12 months: this has a zero outflow weight in the LCR and an available stable funding weight in the NSFR between 0 and 50%. Furthermore, banks hold off-balance sheet exposures relevant for both requirements.

To accommodate this, consider a general balance sheet:

Figure 3: General Bank Balance Sheet	
Assets (A)	Liabilities (L)
<i>Liquid (H)</i>	<i>Runnable (R)</i>
<i>Illiquid (I)</i>	<i>Stable (S)</i>
<i>Other Assets (OA)</i>	<i>Other Liabilities (OL)</i>

In addition, assume that banks have off-balance sheet exposures that affect both the LCR and the NSFR. Call these OBS_L and OBS_N .

²² Vives (2014) makes a similar point. See his footnote 16.

In this general case the requirements are

$$(1) \text{ LCR: } H \geq R + OBS_L$$

$$(2) \text{ NSFR: } S \geq I + OBS_N$$

Using the balance sheet identity, and rearranging terms, we can rewrite these as inequalities where the requirement holds when liquid assets (H) less runnable liabilities (R) is greater than some quantity. The result is the following:

$$(3) \text{ LCR: } H - R \geq OBS_L$$

$$(4) \text{ NSFR: } H - R \geq OBS_N + (OL - OA)$$

That is, the LCR binds if (3) holds, and the NSFR binds if (4) holds.

Looking further, we see that (3) implies (4) if:

$$(5) \text{ } OBS_L > OBS_N + (OL - OA) \Rightarrow OBS_L + OA > OBS_N + OL$$

That is, when (5) holds, then a bank that meets the LCR also meets the NSFR. And, the converse is true as well: if (5) does not hold, then a bank that meets the NSFR, necessarily meets the LCR.

Looking at some examples, we can see the more likely case is the first of these: $\text{LCR} \rightarrow \text{NSFR}$. For a mortgage bank or a retail bank, OA tends to be large since they hold a relatively large quantity of low-risk loan assets, and OL tends to be small since they have very little wholesale funding. For universal and investment banks, while there is wholesale funding with maturity between one and twelve months, they provide lines of credit that result in large OBS_L .

To be bound by the NSFR, instead of the LCR, requires that a bank have a large quantity of long-term assets with relatively high-risk weights that are funded by unsecured wholesale borrowing. This seems unlikely.

This exercise leads to the critical conclusion that if a bank meets the LCR, then it is very likely the bank will meet the NSFR. This assessment is consistent with the evidence in the BCBS quantitative impact study for end-2016: of the 105 largest global banks (those with tier 1 capital in excess of €3 billion), 91% met the fully phased-in LCR and 94% meet the fully phased-in NSFR.²³

Put differently, a given LCR—with its definitions for HQLA, run-off rates, and treatment of off-balance sheet exposure—implies a shadow NSFR. So, for example, the more rigorous the LCR's definition of HQLA—the fewer items qualify—the more expansive the implied required stable funding factors in the shadow NSFR. Moreover, the higher the run-off rates on liabilities in the LCR, the lower the level of implied available stable funding in the shadow NSFR.

The practical implication of this complementarity is profound. It means that we really only need one liquidity requirement, and it should be the LCR. If there is concern that the shadow NSFR is overly lax,

²³ See Basel Committee on Banking Supervision (2017) Graph 6, page 8.

allowing too much short-term wholesale funding of long-term illiquid assets, then there is a simple fix: increase the horizon of the LCR from 30 days, with run-off rates that slowly decrease.²⁴

4. Resolution

In a market-based capitalist system, the opportunity to succeed is also the opportunity to fail. For example, new restaurants come and go at a fast pace. Half of restaurants fail within their first five years of existence.²⁵ If your favorite restaurant closes suddenly, you can simply shift to another one relatively easily. In principle, banks should be no different from restaurants: new ones should open and unpopular ones close. For small banks, this is largely the case. In fact, over the past decade, the FDIC has closed 526 banks, of which fully 90 percent had assets of less than \$1.5 billion.²⁶

The challenge is *not* to manage the failure of small banks, or even medium-sized ones. It is to create a mechanism for the resolution of large banks, especially ones that are complex, opaque, highly interconnected, and operate in a range of national jurisdictions. That is, we need a way to ensure that the owners, bondholders, and managers of global systemically important financial intermediaries internalize the spillover costs that their risk-taking imposes on the financial system as a whole. The discussion, then, focuses on a relatively small set of very large institutions. With a threshold of \$250 billion in current assets, for example, this would mean 13 U.S. financial holding companies; worldwide, the number is fewer than 100.²⁷

Both U.S. and European authorities have made significant changes in the regulatory and legal frameworks in an effort to make it possible to resolve such large entities. These include the introduction of living wills and the creation of temporary government backstops for debtor-in-possession financing. In addition, the U.S. Congress is working on an improved bankruptcy procedure that could usefully supplement, but not substitute for, the Orderly Liquidation Authority established by the Dodd-Frank Act.²⁸

But the most important change, in our view, is the dramatic increase in loss-absorbing capital. The equity component will certainly reduce the impact of failure when it occurs. To the extent that TLAC is

²⁴ Properly designed liquidity regulation would allow the stock of liquid assets to be readily usable without stigma. Such a design avoids the problem highlighted by Goodhart (2007). One possibility is to define high quality liquid assets so narrowly that they are in systemic shortage, forcing the central bank to be the marginal supplier of HQLA through a committed liquidity facility (with an associated ex ante fee) analogous to the one used by the Reserve Bank of Australia. See <https://www.rba.gov.au/media-releases/2011/mr-11-25.html> <https://www.rba.gov.au/media-releases/2011/mr-11-25.html>.

²⁵ See Tian and Stark (2014).

²⁶ Only three failed banks had assets in excess of \$15 billion: Colonial Bank (\$25 billion), IndyMac (\$32 billion) and Washington Mutual (\$307 billion). The data are available at <https://www5.fdic.gov/hsob/SelectRpt.asp?EntryTyp=30>.

²⁷ S&P Global currently lists 88 banks with assets in excess of \$250 billion. See <https://marketintelligence.spglobal.com/our-thinking/ideas/ranking-the-world-s-100-largest-banks>.

²⁸ See Cecchetti and Schoenholtz (2017a).

credible, the ability to convert bonds into equity either before or during resolution also makes the system safer.²⁹

To be sure, there is plenty of work to be done. For example, living wills should be reconceived as devices to instruct regulators how to implement a speedy, virtually automatic recapitalization of failed systemic intermediaries.³⁰ If these *phoenix plan* components of living wills were widely publicized—rather than confidential as living wills currently are—they could usefully influence the market risk assessment and credit rating of TLAC debt. To the extent that TLAC debt is viewed by market participants as a close substitute to equity, its credibility as a loss absorber and its disciplining impact on systemic risk-taking would be enhanced. But critically, for us to expect that TLAC will be converted into equity amid a crisis, there must be restrictions on who is allowed to hold it. Specifically, ownership should be restricted to sophisticated, long-only investors. Should leveraged institutions or retail investors be allowed to own these bonds, doubts about eventual conversion will undermine the disciplining role of TLAC.³¹

To conclude this brief section, resolution reforms have come a long way, but (as the Minneapolis Plan argues) they have not solved the too-big-to-fail problem. Moreover, since the current resolution system remains untested, it is difficult to know how well it will work.³² When a large bank fails, what will happen to its TLAC bondholders? Will politicians allow the resolution authorities to impose losses on domestic creditors? If the losses affect leveraged intermediaries, what will be the impact on the supply of credit? If converted to equity, will TLAC debt be sufficient to cover losses and provide sufficient going-concern capital? Will authorities ring-fence the capital of foreign subsidiaries in their jurisdictions? How will the burden of resolving internationally active institutions be apportioned across borders?

Ultimately, if the resolution regime is not clearly workable—that is, sufficiently credible to impose market discipline today—then the remedy will be to require the most systemic institutions to substantially increase the share of risky assets financed with equity and (thereby) further reduce the probability of insolvency.³³

²⁹ The enhancement of resolution frameworks worldwide has been spurred, at least in part, by the Financial Stability Board's release of the [Key Attributes of Effective Resolution Regimes](#), which sets out new international standards for the resolution of distressed financial institutions.

³⁰ See Cecchetti and Schoenholtz (2014a).

³¹ There is a heated ongoing discussion about the reliability of the bail-in mechanisms that TLAC is intended to facilitate. See Goodhart (2010) and Goodhart and Avgouleas (2015) for critical discussions.

³² For a comprehensive discussion of the current state of the debate on bank resolution, see Tucker (2014).

³³ In essence, this is the solution in the Federal Reserve Bank of Minneapolis's (2017) Minneapolis Plan.

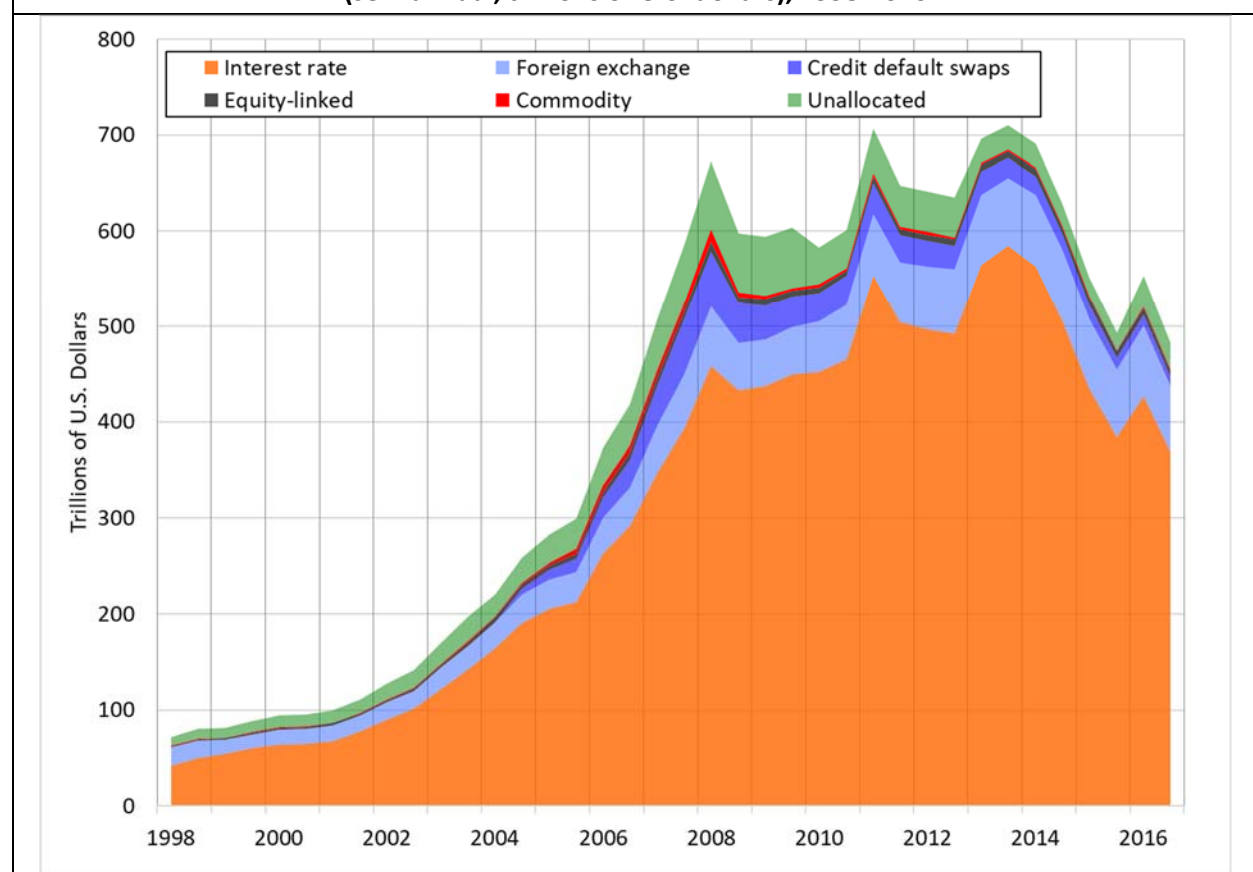
5. Central Clearing

Acknowledging the role that the derivatives market played in the 2007-2009 financial crisis, at their summit in September 2009, the [leaders of the G-20 agreed](#) that:

“All standardized OTC derivative contracts should be traded on exchanges or electronic trading platforms, where appropriate, and cleared through central counterparties by end-2012 at the latest.”

To understand the enormity of this task, start with a few numbers.³⁴ The chart below shows the gross notional amounts outstanding of over-the-counter (OTC) derivatives. Three points are worth noting. First, since 2013, the reported outstanding volume has fallen by more than \$200 trillion to \$480 trillion. After adjusting for double counting, we conclude that the amount outstanding has fallen by roughly half. Second, the two largest categories—interest rate swaps and foreign exchange derivatives—account for over 90 percent of the total. Third, while this is not in the chart, the vast majority of these two categories is denominated in either U.S. dollars or euros.

**Figure 4: Gross Notional Value of OTC Derivatives Outstanding
(semiannual, trillions of U.S. dollars), 1998-2016**



Source: [BIS Semiannual derivatives statistics](#).

³⁴ This section is draws on Cecchetti and Schoenholtz (2016a and 2017c).

The AIG case focused everyone's attention on the systemic risks arising from OTC trading. By end-June 2008, AIG's London-based Financial Products Group had taken on \$446 billion in notional credit risk exposure as a seller of credit risk protection via credit default swaps (CDS). These positions, which were largely unhedged and uncollateralized, concentrated credit risk in a financial institution that did not have the cash to meet crisis-related margin calls. Because the transactions were bilateral and OTC, no single counterparty could observe the aggregate risk concentration and charge a commensurate risk premium (say, in the form of a heightened collateral requirement). Unlike LTCM, where the private sector provided the funds needed to resolve the crisis in 1998, with AIG, the Federal Reserve stepped in a decade later with an \$85 billion loan.

To understand the allure of central clearing, compare the crises associated with LTCM and AIG with what happened when Amaranth Advisors, a U.S.-based hedge fund failed in September 2006. As a consequence of a sudden move in natural gas prices, Amaranth lost two-thirds of its \$9 billion in assets under management within a few weeks and was liquidated. With the exception of its shareholders, most people watched with detachment. A key difference was that Amaranth's trades (in natural gas futures contracts) occurred on an organized exchange through a central clearing party (CCP), while LTCM and AIG each had thousands of bilateral OTC contracts.

Shifting OTC transactions to CCPs improves the resilience of the financial system in three important ways. First, it diminishes the linkages among intermediaries, so that a single default (aside from that of the CCP itself) is less likely to harm others.³⁵ Second, it facilitates the enforcement of collateral standards. Third, it makes risk concentrations transparent, thereby fostering appropriate risk premia and incentives.³⁶

Importantly, there has been notable progress in recent years in improving derivatives market infrastructure. In its [12th semi-annual progress report](#), the Financial Stability Board (FSB) reports that roughly 80% all interest rate and credit derivatives in the United States are now centrally cleared.³⁷ This is consistent with evidence from the BIS surveys that, from 2007 to 2016, the fraction of interest rate derivatives centrally cleared globally rose from 16% to 76%.³⁸ Note that interest rate derivatives accounted for nearly 80% of outstanding OTC contracts over the past decade.

Of course, central clearing is *not* a panacea.³⁹ The key concern is what happens to a CCP in a period of market stress: what if one fails?

Experience shows that [when a CCP fails, financial markets cease to function](#).⁴⁰ In the past, the geographic spillover of these collapses was limited by the size of the market or by the lack of cross-

³⁵ Financial Stability Board (2017), Figure 5, reports that trade compression currently eliminates well over \$100 trillion in gross notional value.

³⁶ Domanski, Gambacorta and Picillo's (2015) study of the 2007-09 crisis period concludes that the larger the portion of transactions in a particular jurisdiction that were centrally cleared, the less the damage to banks operating there.

³⁷ See Financial Stability Board (2017), Figure 4.

³⁸ See Schrimpf (2015), ISDA (2016) and the BIS semi-annual derivatives statistics.

³⁹ See Domanski, Gambacorta and Picillo's (2015) for a detailed discussion of the risks of central clearing.

⁴⁰ See Tucker (2013).

border financial integration.⁴¹ However, given the development of the global financial system since 1980, a failure today would have a much broader and more prominent impact.

As a result, the design of CCPs has been a principal focus of post-crisis regulatory reform. While this has not attracted the same attention as banking system reform, international authorities have been hard at work developing and promulgating principles to guide the functioning of these enormous financial intermediaries.⁴²

To be sure, there are now several safeguards in place. CCPs require collateral posting, they have prepaid guarantee funds, and they have their own capital buffers. In our view, however, the amounts are not all that large. For example, at the Chicago Mercantile Exchange, margin, the pre-paid guarantee fund, and the CME's own contribution are 0.5%, 0.02% and 0.0007% of notional gross open interest, respectively. It does not seem as if it would take an unprecedented market move to wipe this all out.

The vulnerability of CCPs (and other financial market utilities) has not escaped authorities. To manage systemic risk from these behemoths, supervisors have taken the obvious approach: stress testing.⁴³ Both the European Securities Market Authority and the Commodity Futures Trading Commission (CFTC) have conducted stress tests on CCPs, and the U.S. Treasury's October 2017 report on capital markets notes the need for appropriate risk management practices in financial market utilities more generally.⁴⁴

Focusing on one of these, the CFTC reported in 2016 the results of its first supervisory stress tests of clearinghouses. Included in the tests are the five entities—including two located in London—that account for 98 percent of futures and swap clearing registered in the United States.

To stress test the CCPs, the CFTC started by creating a set of 11 scenarios that include different combinations of volatility across markets. For each scenario, positions are marked-to-market. The CFTC test assumes that no clearing member can respond to a variation margin call, so a member defaults when the sum of its existing margin plus its contributions to the guarantee fund is exhausted. Supervisors then compute the number of member defaults that a clearinghouse can withstand before exhausting its resources, *without resorting to assessments*. The clearinghouses passed under two-thirds of the scenarios.⁴⁵

Should we be worried? How likely is it that a CCP will run out of resources? In that situation, what happens next? What will be the resolution and recovery mechanism for a failed CCP? Despite recent

⁴¹ The 1974 failure of the Paris commodities futures market described by Bignon and Vuillemeys (2016) is a case in point.

⁴² For the Committee on Payments and Market Infrastructure "Principles for Financial Market Infrastructure," see https://www.bis.org/cpmi/info_pfm.htm. For the Financial Stability Board's guidance, see <http://www.fsb.org/2017/02/guidance-on-central-counterparty-resolution-and-resolution-planning/>.

⁴³ For a discussion of CCP stress test, see Committee on Payments and Market Infrastructure (2017).

⁴⁴ See European Securities Markets Authority (2016), Commodity Futures Trading Commission (2016) and U.S. Treasury (2017b). In October 2017, the CFTC published a follow-up study regarding the funding liquidity of stressed CCPs.

⁴⁵ We have been unable to find disclosures by the CFTC or by the clearinghouses of the detailed results—for example, which clearinghouses passed which tests and by how much.

closer oversight of CCPs by key regulators, we still do not have adequate answers to these questions.⁴⁶ Considering the lack of short-run substitutability for key CCPs, the policy challenge is to ensure a virtually instant recovery.

6. Systemic Regulation

To understand the need for systemic regulation—what many people call *macroprudential regulation*—we need to start with a description of the properties of financial stability more generally.⁴⁷ Following Tucker (2015), it is useful to think of financial stability as a *tragedy of the commons* analogous to grazing on public lands or fishing in public waters. In such a circumstance, agents have an incentive to do things that degrade the environment for everyone else.

To be specific, since financial stability is based on a common resource, the resilience of the system is non-excludable but rival. That is, if the financial system is stable, no one can be kept from enjoying the benefits. They are a public good. Importantly, however, firms can act in ways that reduce the resilience of the system. Just as a farmer has the incentive to overgraze his or her cows, letting them eat until the public green becomes bare, an actor in the financial system has an incentive to behave in ways that deplete its resilience and so put others at risk. This is a classic externality in which private and social incentives diverge.

In the case of the financial system, institutions can sometimes deplete the resilience outside of the public view through their *hidden actions* (a form of moral hazard). For example, given the inherent opacity of their exposures, large, complex intermediaries may be riskier than they outwardly appear. In the case of a bank, owners and managers succumb to moral hazard due to a combination of limited liability, the government safety net, and authorities' past tendency to bail out insolvent firms. Again, as a result of opacity, spillovers from a single bank failure can lead to a system-wide panic: the generalized balance sheet shrinkage that follows is the source of fire sales and credit crunches. These are the externalities that macroprudential regulation is designed to address.⁴⁸

The prudential policy toolkit to discourage systemic risk-taking and promote resilience has a vast array of elements. These include tools aimed at borrowers, lenders and markets. For most of the tools, there is steady-state calibration and then the potential for time-variation. We have discussed the first of these in early parts of this essay, so here we will focus on the second: *dynamic macroprudential policy*. And, in this discussion, we will focus on policies aimed primarily at banks. These include countercyclical capital surcharges, adjustments of sectoral risk weights, loan-to-value limits (both for households and for firms), restrictions on foreign exchange lending, concentration limits, and stress tests.⁴⁹

⁴⁶ As Cœuré (2017) notes, large CCPs operate in a wide range of currencies and across borders, implying a need for international cooperation among central banks and regulators.

⁴⁷ This discussion draws on Cecchetti and Tucker's (2016) discussion of the need for international coordination in the construction of macroprudential policy. For a model-based treatment, see Agénor, Kharroubi, Gambacorta, Lombardo and Pereira da Silva (2017).

⁴⁸ See Hanson, Kashyap, and Stein (2011) for a discussion of the externalities that provide a theoretical basis for broad-based capital and liquidity regulation.

⁴⁹ For a discussion of macroprudential tools see Committee on the Global Financial System (2010).

We begin by emphasizing that the adjustment of macroprudential tools is not primarily about managing the credit cycle or about leaning against asset-price bubbles. The focus is on maintaining resilience—assuring that the financial system can absorb shocks to prices of various assets without undermining the core financial services necessary to maintain economic activity. We doubt that economic policymakers and researchers have sufficient knowledge to fine-tune credit or asset-price cycles using macroprudential tools.

In this view, stress tests are the most important component of macroprudential policy in common use today. Modern stress testing builds on the U.S. experience during the crisis. In late 2008, the solvency of the largest American intermediaries was in doubt. That uncertainty made their own managers cautious about taking risk and it made potential investors, creditors, and customers wary of doing business with them. Those doubts contributed to the extreme fragility in many financial markets, leading to a virtual collapse of unsecured finance. The May 2009 publication of stress test results for the 19 largest U.S. banks constituted a key part of the remedy. The tests evaluated, on a common basis, the prospective capital needs of these firms in light of the deep recession that was far advanced. While observers questioned whether the tests were stringent enough—the ‘stress’ scenario quickly turned into the central forecast—the results were sufficient to reassure the government, market participants, and the banks themselves that most of the institutions were in fact solvent. And, armed with the stress test evidence of their wellbeing, most large banks could attract new private capital for the first time since the Lehman failure the previous September.

Stress tests remain the most powerful prudential tools available for safeguarding the resilience of the financial system. In their purest form, they take seriously the fact that when a large common shock hits, there is no one in the private sector to sell assets to or raise capital from. Ensuring that each individual institution can withstand significant stress raises the likelihood that the system can survive. And, importantly, by adjusting the scenarios, authorities can maintain a chosen level of resilience. At least in principle, stress tests can both account for changes in the distribution of the shocks that hit the system and limit the amplification potential of the propagation mechanism. They also may reveal otherwise hidden information about the firms and the work of supervisors.

Even so, macroprudential policy faces significant challenges.⁵⁰ The first is that there is no agreed-upon yardstick for evaluating systemic resilience. That is, unlike monetary policy, where we have had measures of inflation, output and unemployment for a century, we have no consensus about the metrics and the accompanying threat assessments on which financial stability policymakers should base their decisions (and be held accountable).⁵¹ Second, the models that link macroprudential tools to objectives remain in their infancy. Third, there is no clear best practice in organizational structure and governance. Should financial stability policymakers be inside the central bank? How independent should they be? And fourth, there is the issue of international coordination. Given the global nature of the financial

⁵⁰ For a broad discussion of the design of a financial stability policy framework, see Tucker (2016).

⁵¹ See Berner (forthcoming).

system, it is difficult to see how any individual jurisdiction can proceed to ensure the resilience of its own financial system without cross-border coordination.⁵²

To understand this last point, keep in mind that financial stability policy is fundamentally different from monetary policy. When a monetary policy authority announces its periodic policy decision, the incremental information revealed about the state of the economy is small. By contrast, in announcing a policy decision, a macroprudential policymaker reveals private information about the condition of the financial system.

The implication is maintaining resilience requires international coordination. To see why, consider the following example described in Cecchetti and Tucker (2016). The authorities in country A announce that they are taking action because of concern about the riskiness of their financial system's exposures to a business sector that operates globally—say, the energy sector. Suppose, in addition, that the financial system of country B is known to be even more exposed to the energy sector than country A's. And, further, assume country A's financial system is heavily exposed to country B's financial system. In those circumstances, the authorities of country A might find it in their own self-interest to communicate to the authorities of country B about the actions they were planning to take, with a view to seeing whether country B might take action, too. If not, the authorities of country A might impose on their financial institutions a higher capital requirement against exposures to country B's financial institutions.

Where does this leave us? The answer is not encouraging. We have not yet settled on metrics, tools, governance, or the management of cross-border spillovers. The latter also poses a big time-consistency problem: how can governments credibly commit their successors to cooperate in a future crisis when their short-run interests may diverge? If we are to be successful in designing and implementing an effective financial stability policy framework, addressing these deficiencies must be high on the agenda.

7. Unfinished business

The financial crisis began in mid-2007, so we have now passed the 10th anniversary. In that time, thousands of people have been hard at work providing research aimed at changing the way we think about the financial system, creating new domestic and international institutions, and calibrating and implementing a broad array of new regulations. As a result, the system is clearly safer and more resilient. Is it resilient enough?

Answering this question requires that we first admit the existence of a tradeoff. Following World War II, for several decades, the advanced-economy financial system was safe: outside of the emerging world, there were no financial crises. Yet, as Gorton (2012) describes in detail, this “quiet period” had a cost: the financial system was subject to extensive government control, and was surely very inefficient.

Have we chosen the right point on the tradeoff between safety and efficiency? We doubt it. It is not even clear that we are on the efficient frontier: that is, we can probably make the system safer without diminishing its efficiency (or vice versa).

⁵² This is an example of the *financial trilemma*. See Cecchetti and Schoenholtz (2017b).

With respect to financial intermediation, we need to do two things. First, we need to raise capital requirements further. In our view, within the range that we are discussing, this has virtually no social costs. In this range, as we described earlier, better capitalized banks lend more, not less. Consequently, it is concerning that the U.S. Treasury, which had been a leading proponent for enhancing the resilience of the global financial system after the crisis, now voices support for “recalibrating” U.S. capital requirements where they exceed international standards.⁵³

Of course, when bankers say that capital is expensive, they are telling the truth. That is, they are accurately reporting the *private* costs associated with a shift from subsidized debt to equity finance (including the increased financing cost associated with a decline in the value of the implicit government backstop). But, the private costs typically exceed the social costs, reflecting the reduction in taxpayer support, as well as the potential for a safer absorption of undiversifiable risk elsewhere in the financial system.

Second, to be sure, as we raise capital requirements on banks, we need to anticipate the potential for regulatory arbitrage that shifts systemic risk without reducing it. To address this problem, as well as a number of structural changes brought on by technological innovations, we need to change our approach to regulation. Instead of focusing on a firm’s *legal form*—whether it be a bank, an insurance company, an asset management firm, or whatever—we need regulation by *economic function or activity*. That is, we need to treat the transformation of liquidity, credit and maturity—the key functions of banking—in a similar way regardless of the institutions performing that service. In the United States, that will require streamlining the regulatory system.⁵⁴

On liquidity regulation, we only need one tool, not two. Given that the LCR has already been implemented, the focus should be there. If there are perceived deficiencies, they can be remedied by adjusting its terms.

Turning to resolution, there remains considerable work to do. As it currently stands, we doubt that the most systemic global institutions can be efficiently resolved in a crisis without severely damaging the system.

The shift of OTC derivatives to CCPs appears to be proceeding relatively smoothly.⁵⁵ But, as that shift occurs, CCPs are becoming even larger and more systemic. At this writing, it is doubtful that sufficient safeguards are in place to mitigate the fallout from the insolvency of one of these behemoths.

Finally, there is systemic regulation. Here, we have emphasized the poor state of our framework. It is tempting to say that we are at the same stage of development that monetary policy frameworks were half a century ago, except for worse. Back in 1960, we had consumer price measures, national income accounts, and useful labor market indicators. Once researchers developed analytical models of the

⁵³ See U.S. Treasury (2017a).

⁵⁴ See Cecchetti and Schoenholtz (2015b).

⁵⁵ We would be remiss if we did not mention the challenge posed by the desire to shift euro-denominated transactions out of London. As the Bank of England’s Financial Policy Committee mentioned in the record of their September 2017 meeting, tens of thousands of counterparties will be affected, representing notional value that could total £20 trillion. See [here](#).

economy and an understanding of time consistency, it was a small conceptual step to central bank independence and inflation targeting. But all of that still took over 30 years. Hopefully, we can go faster this time.

In closing, we note a series of concerns about our current approach to regulation and how it is influencing the financial system. First, by placing such a large number of complex constraints on intermediaries' activities, we may be pushing them to become more and more similar. To understand why this is likely to happen, note that, at least initially, some institutions are bound by different sets of regulatory constraints. Wanting to expand their businesses, each grows in the direction of a slack constraint. In the end, this will drive intermediaries to be the same. To the extent that regulation makes the financial system more homogenous, it creates, rather than reduces, systemic risk.

Our final concern is about fragmentation in the absence of international cooperation.⁵⁶ A short anecdote helps make the point. In July 2010, at the meeting to finalize the Basel III framework, there was a large sticking point. Some members of the Basel Committee were standing firm on their desire to have higher capital requirements. Others felt that this would make credit more expensive and less plentiful. Had agreement not been reached, those insisting on more capital might have said: "Go ahead, be lax. But if you let your banks operate with low levels of capital, we'll restrict our banks from doing business with them." Fortunately, it didn't come to that, and the national authorities were able to reach an agreement. Like other international agreements on issues ranging from arms control to the environment, this required a level of mutual trust, backed by some ability to monitor (verify) performance.

This is a good thing, because without a common prudential standard, the global financial system would balkanize and fragment, diminishing both global growth prospects and opportunities for risk-sharing among residents of different countries. Absent enlightened leadership and extensive cooperation among the countries with the largest financial systems, fragmentation will remain a large risk.

⁵⁶ See Cecchetti and Schoenholtz (2017b).

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