

Pitfalls of Global Harmonization of Systemic Risk Regulation in a World of Financial
Innovation*

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Abstract

The working hypothesis of international financial regulation is that regulation should be globally harmonized. This paper contends, to the contrary, that we should be wary about the efficacy of global harmonization, and in particular, harmonization of systemic risk measurement and regulation. The thesis is informed by what I consider two key lessons from the recent global financial crisis. The first lesson is that, when business strategies that internationally-harmonized regulation induces banks to follow go seriously awry, the adverse consequences will spread globally and not be limited to one regulator's domain. The second lesson is that, innovations in financial technology that have been engines of prosperity across the globe also may contain the seeds of financial calamity with imprudent use and regulatory inattention. In addition, three kinds of uncertainty operate in this context: i) uncertainty regarding how best to define and measure systemic risk; (ii), dynamic uncertainty, that financial institutions respond to regulation in unpredictable ways that tend to undermine regulatory effectiveness; and (iii) radical uncertainty, that we do not know all possible future states of the financial system and therefore cannot compute the probabilities of outcomes that would be necessary for informing rules regarding systemic risk measures. The uncertainty in the regulatory context, in conjunction with the lessons from the crisis, suggest that a value-added international regulatory strategy would foster at least a modicum of diversity across national regulatory regimes, along with periodic updating of global standards. At the national level, they suggest adopting a dual-pronged regulatory approach that focuses regulators' attention on monitoring developments in short-term debt markets, leverage levels, and the impact of new financial products and services, as well as on promoting experimentation, to better inform regulatory decisionmaking

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A working hypothesis of international financial regulation, whether it be capital requirements or, as is the focus of this conference, systemic risk – “the risk that instability in the financial system will cause a recession or otherwise significantly impair the real economy”¹-- is that regulation should be globally harmonized. This chapter contends instead that we should be wary about mechanically assuming the efficacy of global harmonization, and in particular, harmonization of systemic risk measurement and regulation. My argument is informed by what I consider two key lessons from the recent global financial crisis. The first lesson is that, when internationally harmonized regulation incentivizes banks to follow similar business strategies that go seriously awry, the adverse consequences spread globally and are not limited to one regulator’s domain. In other words, harmonization can amplify, rather than dampen, systemic risk, which is particularly troubling when we are operating more or less in the dark.

The second lesson cautioning against harmonization of systemic risk regulation stems from the relation between crises and financial innovation. Innovations in financial technology that have been engines of prosperity across the globe also contain the seeds of financial calamity with imprudent use. This double-edged phenomenon poses an acute threat to regulatory efficacy. First, regulation that may have been effective when adopted can become counterproductive, if not toxic, as the economic environment changes, with, for example, the introduction of new financial products.² Second, and relatedly, regulation must be attentively updated to retain its efficacy in light of the dynamism in financial markets, yet the necessary updating is exceedingly challenging when regulation has been harmonized worldwide, as it requires the participation of numerous nations. I illustrate this by discussing the cumbersome process for revising the Basel Accords, which set the international standards for financial regulation.

These lessons indicate that it would have been beneficial to have had regulatory diversity in capital requirements during the recent financial crisis. These lessons, in my judgment, are equally applicable to systemic risk regulation, particularly given limits to our knowledge of how

¹ Steven L. Schwarcz, “Securing Financial Stability: Systemic Regulation of Systemic Risk” 2019:1 Wis. L. Rev. (forthcoming); online: <https://ssrn.com/abstract=3233666>, at 2.

² Cf. Steven L. Schwarcz, “Regulating Financial Change: A Functional Approach,” 100 Minn. L. Rev. 1441, 1443-44 (2016) (observing that “the pre-crisis financial regulatory network, which assumed the dominance of bank-intermediated funding, failed to adequately address a collapsing financial system in which the majority of funding had become non-bank intermediated”).

to measure systemic risk.

My contention is not that regulatory diversity in international financial regulation would eliminate all financial crises or be accompanied solely by advantages with no drawbacks. Rather, my contention is that these lessons suggest that the benefits of diversity could well outweigh the cost, and that efforts to achieve global harmonization in financial regulation – as opposed to cross-border coordination by regulators in the supervision, support or sanctioning of multinational banks-- should proceed with humility and caution. Financial regulation need not be harmonized for regulators to coordinate supervisory or enforcement efforts. The absence of global harmonization of securities regulation has not, for instance, prevented regulators’ implementing numerous memoranda of understanding, facilitating cross-border coordination.

1. The Global Financial Crisis of 2008-09

The case for introducing diversity into global systemic risk regulation is best conveyed by the lessons that should have been learned from the recent global financial crisis and its relation to globally harmonized capital requirements. In order to provide a context for understanding what happened and how it relates to regulatory harmonization, the analysis begins with a thumbnail sketch of Gary Gorton’s canonical explanation of the trigger of the recent crisis, which, in subsequent co-authored work, he has maintained is true of past financial crises in the United States as well: a run in short term funding markets.³

A core function of the banking sector is maturity transformation, by which financial institutions borrow short term through issuing retail deposits and lend long term to corporations or individuals for business investment or acquisition of property. Starting in the decades before the global financial crisis, many financial institutions met their short term funding needs by borrowing in wholesale or institutional markets, that are referred to as the shadow banking sector, as they perform the identical intermediation function as the regulated banking sector but are not subject to banking regulation. Accordingly, the shadow banking system was largely under the radar of regulators. Given shadow banking’s unregulated status, the Federal Reserve Bank did not collect information on the sector pre-crisis (apart from the segment related to

³ Gary B. Gorton, *Slapped by the Invisible Hand: The Panic of 2007* (New York: Oxford University Press, 2010) (trigger of recent global financial crisis); Gary B. Gorton and Ellis W. Tallman, *Fighting Financial Crises: Learning from the Past* (Chicago: University of Chicago Press, 2018) (characterizing panics in short term debt markets as trigger of all financial crises, from examination of crises in the United States in the nineteenth and twentieth centuries).

dealers in U.S. Treasury securities), and we therefore cannot generate an accurate estimate of its pre-crisis size. It was, however, quite large: for example, traditional banking liabilities were \$14 trillion in 2007, while the gross size of shadow banking liabilities at its peak in June 2007 was approximately \$22 trillion (although the appropriate comparison would be to net shadow banking liabilities, which cannot be estimated).⁴

Banking, in a nutshell, evolved dramatically over the last decades of the twentieth century as banks encountered increasing competition by nonbanks on both the asset and liability sides: businesses were able to raise debt financing more cheaply by issuing junk bonds in capital markets than by borrowing from a bank; and depositors could earn a higher return without increasing their risk by shifting savings from bank accounts into money market funds.⁵ Banks responded to the deterioration in their competitive position by entering into new lines of business, the most important of which was securitization, by which banks moved assets (corporate loans) off their balance sheets by selling interests in portfolios of the assets to investors. A further factor in the evolution of banking was deregulation, whose objective was, at least in part, to enable banks to compete more easily.⁶ As Gorton notes, we do not know “for sure” why securitization arose,⁷ but one factor in its increasing use was that it enabled banks to avoid costly capital requirements that were geared to assets that were retained on balance sheets.⁸ This use of securitization correspondingly increased banks’ leverage and thereby increased risk in the banking system.

My more specific point, however, concerns securitization and regulatory harmonization. The capital requirements set by the Basel Accords made securitized assets an advantageous form of capital for banks to hold. The worldwide harmonization of those requirements greatly increased both domestic and foreign bank demand for those assets, which in turn increased risk in the global banking system.⁹ Furthermore, as next explained, that increased demand

⁴ Zoltan Pozsar, et al., “Shadow Banking” (2013) 19:2 FRBNY Econ. Policy Review 1 at 6.

⁵ Gorton, *supra* note 3, at 38.

⁶ *Ibid.*

⁷ *Ibid* at 40.

⁸ See parts 3 and 4, *infra*.

⁹ For example, close to half of the sponsors of the \$1.2 trillion worth of asset-backed commercial paper (ABCP) conduits outstanding as of January 2007, just prior to the global financial crisis, were non-U.S. financial institutions, and of the \$714 billion (74%) of ABCP funded in U.S. dollars and sponsored by commercial banks, more than half (\$412 billion) was sponsored by

stimulated the growth of the even riskier subprime securitization market.

There are two primary funding mechanisms in the shadow banking sector: repos (sale and repurchase agreements) and asset-backed commercial paper (ABCP). Both of these mechanisms are secured by collateral and depend on maturity transformation. They are the markets whose collapse triggered the global financial crisis.

In a repo transaction, a financial institution, such as a commercial or investment bank that seeks to borrow funds, sells a security and agrees to repurchase it from the buyer at a later date at a higher price, which reflects interest charged for the use of the cash. If the borrowing financial institution cannot repay the loan (i.e., cannot repurchase the security at the agreed-upon price), then the lender keeps the security. Although these transactions are short term contracts in which the repurchase is often set to take place the next day, the expectation is that the agreement will be rolled over indefinitely.

In the repo market's initial years, transactions were collateralized by U.S. Treasury securities; but as the market grew in the mid-2000s, the range of acceptable collateral expanded to include residential mortgage-backed securities (RMBSs), a type of securitized asset whose payout is a function of the interest and principal collected on an underlying pool of mortgage loans.¹⁰ By the mid-2000s, these underlying mortgage loans included subprime mortgages. Although the subprime borrowers had poor credit, the expectation was that increases in housing prices would enable the borrowers to refinance to be able to make payment. Furthermore, only the more senior priority RMBS were deemed acceptable, and the securities were structured to be oversecured (i.e., the projected income stream from the underlying mortgages was greater than the promised payouts to investors).

Gorton's analysis of the operation of the shadow banking system has two key insights that are central for understanding the financial crisis. First, institutional investors' transactions in repo can be characterized as paralleling retail investors' bank deposits: the investment grade designation of the RMBS collateral functioned equivalently to deposit insurance, while the feature of repo agreements that did not require contracts to roll over was the functional

non-U.S. banks. Viral A. Acharya & Philipp Schnabl, "Do Global Banks Spread Global Imbalances? Asset-Backed Commercial Paper during the Financial Crisis of 2007-09" (2010) 1:1 IMF Economic Review 37 at 48, 55 (tables 3 and 4).

¹⁰ Gorton, *supra* note 3, at 43.

equivalent to the ability to withdraw bank deposits on demand.¹¹ Accordingly, the shadow banking system can be characterized as “resembl[ing] the pre-FDIC U.S. banking system.”¹²

Second, Gorton emphasizes that a critical feature of the short-term fixed income securities that financial institutions issue as debt (RMBSs used as collateral in the repo market and demand deposits in the commercial banking sector) is their “information-insensitivity,” that is, the repo collateral’s AAA rating (or deposit insurance) enables a lender to not have to investigate the creditworthiness of the financial institution that is its counterparty.¹³ The purchaser of an information-insensitive security does not need to be concerned about asymmetric information, that the issuer knows more about the value of the security than the buyer, in contrast to the purchaser of equity securities, which are information-sensitive. Although RMBSs are not riskless compared to federally-insured bank deposits, the securities are designed so that, just as bank depositors, institutional investors can avoid expending time and effort on due diligence, with investment-grade collateral paralleling the deposit insurance fund as a guarantee of exit without loss of investment.

The ABCP market functioned similarly to the repo market. Financial institutions issued short-term commercial paper, which was rated investment-grade, and used the proceeds to purchase long-term assets, typically RMBS. The maturing commercial paper either would be rolled over or repaid from collections on the RMBS.

Following an uptick in the default rate of U.S. subprime mortgage loans, a panic ensued in the shadow banking sector, preventing the rollover of repos¹⁴ and commercial paper.¹⁵ The drying up of these markets was due to asymmetric information regarding the quality of the assets securing the debt: investors were unable to ascertain the extent of defaulting subprime mortgages held by borrowing institutions (i.e., their counterparties) and comprising their collateral. What had been information-insensitive assets almost overnight became information-sensitive, transforming liquid claims into illiquid ones, and creating a panic, as institutional investors, increasingly apprehensive over the quality of their collateral (whose value they were

¹¹ Ibid at 45.

¹² Ibid.

¹³ Ibid at 19-23.

¹⁴ Ibid at 45-51.

¹⁵ Daniel Covitz, Nellie Liang & Gustavo A. Suarez, “The Evolution of a Financial Crisis: Collapse of the Asset-Backed Commercial Paper Market” (2013) 68:3 J. Fin. 81.

not equipped to determine), began refusing to rollover the debt. As a consequence, financial institutions that had borrowed in the repo and ABCP markets were unable to replace the withdrawn capital and were forced to de-lever on a massive scale, selling assets at fire sale prices.

Caught in a downward spiral of selling assets into a market with collapsing prices, even banks not selling assets had to mark down their value to fire-sale market prices under mark-to-market accounting rules, and that resulted in banks further having either to increase capital or sell assets. The fire sales fed back into investors' reluctance to lend at any price, as they could no longer be assured of the value of the collateral, and what began as a liquidity crisis morphed into a solvency one. As panic set in, investor apprehension over subprime mortgages spilled over into other securitized asset markets that had experienced no similar signs of borrower distress, such as automobile loans and credit card receivables.¹⁶ Outside of the shadow banking sector, banks also financed themselves by borrowing in the interbank market, that is, from each other. That short-term funding market froze as well in the panic, because banks were as uncertain as repo investors of their counterparty banks' exposure, and hence of their creditworthiness.

As Gorton explains, the run on repo was similar to the frequent bank runs of the prior century in the period known as the National Banking Era, in which a shock to the system regarding adverse economic information caused investors to panic.¹⁷ The analogue in the recent crisis was a shock to the system that indicated that housing prices had declined, rather than risen, in 2007, which led investors to no longer rollover repos and ABCP, the functional equivalent of depositors' withdrawals in historical bank runs following shocks indicating a spike in the liabilities of failed businesses.¹⁸ And the source of investor panic was analogous: a lack of knowledge of which financial institutions had significant exposure to subprime in 2007-08 parallels lack of knowledge of which banks would fail in the National Banking Era panics. As former Governor of the Bank of England Mervyn King puts it, economic shocks (i.e., new information about economic conditions) change the narratives by which individuals make sense

¹⁶ Gorton, *supra* note 3, at 47, 51.

¹⁷ *Ibid* at 47.

¹⁸ *Ibid* at 32, 52.

of an uncertain economic reality, which creates abrupt shifts in behavior.¹⁹

While the panic Gorton describes began in the U.S. subprime mortgage market, it was transmitted worldwide both because domestic and foreign banks were incentivized to hold RMBS written on those subprime assets by Basel capital requirements and because investors feared that nations that had experienced housing bubbles similar to that of the U.S. would encounter similar banking system failures.²⁰

2. Financial Crises in Relation to Financial Innovation

William Goetzmann's masterly history of finance provides the second key insight for situating the lessons to be learned from the recent crisis for international financial regulation, the dynamism of financial products and markets. Defining finance as the means by which economic value is shifted over time, Goetzmann illustrates the importance of finance's dynamism in which innovations in financial technology, from simple loans to more complex lending agreements and shares of stock or partnerships, led to the development of civilization and economic progress by enabling urbanization, industrialization and the democratization of enterprise (as financial contracts enable individuals with ideas but without resources to implement their ideas).²¹ It is a glorious history. But Goetzmann also emphasizes that throughout recorded history, there is a

¹⁹ Mervyn King, *The End of Alchemy* (New York: W.W. Norton, 2016) at 135-36, 316-17. Nicola Gennaioli and Andrei Shleifer provide an explanation of the financial crisis that may seem similar to King's, as they contend that investors had been overly optimistic and neglectful of the possibility of a significant decline in housing prices (i.e., neglectful of "tail risk"), and when these "errors in beliefs" were eventually corrected, the financial system exploded. Nicola Gennaioli & Andrei Shleifer, *A Crisis of Beliefs* (Princeton, NJ: Princeton Univ. Press 2018). But King's analysis does not require, and indeed rejects, irrational beliefs to explain the sudden shift in investor behavior, explaining it, instead, as "attempts to behave rationally in a world of radical uncertainty." King, *supra*, at 308. Gennaioli and Shleifer further contend that their analysis differs from Gorton's, by explaining the collapse of short-term funding markets as a fire sale rather than bank run, because the drop in housing prices and hence RMBSs' value could have been predicted well before the crisis began, yet were not. Gennaioli & Shleifer, *supra*, at 72-73, 76-77. The distinction does not affect this chapter's analysis, as it focuses on the shadow banking sector's being the locus of ignition of the financial crisis, a fact upon which Gorton and Gennaioli and Shleifer agree

²⁰ Beyond the global crisis related to the use of RMBSs as collateral in short-term debt markets, the European Union experienced a further financial crisis in sovereign debt surrounding fears of a Greek default, a situation also affected importantly by incentives created by Basel requirements. See note 30, *infra*.

²¹ William N. Goetzmann, *Money Changes Everything* (Princeton, NJ: Princeton University Press, 2016).

recurring cycle in finance, the bursts of innovation spurring entrepreneurial advances and prosperity, are often followed by financial collapse.

Financial innovations often disrupt settled social and economic arrangements, creating new winners and losers. What precipitates financial crises from such disruptive innovations, in Goetzmann's narrative, however, is innovations being taken beyond the bounds of prudence. Human nature as we know it often leads individuals to embrace with an overabundance of enthusiasm new financial products, generating pricing bubbles that can burst with severe economic consequences. That is because pricing bubbles go hand in glove with increasing systemic leverage, which is a precursor of financial crises.²² Goetzmann's thesis is not that all financial crises are caused by imprudent uses of novel financial technologies nor that such excesses are the sole cause of a crisis, but the more modest proposition that financial innovations contain the seeds of potential financial crises.

Goetzmann refers to the pattern that he describes as a "duality in the nature of finance."²³ Financial innovation creates a fragile equilibrium, in which financial technology can lead to some of humankind's greatest achievements as well as severest failures. Implicit in his perspective is the suggestion that fragility in a financial system cannot be eliminated as it is inherent in the means by which civilizations achieve economic growth and hence improve social welfare. It would therefore be reckless for regulators to take elimination of fragility in the

²² Carmen M. Reinhart & Kenneth S. Rogoff, *This Time Is Different: Eight Centuries of Financial Folly* (Princeton, NJ: Princeton University Press, 2009), at xxxiii, 217-20. John Geanakoplos makes a further contribution, identifying as key to understanding the pattern of financial crises, a "leverage cycle": a boom and bust in the availability of credit, measured by the amount of collateral lenders require, and corresponding rising and falling asset prices. E.g., John Geanakoplos, "The Leverage Cycle," in Daron Acemoglu, Kenneth Rogoff & Michael Woodford, eds., *24 NBER Macroeconomics Annual 2009* (Chicago: Univ. of Chicago Press, 2010) 1 at 2-3. The tightening of credit, forcing deleveraging at the tail end of the leverage cycle that Geanakoplos elucidates, leads to asset price declines and the collapse of highly leveraged institutions, whether or not the assets at issue were financial innovations. Geanakoplos does associate financial innovation with boom and bust cycles but in his narrative, the innovation responsible for the boom is different from the innovation responsible for the bust (e.g., he identifies RMBSs and credit default swaps as the innovations affecting the boom and bust sides, respectively, of the 2008-09 global financial crisis). In Goetzmann's narrative, the innovation sparking the boom is also responsible for the bust (e.g., securitized subprime mortgages in the recent crisis).

²³ Goetzmann, *supra* note 21, at 519.

financial system as a sole objective.²⁴ Rather, the duality in finance would seem to be better served by a more measured and efficacious goal of crafting a regulatory regime that has the capacity both to recognize and react when a new financial technology is veering toward perilous rather than beneficial use, characteristics that, as the recent financial crisis made apparent, are not features of the international regulatory system that we currently have.

3. First Lesson: Harmonized International Financial Regulation and the Global Financial Crisis

The first lesson from the recent global financial crisis involves the relation, which is not often fully acknowledged in accounts of the crisis, between the crisis and international financial regulation. Namely, because international financial regulation is premised on harmonizing capital requirements across internationally active banks, when such regulation goes wrong, banks worldwide will have been incentivized to follow correlated business strategies, and as a consequence, their actions increase systemic risk. In other words, financial difficulties that start in a few banks could spark contagion that crosses borders, setting off a global conflagration. In the most recent crisis, international regulation incentivised banks to invest heavily in the financial products at the fore of the shadow banking markets that, in Gorton's analysis, triggered the crisis.

Global capital standards were established in 1988 by the Basel Committee on Banking Supervision, a unit of the Bank for International Settlements, currently consisting of central bankers and supervisors of 28 jurisdictions, including the G-20 nations. The key feature of the Basel accords is the imposition of risk-weighted capital requirements, by which banks must

²⁴ Cf. Iman Anabtawi & Steven L. Schwarcz, "Regulating *Ex Post*: How Law Can Address the Inevitability of Financial Failure," 92 *Tex. L. Rev.* 75 (2013) (arguing that as a result of the inevitability of financial change and our failure to fully understand human behavior, systemic collapses may be inevitable; therefore, financial regulation should be designed to work not only *ex ante*, to try to prevent those collapses, but also *ex post* to try to mitigate their harmful consequences). The fragility inherent in a financial system due to innovation differs from fragility due to interconnections among financial institutions which transmit shocks across firms (i.e., contagion) because that type of fragility could presumably be reduced, albeit not entirely eliminated, by altering those institutional relationships, whereas the fragility Goetzmann analyzes cannot be eliminated because it is intrinsic to finance. E.g., Andrew Haldane, "Rethinking the Financial Network" (2009) 53:2009 *BIS Rev.* 1, online: <https://www.bis.org/review/r090505e.pdf> (advocating altering organization of firms and markets to reduce transmission shocks that create fragility in a financial network).

have more equity capital, the greater the credit risk of the assets they hold. The rationales for establishing the international regime were to promote the stability of the international banking system and to equalize international banks' competitive positions by "leveling the playing field." While in the abstract, an internationally harmonized regime of risk-weighted capital requirements might seem sensible for realizing the Committee's goals – it sets a minimum capital amount that takes into account a bank's risk and is thought thereby to foster stability and create a level playing field -- in practice it has turned out to be anything but straightforward, no doubt, in no small part because in establishing the standards, influential nations have not sought simply to devise the most economically efficient rules but have sought to advance their own social and political objectives. For instance, the definition of core capital includes intangible assets that featured prominently in the balance sheets of some nations' banks with otherwise little justification for being so included as they are not as robust a measure of capital as equity -- deferred tax assets (Japanese banks), mortgage servicing rights (U.S. banks) and minority interests in other financial institutions (French and German banks).²⁵

Prior to the global financial crisis, the Basel capital requirement was set at 8 percent. Under the standardized risk weights system of the first accord, corporate loans, deemed the riskiest asset, were assessed at the highest weight of 100 percent whereas government bonds were characterized as risk-free with a weight of 0 percent.²⁶ Accordingly, were a bank to make a

²⁵ When Basel III sought to tighten the definition, the three items were retained but limited to the identical percentage of capital, so that those nations could protect their "national champions" from having to hold higher capital. Roberta Romano, "For Diversity in the International Regulation of Financial Institutions: Critiquing and Recalibrating the Basel Architecture" (2014) 31:1 Yale. J. Reg. 1 at 22.

²⁶ In addition, under Basel I, ABCP issuances were not subject to any capital requirements given the structure that removed the mortgages from banks' balance sheets, while the banks' guarantees of those issuances required less than 20 percent of capital, compared to what would be required were the loans held on the banks' balance sheets. Viral V. Acharya & Philipp Schnabl, "How Banks Played the Leverage Game," in Viral V. Acharya & Matthew Richardson, eds., *Restoring Financial Stability: How to Repair a Failed System* (New York: John Wiley & Sons, 2009) 83.

A second accord, Basel II, adopted in 2005, replaced the standardized risk weights for the largest banks with an internal model approach to risk weights, under which banks computed capital by engaging in a value-at-risk (VaR) analysis of their assets, subject to parameters set by Basel and regulators' approval. That approach did not alter the assessed relative riskiness of assets, i.e., banks' internal models assessed corporate loans as riskier than residential mortgages or government securities, nor did it eliminate the preference for ABCP and related guarantees.

\$1000 loan to a business, it had to hold \$80 in capital assets (at least half of which were to be common stock), but no capital was needed were it to invest the \$1000 in a U.S. Treasury note. The key feature of the system of risk weights for appreciating the financial crisis is that residential mortgages were preferenced over corporate loans, being assigned a risk weight of only 50 percent, so that \$1000 loaned to a homeowner required only \$40 in capital. More important, mortgage-backed securities of investment grade were assigned an even lower risk weight, as the Basel accords incorporated credit ratings into the weights, such that a bank holding \$1000 in investment-grade RMBSs needed to hold only \$16 in capital.²⁷ To illustrate the preference more starkly, a bank could use the \$40 in capital required for a directly-held mortgage of \$1000 to invest in \$2500 worth of securitized mortgages.

It should not, then, come as a surprise that banks held securitized mortgages, whose purchases they financed through repos and ABCP. These assets ended up on banks' balance sheets in two ways: warehousing in a dealer function or as investments. Commercial and investment banks that sponsored securitizations would buy mortgages, create securitized assets, and hold them until they could be sold to investors. The purchases and consequently expanded balance sheets required financing, which the banks obtained in the repo market. Banks also bought the securitized assets for investment purposes.

What is most critical to observe, albeit surprisingly often omitted from analyses of the crisis, is that, although some of the large U.S. firms that failed, such as Bear Stearns and Lehman Brothers, were not commercial banks, banks, on average, not only held more RMBSs, but their holdings were also more concentrated in those assets, than any other financial sector, be it

But the internal models approach resulted in banks' needing less capital than required under standardized risk weights, as, for example, VaR models take account of correlations across assets.

In the aftermath of the global financial crisis, the Accords were further revised (in Basel 2.5 and Basel III), but the revisions, which increased the capital required, did not alter the centrality of risk-weighted capital, nor the preferential weighting of residential mortgages.

²⁷ Permitting the incorporation of credit ratings to determine risk under Basel II in both internal models and the standardized approach was intended to align risk weights more closely with credit risk. Although the U.S. was only transitioning to Basel II at the onset of the financial crisis, it had separately promulgated a rule allowing banks to rely on credit ratings for the capital required against securitized assets. Romano, *supra* note 25, at 15 n. 38. The examples in the text simplify Basel's structure of two tiers of capital to facilitate the exposition.

insurance companies, pension funds, mutual funds, or hedge funds.²⁸ In addition, the large non-U.S. financial institutions that failed were Basel-regulated banks.²⁹ The most plausible explanation of this pattern is that institutions that were not incentivized by Basel capital requirements to hold RMBSs did not consider them a good investment, given their risk/return characteristics and the alternatives. In short, financial institutions operating under Basel were incentivized to hold the assets whose implosion set the global financial crisis in motion.³⁰

Moreover, global banks' standard use of VaR analysis as mandated or encouraged by regulators to manage risk, further exacerbated the crisis: As securitized asset prices fell, the VaR analyses led banks that had been incentivized to hold similar assets simultaneously to sell them, compounding the frenzied fire sales in the repo and ABCP markets.³¹ And because the regulatory regime was internationally harmonized, the collapse of those U.S. markets had devastating global repercussions. This is not to say that all globally harmonized regulation is likely to magnify systemic risk. Capital regulation that is independent of banks' business strategies, such as a simple leverage ratio, would not incentivize banks to engage in similar activity and asset-holding; hence, were a specific strategy or asset class to fail, under such regulation, it would be less likely that institutions worldwide would fail, as occurred in the global financial crisis.

Accordingly, a financial crisis that might have been largely contained locally to U.S. banks

²⁸ See, e.g., Jeffrey Friedman, "Capitalism and the Crisis: Bankers, Bonuses, Ideology and Ignorance," in Jeffrey Friedman, ed., *What Caused the Financial Crisis?* (Philadelphia, PA: Univ. Pennsylvania Press, 2011) 1 at 48.

²⁹ See, e.g., Tamin Bayoumi, *Unfinished Business* New Haven, CT: Yale Univ. Press, 2017) at 186.

³⁰ A similar phenomenon contributed to the E.U.'s sovereign debt crisis, given Basel's preferencing of such debt. E.g., Romano, *supra* note 25, at 18-19. Ashoka Mody adds that contributing to the E.U.'s sovereign debt crisis was the weak condition of E.U. banks following the subprime mortgage financial crisis because neither the European Central Bank nor national governments acted decisively to shore up their banks, as did the Fed, and yet those banks were in worse condition, having been more leveraged pre-crisis than U.S. banks, given i) limited opportunities for profitable investing due to low Eurozone productivity leading to greater risk-taking and ii) operating under the lower capital requirements of Basel II while U.S. banks were still operating under Basel I and they were subject to a (non-risk-weighted) leverage ratio. Ashoka Mody, *Euro Tragedy A Drama in Nine Acts* (New York: Oxford Univ. Press, 2018) at 166-72, 226-27, 231.

³¹ See Charles K. Whitehead, "Destructive Coordination" (2011) 96:2 Cornell L. Rev. 323 at 343-50.

operating in subprime markets, became global in scope as banks worldwide were incentivized by Basel requirements to hold similar investments. The contention is not that banks would have followed totally dissimilar business strategies had there not been globally harmonized capital requirements favoring RMBSs. There may well be herding in financial markets independent of regulatory inducement. For instance, managers may have an incentive to imitate the strategy of others, on the rationale that if the strategy turns out to be mistaken, then all firms will do poorly simultaneously and that will shield a manager from being penalized by investors for underperformance, as poor performance cannot be readily attributed to a particular individual when all banks perform similarly poorly. Furthermore, the incentive to herd is said to be even more powerful for bank managers, for it is thought to increase the probability that a bank will be bailed out. The rationale is that although the government might be willing to let one bank fail, it would certainly not permit all or most banks to go under given the perceived dire consequences.³² But even if banks' pre-crisis behavior were to fit into such a framework, the Basel Accords' preferencing of particular assets would have facilitated herding, by providing banks with a focal point upon which assets to coordinate strategies. And as such focal points for herding will be on assets requiring the least capital, if those assets' value declines sharply, the financial system can swerve toward illiquidity followed by insolvency, as occurred in the global financial crisis.³³

4. Second Lesson: Financial Innovation, International Financial Regulation and the Global Financial Crisis

The interaction of the Basel Accords with the financial crisis trigger as characterized by Gorton can be linked to Goetzmann's comprehensive historical narrative of the dual role of financial innovation throughout recorded history. Although the decision to assign low risk weights to residential mortgages has a political dimension, to support government policies

³² For the contention that herding allows banks to increase the probability that they will be bailed out, see, e.g., Viral V. Acharya & Tanjo Yorulmazer, "Too Many to Fail-An Analysis of Time-Inconsistency in Bank Closure Policies" (2007) 16:1 J. Fin. Intermediation 1.

³³ Cf. Daniel Schwarcz & Steven L. Schwarcz, *Regulating Systemic Risk in Insurance*, 81 U. CHI. L. REV. 1569, 1602 (2014) (citations omitted) (discussing how harmonized regulation could prompt insurance companies to engage in widespread coordinated forced selling of downgraded (or about-to-be downgraded) corporate bonds, creating fire sales in the bond market that could trigger systemic risk).

encouraging home ownership of influential Basel Committee members who feared that otherwise their large domestic banks would reduce their mortgage financing to what might be politically unacceptable levels,³⁴ there was at the outset a plausible economic rationale for treating those mortgages as less risky than loans to corporations. When Basel I was drafted in the 1980s, residential mortgages were available to individuals with prime credit ratings and had high value to loan ratios. Although mortgages were favored in the assignment of risk weights to ensure government policies encouraging homeownership would not be adversely affected by capital requirements,³⁵ at the time, the probability of residential mortgages' repayment would have been appropriately perceived as higher than that of loans made to small businesses, justifying a lower risk weight.

But by the mid-2000s, the financial innovation of securitization that permitted the creation of RMBSs facilitated a further financial innovation, subprime mortgages, which enabled low credit individuals to borrow to buy residences, through a loan structure built not upon the borrower's ability to pay but upon the appreciation in the home's value over a short period of time, that would then become collateral for a new mortgage (with the low credit borrower now having equity in the house), or cash extracted for consumption.³⁶ Subprime mortgages were not only made to individuals who were poor credit risks, but they also had extremely high loan to value ratios. These were therefore inherently high risk securities. And this innovation facilitated a buildup of leverage in the financial system, with a predictable soaring of housing prices.

Despite the increased risk, RMBSs issued on pools containing subprime mortgages received the identical investment grade rating from credit rating agencies as did those written on pools of prime mortgages, for they replicated the same waterfall structure of priorities of payment and oversecured collateral. As a consequence, Basel's risk-weighting of the residential mortgage and investment grade RMBS asset classes was creating a dangerous buildup of risk in the banking sector. For, as earlier noted, lower risk weights provided banks with an incentive to hold subprime mortgages and securities issued upon pools containing such mortgages, because they produced a higher return, given the greater risk, while requiring no more capital than what would

³⁴ E.g., Richard J. Herring & Robert E. Litan, *Financial Regulation in the Global Economy* (Washington, D.C.: Brookings Institution, 1995) at 109.

³⁵ *Ibid.*

³⁶ For a comprehensive explanation of the extent of innovation in the structure of subprime mortgages and the RMBSs written on those mortgages, see Gorton, *supra* note 3, at 63, 74 and ff.

be required for holding lower yielding prime mortgages. And as the earlier numerical example illustrated, the lower risk weights accorded securitized assets over direct mortgages, facilitated banks' increasing leverage. The embracing of the innovation of the securitized subprime mortgages that factor crucially in Gorton's analysis of the recent financial crisis dovetails with Goetzmann's thesis that enthusiasm over a financial innovation can fuel a crisis.

These financial innovations did not spur regulators to reevaluate the capital requirements for subprime mortgages and the securitized assets derived from them, perhaps because they were lulled by the experience from 1998 to 2006 when subprime mortgages worked as expected, as housing prices rose and borrowers repaid mortgages rapidly and refinanced their debt,³⁷ a regulatory attitude that might have been compounded by knowledge of how cumbersome it would be to revise international standards, given the need for consensus among numerous nations. That is not to say that U.S. regulators could not have acted on their own to increase the capital required for U.S. banks to hold subprime mortgages or RMBSs, as they had always imposed a leverage ratio in addition to the international requirements. But reining in bank lending would have been contrary to government policy, supported across the political spectrum, of expanding home ownership to lower income individuals³⁸ and a large number of mortgages were made by nonbanks (specialized mortgage companies regulated by states). In addition, there was no consensus among central bankers and economists over whether a central bank should take action to "lean against the wind" so as to proactively burst bubbles as opposed to mopping up the damage after they burst (particularly given the daunting difficulty of identifying bubbles), and the legacy of the Greenspan Fed was a "mopping-up" approach that was perceived to have been successful.³⁹

³⁷ Ibid at 81.

³⁸ See, e.g., Ben S. Bernanke, *The Courage to Act: A Memoir of a Crisis and Its Aftermath* (New York: W.W.Norton, 2015) at 102 (regulators were concerned about restricting subprime mortgages, even though they were aware of trends of deteriorating credit, because they were viewed as an "antidote to redlining." that is, as a means of democratizing credit so that low-income minorities would be able to buy homes). Gennaioli and Shleifer characterize this as an example of the behavioral phenomenon, neglect of tail risk. Gennaioli & Shleifer, *supra* note 19.

³⁹ For instance, in the late 1990s, Fed Chairman Alan Greenspan favored a "clean-up" approach, and thus the internet stock bubble burst on his watch, a subject of criticism for not having acting pre-emptively. E.g., Alan Greenspan, Testimony Before the U.S. House of Representatives Committee on Banking and Financial Services (July 22, 1999) online: <https://www.federalreserve.gov/boarddocs/hh/1999/July/testimony.htm> (commenting on bubble

Even when the Federal Reserve Bank took note of the rise in the rate of subprime mortgage defaults, it did not perceive this to be a source of concern because those mortgages comprised an extremely small piece of the housing market and overall economy.⁴⁰ As former Fed Chairman Ben Bernanke reflected post-crisis, while regulators were aware of “pieces of the puzzle,” no one could “imagine” the full picture, and so they did not want to take any precipitous action.⁴¹ With hindsight that was a catastrophic error as subprime mortgages, which were a socially beneficial innovation by providing low credit individuals the opportunity to become homebuyers, led to an economic fiasco. The increasing enthusiasm of borrowers, banks, government agencies, and investors, respectively, to take up and issue such mortgages and purchase securities on them, fed into a housing bubble, which, as it burst, would spark a panic in the shadow banking markets with massive spillover effects for the broader global economy.

Gorton’s analysis of financial crises, focused on bank runs in short-term funding markets, provides an account of the triggering event in the recent crisis of subprime mortgage-backed securities’ loss of their information-insensitivity. Goetzmann’s broad historical perspective regarding the possible impact of financial innovation suggests that securitized subprime

bursting: “job of economic policymakers [is] to mitigate the fallout when it occurs”); “Monetary Myopia,” *Economist* (Jan. 12, 2006) (criticizing Greenspan’s approach in relation to the bursting of the internet stock bubble in the early 2000s). Prior to the financial crisis, positive assessments were offered of Greenspan’s approach, and it no doubt had a legacy effect within the Fed years later. E.g., Alan S. Blinder & Ricardo Reis, “Understanding the Greenspan Standard,” in Federal Reserve Bank of Kansas City, *The Greenspan Era: Lessons for the Future, Proceedings of the 2005 Jackson Hole Symposium* (Kansas City, MO: Federal Reserve Bank of Kansas City, 2005), at 11. The jury is still out, so to speak, on the issue, as the Swedish Central bank “leaned against the wind” in the 2010s, and the experience was mixed. E.g., “Tactic of ‘lean against the wind’ has failed Sweden,” *Fin. Times* (Oct. 29, 2014), online: <https://www.ft.com/content/9dfad56a-5f64-11e4-986c-00144feabdc0>; “Riksbank’s Jansson changes his mind on leaning against wind,” *Central Banking Newsdesk*. (Dec. 6, 2017), online: <https://www.centralbanking.com/central-banks/monetary-policy/communication/3333181/riksbanks-jansson-changes-his-mind-on-leaning-against-wind> (Deputy Governor of Sweden’s Central Bank says with “benefit of hindsight,” “leaning against the wind” policy was “not entirely successful”).

⁴⁰ Ben S. Bernanke, “The Subprime Mortgage Market” (May 17, 2007), online: <https://www.federalreserve.gov/newsevents/speech/bernanke20070517a.htm> (“[t]he effect of the troubles in the subprime sector on the broader housing market will likely be limited, and we do not expect significant spillovers from the subprime market to the rest of the economy or to the financial system.”)

⁴¹ Bernanke, *supra* note 38, at 82. He also subscribed to former Chairman Greenspan’s view that monetary policy should not be used to burst bubbles, and in defending that view in his memoir, notes the failure of the approach taken in Sweden. *Ibid* at 90.

mortgages would appear to be a poster child for his theme of duality in the nature of finance, and the propensity of investors to become overenthused with a new financial product. Linking the two analyses makes plain the economic perils when regulators fail to attend to how markets in innovative financial technologies, particularly short-term debt products, are evolving and to whether existing regulations are, contributing to a buildup of potentially unsustainable levels of leverage in the financial system.

5. Applying the Lessons to Systemic Risk Regulation

The lessons from the global financial crisis regarding the cost of regulatory error and the impact of financial innovation highlight the need to be wary about mechanically assuming the efficacy of harmonizing systemic risk measurement and regulation. There was much that smart, honest and diligent individuals at banks and regulatory agencies and in the academy did not know or understand regarding financial markets and products, and the interconnections across markets, institutions and products, such as the extent of the shadow banking sector and the workings of complex synthetic instruments derived from RMBSs, that affected the scope of the recent crisis. No doubt there is still much that is not known, and not knowable, as a fundamental characteristic of capitalist economies is what Mervyn King terms “radical uncertainty,” unknowable unknowns (future states for which we cannot assign a probability as we cannot imagine them in advance), that limit the ability of financial markets and products to manage uncertainty, and accordingly regulator’s ability to oversee them.⁴² Moreover, systemic risk regulation is a far dicier proposition than capital regulation, the harmonization of which contributed to the global crisis, because there is no straightforward generally accepted definition of systemic risk, nor method of measuring it. Accordingly, methods proposed to measure systemic risk vary with the definition employed (as proponents emphasize different aspects of systemic risk), and definitions are at times contradictory. This makes it extremely challenging to identify on what measure or set of measures regulators ought to focus attention.

For instance, a survey of systemic risk measures by the Office of Financial Research co-authored with prominent finance scholars identified ten definitions of systemic risk and thirty-one quantitative measures that had been advanced in the economics and finance literature.⁴³ And

⁴² King, *supra* note 19, at 9, 143-45.

⁴³ Dimitrios Bisias, et al., “A Survey of Systemic Risk Analytics” (2012) 4 *Annual Rev. Fin. Econ.* 255. Moreover, the authors note that their list of systemic risk measures was not

the list of proposed measures of systemic risk, which became an object of considerable research effort in the wake of the global financial crisis, is still mushrooming. Browsing the SSRN website for more recent research on “systemic risk measure” generated over 250 papers posted after the year of the survey’s publication (2012), including fifteen in the first half of 2018 alone. The survey’s authors put it well when they noted: “even if an exhaustive overview of the systemic risk literature were possible, it would likely be out of date as soon as it was written.”⁴⁴ In addition, with almost every new systemic risk measure, the creators provide data to support their contention that it is a more accurate predictor of crises than other measures.⁴⁵ Further, given the uncertainty inherent in financial markets, to fix one measure of systemic risk for regulatory purposes in a point of time would be foolhardy, for even if we could identify an optimal measure, no measure would remain optimal over time.

In particular, the introduction of new financial products can alter the correlations across institutions and products and correspondingly, the efficacy of extant measures of systemic risk. This is because proposed measures are derived from data regarding correlations between assets and institutional losses from the most recent financial crisis, and there is scant reason to have confidence that they will be effective in predicting where systemic risk might emerge out of sample (i.e., in the next crisis).⁴⁶ Systemic risk measures, in short, are subject to the same intractable difficulties that King ascribes to the Basel risk weights setting capital requirements: “it is extremely difficult, if not impossible, to judge how the riskiness of different assets will change in the future. The appropriate risk weights can change abruptly and suddenly, especially in a crisis.”⁴⁷ Finally, setting capital requirements in terms of a specific measure of how much a bank contributes to systemic risk, to the extent experience can be a guide, would have a similar effect as did the setting of relative risk weights: banks will be incentivized to develop methods

exhaustive, as they focused on measures that could be most easily estimated from available data. *Ibid* at 257.

⁴⁴ *Ibid* at 259.

⁴⁵ E.g., Stefan Giglio, Bryan Kelly & Seth Pruitt, “Systemic Risk and the Macroeconomy: An Empirical Evaluation” (2016) 119:3 *J. Fin. Econ.* 457 (constructing aggregate systemic risk index from 19 previously proposed measures that predicts macroeconomic shocks whereas none of the individual measures do so).

⁴⁶ Bisias, et al., *supra* note 43, at 259. This contention is supported by the experience of the Basel risk weights, for as King notes, in the crisis, mortgages ascribed low risk weights due to past data were anything but safe. King, *supra* note 19, at 138.

⁴⁷ *Ibid*.

of avoiding or reducing the effect through more clever and more complex products. Even if the new products have salutary economic effects, they will also create novel and largely unanticipated risk in the system, confounding the efficacy of measures of systemic risk developed for markets without such products and creating radical uncertainty, with a possible outcome that regulation will mistake where systemic risk truly lies and once again contribute to a financial crisis.

The behavioral phenomenon of institutions' responses confounding financial regulation has been characterized over the years in various ways by economists and social scientists. One version is known as Goodhart's law that, in a well-known paraphrasing, "when a measure becomes a target, it ceases to be a good measure."⁴⁸ The rational expectations approach to macroeconomics, most prominently expounded in the Lucas critique, provides a similar insight into the feedback loop between regulation and the regulated: in response to regulation, individuals take actions that enable them to continue to pursue their objectives, circumnavigating regulations intended to prevent that pursuit, thereby frustrating the implementation of regulatory policy.⁴⁹

The terrorism literature provides a still further gloss on the implementation conundrum of financial regulation: regulation directed at tail risk is confounded by what this literature terms "dynamic uncertainty."⁵⁰ It analyzes dynamic uncertainty as follows: although the occurrence of a natural disaster, such as an earthquake, is as remotely possible as a terrorist attack, because humans adapt their behavior in response to regulation, they can alter the risk of an event's occurrence in unanticipated ways, making it far more challenging, if not impossible, to predict the impact of regulation on terrorist attacks than in the natural disaster context. For instance,

⁴⁸ Marilyn Strahern, "Improving Ratings': Audit in the British University System" (1997) 5:3 *European Review* 305. Another expression of the phenomenon described by Goodhart's Law is known as Campbell's Law: "The more any quantitative social indicator is used for social decision-making, the more subject it will be to corruption pressures and the more apt it will be to distort and corrupt the social processes it is intended to monitor." Donald T. Campbell, "Assessing the impact of planned social change" (1979) 2:1 *Evaluation and Program Planning* 67 at 85.

⁴⁹ Robert Lucas, "Econometric Policy Evaluation: A Critique," in Karl Brunner & Allan H. Meltzer, eds., *The Phillips Curve and Labor Markets* (New York: American Elsevier Pub. Co., 1976) 19.

⁵⁰ Philip Auerswald et al., "The Challenge of Protecting Critical Infrastructure" (2005) 22:1 *Issues in Sci. and Tech*, 77 at 80.

regulation of housing codes to reduce the damage to property from an earthquake will not affect the probability of an earthquake occurring, but regulation regarding the carrying of potential weapons, such as box cutters, on board airplanes will surely reduce the probability of that threat recurring and instead increase the probability of an alternative, unanticipated future attack. While regulators can anticipate that regulated entities will respond in ways to minimize a regulation's impact, they will likely not be able to predict the specificity of response to be able to devise their regulations at the outset to prevent all responses that limit the regulation's reach. The infinite range of responses that is a function of human inventiveness and resourcefulness works to sap the effectiveness of much regulatory effort.

A global financial crisis is the quintessential tail risk that is characterized by dynamic uncertainty for shocks to the financial system tend to be endogenous, but even were they exogenous, such shocks would be amplified by human responses. Yet prevention of tail risk realization is the objective of systemic risk regulation. While dynamic uncertainty renders predicting the effect of regulation perplexing, it is especially so for systemic risk regulation, as there is no regulatory experience that could suggest even a base case from which to attempt to predict institutional responses, however foolhardy a Lucas-type critique might imply that such a task might be. We are in the realm of King's radical uncertainty of not knowing the possible states of the world, let alone being able to assign probabilities to states.

The fact that global financial crises occur rarely is not the only challenge to devising effective systemic risk regulation. Prior to the recent crisis, regulatory attention focused on ensuring the safety of individual institutions rather than overall system risk. That conventional approach to banking regulation deems it desirable for banks to hold diversified portfolios, so, for example, limits are placed on how much exposure a bank could have to one borrower. But when the risk of concern is to the system as a whole, rather than to a single bank, it is problematic for all banks to be similarly diversified as then a large shock to a subset of assets in their portfolios would undermine all banks, yet globally harmonized regulation is likely to result in similar patterns of diversification across banks, magnifying systemic risk. If banks' holdings are undiversified and varied across institutions, then a shock to a subset of assets would undermine only some banks, that is, there would be a lower probability of the shock's having a systemic impact.

It cannot reasonably be expected that a large bank would voluntarily concentrate its

holdings in one type of asset, as prudent management would counsel diversification. Small banks, by contrast, might develop a niche specialization, such as specializing in making agricultural loans.⁵¹ However, the issue of concern with regard to diversification and systemic risk regulation is large, interconnected multinational banks, whose business strategies would not profitably be so delimited. Regulators have not required such banks to undiversify for, notwithstanding the benefit to system resilience of such an approach, it would be difficult to justify to the public – or to bank investors -- a policy that increases the probability of individual bank failures, and that in the end might well increase, rather than decrease the number of government bailouts. Still, the conflict between individual bank and financial system stability is no doubt real, and presents a regulatory conundrum, not present for microprudential regulation.

I have been emphasizing the challenge of systemic risk regulation stemming from definitional and measurement issues in a context of dynamic and radical uncertainty, and the conflict between individual bank and systemwide financial stability, with the lessons of the global financial crisis regarding the impact of innovation on harmonized rules in the background. Is the import of this dismal narrative that regulators should pack up their marbles and go home, so to speak? Hardly. The radical uncertainty characterizing the markets that are subject to financial regulation does not imply that regulators can and should do nothing. Rather, it suggests that there would be value-added from a regulatory framework that facilitates flexible adaptation to new financial technologies and economic shocks as they emerge. In conjunction with the two lessons from the global financial crisis regarding financial innovation and Basel's contribution to the panic, such uncertainty suggests a need for regulators to be highly attentive to the impact of new financial technologies and for efforts at global harmonization to proceed with humility and caution.

How might the lesson regarding the dual nature of financial innovation be addressed? First, regulators should attend to developments in short-term debt financing – both by ongoing monitoring of existing short-term financing markets and by scouting for new ones. This is a straightforward application of Gorton's identification of those markets as the source of financial crises. Second, monitoring leverage in the economy to identify increased risk generated by new products should be a prime focus of regulatory attention, along with monitoring financial

⁵¹ I thank Jon Macey for this example.

innovations and their impact on economic behavior more generally.⁵² However, in doing so, regulators would need to take care that the monitored indicator(s) do not morph into capital regulation, in order to avoid Goodhart's law, that banks' responses would in due course undermine the indicators' ability to provide an accurate measure of systemic risk. Furthermore, when implementing a leverage-monitoring system, or, indeed, any regulation calibrated to systemic risk measures, regulators must beware that the monitoring and regulation not overly impede the development of new financial technologies. This formidable balancing of concerns follows straightforwardly from Goetzmann's narrative, which suggests that over time the benefits of innovation have overwhelmed the cost, including the fallout of periods of sustained economic distress and even calamity.

How can we adapt the international regulatory architecture to take account of the lesson regarding the peril of global harmonization, that were regulation to go awry, it would magnify systemic risk? It is my contention that a central focus of international efforts at systemic risk regulation should be the fostering of meaningful regulatory diversity along with periodic regulatory updating. The objective of such a policy is twofold: to reduce the probability that financial institutions across the globe follow identical business strategies, as their incentives would differ were they subject to different systemic risk measures, and thereby diminish the likelihood of a regulatory misstep leading to a global crisis; and to increase the probability that were financial innovation to undermine the effectiveness of a chosen risk measure, the regulation would be revised.

As Simon Levin's work with a number of coauthors has emphasized, in studying the financial system, we can learn from the literature on biological ecosystems because, like financial markets, they evolve over time, in a highly uncertain environment that experiences perturbations from unknown risks.⁵³ That literature indicates that biodiversity is one of a small

⁵² For such a policy suggestion, see, e.g., John Geanakoplos, "Solving the Present Crisis and Managing the Leverage Cycle," (2010) 16:1 Fed. Res. Bank N.Y. Econ. Policy Rev. 101; John Geanakoplos & Lasse Heje Pedersen, "Monitoring Leverage," in Markus Brunnermeier & Arvind Krishnamurthy, eds., *Risk Topography: Systemic Risk and Macro Modeling* (Chicago: Univ. of Chicago Press, 2014) 113. Geanakoplos's policy proposal is not conditioned on leverage related to new products, but considers leverage on all products and in all sectors. Given the connection between leverage and financial crises, see note 20, supra, his broader application makes much sense.

⁵³ Simon A. Levin & Andrew W. Lo, "Opinion: A New Approach to Financial Regulation"

number of properties that enhance the robustness of ecological biosystems, and introducing diversity into financial regulation would operate analogously to enhance the resiliency of the global financial system.⁵⁴ Introducing meaningful diversity into the global regulatory architecture could also improve the quality of regulatory decisionmaking, as regulators could learn from the experience of banks operating under differing regulatory arrangements which ones work more effectively.

There is a further rationale for advocating diversity in international financial regulation, as well as diffidence when regulating: the one-size-fits-all approach of harmonized requirements is likely to be inappropriate given the heterogeneity in financial institutions and level of financial and legal development across the many nations following the regulatory standards set out in the Basel Accords.⁵⁵ The desirability of tailoring systemic risk regulation is supported by the findings of an intriguing study suggesting that there are countervailing considerations regarding financial crises with respect to economic growth, questioning the very core of the effort to restrict systemic risk. Examining eighty-three nations over the period 1960-2000, Romain Rancière and colleagues find that among nations with weak institutions (that is, developing economies), those experiencing financial crises have, on average, grown faster than those with stable financial conditions, despite the distress occasioned by crises.⁵⁶ They interpret the finding, which is robust to alternative specifications, as indicating “a positive effect of systemic risk on growth.”⁵⁷ The channel for how systemic risk affects growth would appear to be its positive effect on investment (by reducing borrowing constraints it permits firms to invest more, which fosters growth).⁵⁸ Hence, it would seem that at least for such nations, it might not be wise to advance regulation focused on minimizing systemic risk.

How could the international regulatory framework premised on harmonization be

(2015) 112 PNAS 12543; Robert M. May, Simon A. Levin & George Sugihara, “Ecology for Bankers” (2008) 451 Nature 893.

⁵⁴ Levin & Lo, *supra* note 53, at 12544.

⁵⁵ For a discussion of empirical research indicating a need for differential financial regulations across nations, particularly for distinguishing between advanced and emerging economies, see Romano, *supra* note 25, at 29.

⁵⁶ Romain Rancière, Aaron Tornell & Frank Westermann, “Systemic Crises and Growth” (2008) 123:1 Q. J. Econ. 359.

⁵⁷ *Ibid* at 360.

⁵⁸ *Ibid* at 395, 399.

reshaped to incorporate the benefits of regulatory diversity? In prior work, I have elaborated a procedural mechanism through which a modicum of diversity could be introduced into the Basel Accords by permitting voluntary national deviations from its approach to capital requirements.⁵⁹ Without rehearsing all of the procedural requisites for successfully implementing such an approach, the gist of the proposal is establishment of a peer review apparatus within the Basel framework that would approve a nation's proposed departure from Basel requirements, subject to ongoing monitoring to ensure that a departure was not increasing global systemic risk, with an illustration of a departure of replacing Basel's risk weighted capital requirement with a simple leverage ratio and subordinated debt requirement.⁶⁰ I have further advocated use of regulatory experimentation in domestic regulation, as a mechanism for ascertaining which regulatory strategies might work best.⁶¹ Such an approach has an equal, if not more important, purpose in the context of systemic risk regulation: if systemic risk measures were varied across banks, along with the method by which additional capital is calculated to account for banks' contribution to systemic risk, then banks' behavioral responses will diverge as well, and that should reduce the likelihood of increased systemic risk by discouraging what would otherwise be uniformity in banks' activities circumventing regulation.

Regulatory updating due to information gleaned from experiments concerning risks that arise from, and firms' responses to, regulation has commonalities with what has been a keystone of conservation efforts in natural resource management for decades: the strategy of adaptive management, which refers to "management as a learning process or continuous experiment where incorporating the results of previous actions allows managers to remain flexible and adapt

⁵⁹ Romano, *supra* note 25, at 26-42. The focus of that work was the introduction of diversity into Basel's risk-weighted capital regime. Calling for diversity in systemic risk regulation is not as out of the norm as doing so for capital regulation. Although Basel III introduced a number of macroprudential capital requirements that are intended to reduce systemic risk as opposed to microprudential policies whose objective is to reduce the risk of individual banks, prior to the financial crisis many nations, particularly emerging economies, had adopted a variety of macroprudential policies, such as placing limits on borrowers and lenders, matters not regulated by Basel. See Eugenio Cerutti, Stijn Claessens & Luc Laeven, "The Use and Effectiveness of Macroprudential Policies: New Evidence" (2017) 28 J. Fin. Stability 203 (analyzing twelve macroprudential policies used across 119 countries from 2000-13).

⁶⁰ Romano, *supra* note 25, at 26-41, 46-48.

⁶¹ Roberta Romano, "Regulating in the Dark," in Cary Coglianese, ed., *Regulatory Breakdown: The Crisis of Confidence in U.S. Regulation* (Philadelphia, PA: Univ. Pennsylvania Press, 2012) 86.

to uncertainty.”⁶² Indeed, in adaptive environmental management, it is maintained that “even when current strategies seem to be working adequately,” alternative strategies should be continually explored (referred to as “adaptive probing”), given the need for information to be able to adjust for unanticipated environmental changes.⁶³ Financial systems have the same need for flexible adaptability.

The gold standard of regulatory experimentation in a domestic setting would randomize across firms different approaches to systemic risk measurement and corresponding capital assessment, enabling regulators to explore which regulations were more difficult to game, and hence more likely to reduce institutions’ contribution to systemic risk. Randomized experiments might seem to be impractical because banks can be expected to lobby legislators vigorously to prohibit regulatory experimentation, contending that being subject to differing rules would place them at a severe competitive disadvantage. But there has been at least one successful randomized experiment addressed to financial regulation, which suggests that the use of such experiments in this context is in the realm of the possible. In 2004, the U.S. Securities and Exchange Commission undertook a randomized experiment that varied the applicability of the uptick rule, which restricted short sales, to investigate the effect of relaxing the restrictions, and finding that the relaxation did not have the adverse effects managers had predicted, altered the rule.⁶⁴ In addition, a number of regulators around the globe have created “regulatory sandboxes” in the fintech area, to permit experimentation with new products and services outside of existing regulation.⁶⁵ While these regulatory spaces are not random experiments, they are in the spirit of

⁶² R. Edward Grumbine, “What Is Ecosystem Management?” (1994) 8 *Conservation Biology* 27 at 31.

⁶³ Simon A. Levin, *Fragile Dominion* (Cambridge, MA: Helix Books, Perseus Publ.) at 199-200.

⁶⁴ U.S. Securities and Exchange Commission, Office of Economic Analysis, Economic Analysis of the Short Sale Price Restrictions under the Regulation SHO Pilot (2007), online: <http://www.sec.gov/news/studies/2007/regshopilot020607.pdf>; U.S. Securities and Exchange Commission, SEC Votes on Regulation SHO Amendments and Proposals: Also Votes to Eliminate ‘Tick’ Test, Press Release 2007-114, online: <http://www.sec.gov/news/press/2007/2007-114.htm>.

⁶⁵ The first regulatory sandbox was launched by the U.K.’s Financial Conduct Authority in 2015, followed by regulators in Abu Dhabi, Australia, Canada, Denmark, Hong Kong, Indonesia, Malaysia, the Netherlands, Singapore, Thailand, and most recently, Arizona. Finextra, *The Role of Regulatory Sandboxes in Fintech Innovation* (Sept. 10, 2018), online: <https://www.finextra.com/blogposting/15759/the-role-of-regulatory-sandboxes-in-fintech-innovation>. The latest, and first, announcement by a U.S. federal agency proposing to create a

the experimentation that I am advocating, as they are directed at fostering the development of diverse business models for the provision of financial goods and services.

Where randomized experiments within a nation are infeasible due to domestic firms' intra-industry competitive concerns, if there is cross-border regulatory diversity, then there is another, albeit second-best regulatory approach consisting of observational studies, in which regulators compare outcomes across differing national regimes. For example, regulators could investigate whether there is a difference in systemic risk, calculated using a variety of measures, for banks operating under the U.S. Volcker rule compared to banks operating under the U.K. ring-fencing approach. In my judgment, devising how to implement such a policy effectively, and thereby generate information for policy evaluation, is a critical issue on which global efforts addressing systemic risk regulation should focus.

6. Conclusion

The contribution of the Basel capital requirements to the global financial crisis is a cautionary tale for systemic risk regulation. Basel's harmonization of capital requirements incentivized banks across the globe to hold large amounts of Basel-preferenced assets – securitized subprime mortgages—whose risk turned out to be far greater than the risk assigned by Basel, and when the default rate of the underlying mortgages increased, it triggered a panic in financial institutions' short-term funding markets which spread rapidly across borders, as the collapse of highly leveraged banks wrought economic calamity worldwide. This is an oft observed pattern throughout history, as financial innovations, such as securitized subprime mortgages, that can create tremendous social benefits also contain the seeds for potential collapse if enthusiasm produces pricing bubbles generating unsustainable leverage.

The historical pattern, accordingly, argues for exercising caution in seeking to harmonize the regulation of systemic risk. For three types of uncertainty combine in this context to make fixed and uniform regulation problematic, particularly given the difficulty in nimbly revising globally harmonized requirements: the issue-specific uncertainty regarding how to measure systemic risk; the radical uncertainty of the financial system that we do not know the possible future states and therefore cannot compute the probabilities of outcomes that would be necessary for formulating helpful rules regarding the use of a specific measure of systemic risk; and dynamic uncertainty,

sandbox is the Bureau of Consumer Financial Protection, see CFPB, Policy on No-Action Letters and the BCFP Product Sandbox, 83 Fed. Reg. 64036 (Dec. 13, 2018).

the fact that financial institutions respond to regulation in ways that cannot be predicted but that tend to undermine regulation's effectiveness.

The interaction of the different types of uncertainty suggests that a value-added international regulatory strategy would foster diversity across national regimes and periodic updating of global standards. This approach would reduce the probability of regulatory error contributing to a global catastrophe, for the number of banks that fail would be spatially delimited, as the probability of all banks following similar strategies would be reduced, thereby lowering the likelihood of a crisis spreading worldwide. In addition, as uncertainty unfolds, we could glean from the actions of banks operating under different systemic risk regulations information regarding which regimes are more or less effective in reducing risk. Finally, continuous assessment and periodic updating of international regulation would focus attention on the effectiveness of regulation as financial markets evolve over time. Informed by the learning gathered from the operation of diverse regulatory regimes, such updating would facilitate a more nimble revision of international regulation that is not functioning well and could thereby decrease the likelihood of a global crisis.