



Sunsetting as an adaptive strategy

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Major financial legislation is invariably enacted in the wake of a financial crisis. However, legislating following a crisis is hazardous because information is scarce regarding causes of the crisis, let alone what would be an appropriate response. Compounding the lack of information, crisis-driven legislation is sticky, but financial markets are dynamically innovative, which can undermine the efficacy of regulation. As a result, it is foreseeable that such legislation will contain at least some provisions that are inapt or inadequate or, more often, have consequences that are not well understood or even knowable. This article advocates the use of sunseting as a mechanism for mitigating the potentially adverse consequences of crisis-driven financial legislation. With sunseting, after a fixed time span, legislation and its implementing regulation must be reenacted to remain in force. This approach has parallels in evolutionary biology, in which a central issue is the ability to adapt to changing environments. Sunseting does not mean simply discarding (or reenacting) existing regulations, but revisiting them and improving them, much as mutation and recombination do in the evolutionary process.

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This approach has parallels in evolutionary biology, in which a central issue is the ability to adapt to

changing environments. Sunseting does not mean simply discarding (or reenacting) existing regulations, but revisiting them and improving them, much as can potentially be achieved via mutation and recombination in the evolutionary process. In evolutionary modification, mutational changes leave most of the genome alone, and selectively replace some; recombination uses existing segments but recombines them in ways that will be selected if they produce higher fitness. Similarly, in modifying existing legislation, one can keep some provisions, modify others, and “recombine” by adding provisions from other legislative efforts (1, 2).

There are of course major differences in how evolution works and how regulations are constructed. Fitness differences drive evolutionary processes myopically, with no long-term vision. In the case of legislation and implementing regulations, we have the potential to take the longer-term view, with clear objectives. Still, if short-term processes in evolution fail to produce longer-term robustness, the result is likely to be extinction of the lineage; hence, much can be

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learned in the construction of regulations meant to provide robustness and resilience in financial systems from the mechanisms that achieve this in biological systems.

Overview: Financial Markets and Crisis-Driven Financial Regulation

The inherent shortcomings of crisis-driven financial legislation are informed by the confluence of three factors: 1) financial institutions' operating environments, characterized by radical and dynamic uncertainty; 2) legislators' actions in the aftermath of financial crises to increase regulation markedly; and 3) political institutions that by design make legislative revision arduous. While legislation and accompanying regulatory directives under the best circumstances may have adverse unintended consequences, in the context of crisis-driven legislation, given the characteristics of financial markets, costly errors are likely to follow.*

Characteristics of Financial Markets. Financial markets are characterized by a highly uncertain environment of dynamic innovation.

Two types of uncertainty of special concern for financial markets. Two types of uncertainty are of special concern for crisis-driven financial legislation. Knightian uncertainty is named after Frank Knight, who famously distinguished uncertainty from risk, as a future state of the world whose probability of occurrence cannot be quantified (4). Knight's definition of uncertainty is well captured by what former Bank of England Governor Mervyn King terms radical uncertainty, future states for which we cannot assign a probability because we cannot imagine them, and contends is a fundamental characteristic of capitalist economies (5). The crucial point about radical uncertainty is that financial institutions and regulators cannot be expected to anticipate and thereby manage events that they cannot even imagine.

The second type of uncertainty that bedevils financial markets and financial regulation is related to the behavior of financial institutions and the ingenuity of human beings. Financial institutions respond to regulation by seeking to reduce the cost of compliance or otherwise circumvent it, in ways that confound regulatory efforts. This type of uncertainty is endogenous to the system (i.e., caused by financial system participants' behavior), in contrast to the first type of uncertainty, which is exogenous (i.e., due to events unrelated to actions by participants). While regulators are aware that such responses are likely to occur, it is difficult, if not impossible, to predict the precise form they will take, and hence, the location in the financial system where responses or their consequences will emerge. However, most assuredly, regulated entities' responses will make regulation less effective than anticipated by regulators.

This phenomenon has been characterized in a number of different ways in the academic literature.† The most helpful description is from the terrorism literature, which in considering

regulation directed at tail risk, terms the uncertainty created by humans' adaptation of their behavior to regulation as dynamic uncertainty (7). The point of this literature can be illustrated by noting that the occurrence of both a natural disaster, such as an earthquake, or a terrorist attack on an airplane, is an extremely low-probability event. Regulation of housing codes adopted to reduce the damage to property from an earthquake will not affect the probability of an earthquake occurring, whereas regulation to reduce terrorist attacks by prohibiting passengers from carrying box cutters onto planes will decrease the probability of attacks on planes by means of box cutters but increase the probability that terrorists will engage in some alternative, unanticipated form of attack. Similarly, although regulators can anticipate that regulated entities will respond in ways to minimize regulation's impact, they cannot predict the specific response and, more importantly, the new risks a response will generate. The broad range of responses that is a function of human inventiveness and resourcefulness works to sap the effectiveness of regulation.

Dynamic innovation. Goetzmann (8) has authored a masterful history of innovations in financial technology that parallel increasing complexity and diversity of civilization. His work is a compelling chronicle of how economic growth and increasing prosperity, along with economic, social, and political democratization, are integrally related to the development of new financial tools that fund entrepreneurs' innovations in goods and services and productive efficiencies, and facilitate the expansion of global trade.

However, Goetzmann does not provide a uniformly celebratory perspective on the impact of financial innovation. He maintains that financial innovations may disrupt settled social and economic arrangements, creating new winners and losers, or, when taken beyond the bounds of prudence, may precipitate financial crises and collapse. Underscoring the fragility of the equilibrium financial innovation unleashes, he refers to a duality in the nature of finance, in which innovations in financial technology have led to some of humankind's greatest achievements as well as severest failures. What precipitates financial crises in Goetzmann's narrative is an innovation taken beyond the bounds of prudence, as individuals embrace with an overabundance of enthusiasm a new financial product, thereby generating a pricing bubble that can burst with devastating economic consequences. 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. The dynamism of innovation in financial technology, which may, on occasion, be a function of efforts to circumvent regulation (9), suggests that we can expect that among the unknown future states confounding financial regulation will be novel financial products. Moreover, financial innovations can rapidly render obsolete financial firms' and regulators' state-of-the-art knowledge regarding the management of risks. Known risks can be addressed by financial products such as securitized subprime mortgages that enabled individuals with poor credit to obtain bank loans by being structured to reduce lenders' risk of nonpayment, but these can create unanticipated new risks: The use of those instruments as collateral in the shadow banking sector sparked the global financial crisis, despite subprime mortgages being a very small piece of the mortgage sector. In such a complex and dynamic context, even the most informed regulatory response will be prone to error as well as be backward-looking, focused on yesterday's perceived problem.

*The increased size, organizational complexity and concentration of assets in US financial institutions over the past few decades magnify the challenges presented by the markets in which the firms operate for effective internal risk management and regulatory supervision (ref. 3, pp. 3-4).

†For example, Kane (6) describes what he terms a regulatory "dialectic," in which parties losing out in the market demand financial legislation and legislators respond with regulation (in exchange for votes or campaign donations or for public-spirited reasons) that may produce a short-term benefit but in the long run is undermined by regulated entities' avoidance responses.

Table 1. Important crisis-driven banking statutes

Statute	Financial crisis
Banking Act of 1933	Great Depression (1929–1933)
Banking Act of 1935	Great Depression (1929–1933)
Competitive Equality Banking Act of 1987 (CEBA)	S&L Crisis (1984–1991)
Financial Institutions Reform, Recovery and Enforcement Act of 1989 (FIRREA)	S&L Crisis (1984–1991)
Comprehensive Thrift and Bank Fraud Prosecution and Taxpayer Recovery Act of 1990 (Title XXV of the Crime Control Act)	S&L Crisis (1984–1991)
Federal Deposit Insurance Corporation Improvement Act of 1991 (FDICIA)	S&L Crisis (1984–1991)
Housing and Community Development Act of 1992*	S&L Crisis (1984–1991)
Resolution Trust Corporation Completion Act (1993)*	S&L Crisis (1984–1991)
The Housing and Recovery Act of 2008*	Global Financial Crisis (2007–2010)
Emergency Economic Stabilization Act of 2008*	Global Financial Crisis (2007–2010)
Helping Families Save Their Homes Act of 2009	Global Financial Crisis (2007–2010)
Dodd–Frank Wall Street Reform and Consumer Protection Act (2010)	Global Financial Crisis (2007–2010)

Notes: Statutes are identified from Federal Deposit Insurance Corporation, Important Banking Laws (14); financial crises are identified by Reinhart and Rogoff (15) (see their appendix table A.4.1).

*Statutes containing provisions setting time limits on granted regulatory authority.

This perspective on financial innovation and regulation has direct antecedents in evolutionary theory. Whereas naive views of the workings of evolution through natural selection hypothesize a notion of optimization, more sophisticated perspectives distinguish the process of adaptation from the attainment of optima (10). Contingency in the evolutionary process is important (11), but dependence of selection depends on the frequency of a genotype within a population and coevolution among species is more fundamental, and leads to feedbacks. Viral or bacterial evolution triggers responses in ecological and evolutionary timescales in host species, which in turn cause further evolution in the pathogen species. Similar feedbacks occur between predator and prey, plants and pollinators, or competitors. Evolutionary biology has adapted Lewis Carroll's metaphor of the Red Queen, who must keep running just to stay in place. Just as the virus continually evolves to escape host immune responses, so too will the regulated continually evolve in response to regulation. If that regulation is not sufficiently adaptive, it is doomed to failure. Just as the delicate balance in human physiological regulatory systems can break down if the timescale of regulatory response is not able to keep up with the timescale of perturbations, so too must financial regulatory response be designed to keep up with challenges, for example the increased speed of trading due to algorithms (12).

Crisis-Driven Financial Regulation. Important financial regulation invariably follows financial crises. The political science literature indicates that issues move to the top of the legislative agenda in conjunction with focusing events and shifts in national mood (13). A financial crisis is a prototypical focusing event. As the crisis unfolds, there typically is a media clamor for action, reflecting, if not spurring, a parallel popular demand that legislative action is necessary to avoid a future crisis. A risk-averse legislator, whose objective is reelection, will rationally conclude that there is need to respond quickly.

Major financial legislation enacted in the wake of financial crises. Table 1 lists major financial legislation that has been enacted in the wake of a financial crisis in modern times. The statutes are identified from the Federal Deposit Insurance Corporation's list of important banking laws, and the definition of a financial crisis is taken from Reinhart and Rogoff's compendium of

financial crises across time and space (14, 15). While major statutes are, of course, also adopted in noncrisis times, crisis-driven statutes invariably produce a powerful regulatory ratchet in which new statutes are layered on top of existing laws and new regulations are grafted onto existing ones, creating an increasingly labyrinthian regulatory regime.

Fig. 1 provides empirical support for the contention that crisis-driven legislation generates a regulatory ratchet: It plots the growth from 1969 to 2016 in chapter 12 of the Code of Federal Regulations (CFR), which contains federal banking regulation, of a set of specific words (shall, must, may not, required, and prohibited) that are viewed in the textual analysis literature as imposing binding constraints on regulated firms, and hence increases in their use are seen as an indicator of increases in regulation (ref. 16, p. 10).[‡] The vertical lines indicate the starting and ending years of the financial crises occurring within the plotted interval, while the arrows identify the first and last statute adopted in response to those crises, as indicated in Table 1. As the figure shows, there is a readily discernible regulatory ratchet: Regulation implemented in response to crisis legislation is piled on top of existing regulations at a steep rate, accumulating over time. Increases in regulation are no doubt related to increasing regulatory complexity, and a further driver of the sustained increase in financial regulation observed in the figure is the increasing complexity of large financial firms and products over the past decades (17, 18).

There is a discernible and entirely predictable lag between statutes' enactment and new regulation because the rulemaking process is time-consuming: Judicial interpretations of the Administrative Procedure Act have imposed a variety of constraints on agency rulemaking that can make adoption of a complex rule a lengthy multiyear endeavor. For instance, a study of 42 rules promulgated by 14 agencies found that the average time between publication of a notice of a proposed rulemaking and its completion was 2 y, but 28 controversial rulemakings took over 7 y (19). Although that study contains no financial regulation, consistent with its findings, Dodd–Frank, Congress's 2010 response to the global financial crisis, required financial regulators to

[‡]Word counts are from the dataset, RegData United States (48).

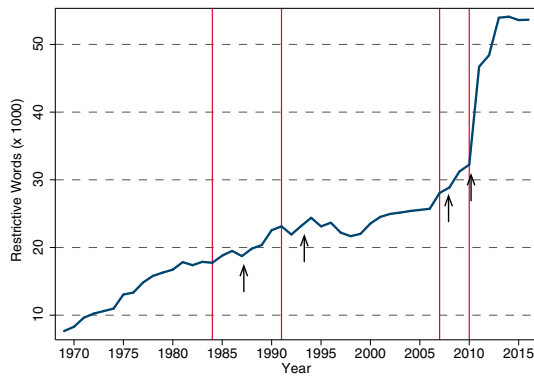


Fig. 1. Growth in restricted words in Title 12 of the CFR. This figure plots the number of restrictive words in Title 12 of the CFR (the title containing banking regulation). The restrictive words are thought to impose binding constraints on regulated firms and their growth and are therefore considered to proxy for increased regulation. The words are “shall,” “must,” “may not,” “prohibited,” and “required.” The arrows indicate the start and end of the US financial crises occurring in the plotted interval, and the vertical lines indicate the first and last statute enacted in response to the crises, both crises and laws being identified in Table 1. The word counts are from ref. 48.

formulate over 400 rules, and it was not until 4 y after enactment that somewhat more than half (58%) of the required rules were finalized (20).

The increase in regulation due to Dodd–Frank is observed in the figure and exhibits the expected lag effect, with the steepest slope in the plotted line occurring over 2010–2015. The upswing in regulation following the extended savings and loan (S&L) financial crisis in the late 1980s to early 1990s is not as sharp as that following the global financial crisis. However, in both instances, clearly regulation increased appreciably following the enactment of crisis-driven legislation.

There were transitory decreases in restrictive words in just 8 of the nearly 50 y of data. The decreases in the 1990s occurred in a time frame that has been identified by economic historians as one of deregulation, and two laws enacted over those years had some deregulatory content (21). The pattern of regulatory changes that appears to be associated with legislation comports with intuition: We would not expect deregulatory initiatives and hence declines in restrictive word counts in the midst of a crisis and legislation enacted in its wake. However, declines were quickly reversed.

While we have introduced Fig. 1 to depict a relationship between crisis-driven financial legislation and increases in financial regulation, the increase in financial regulation is not isolated from a general trend in US agency rulemaking over the time span. The upward path of restrictive words in financial regulation from the start of the dataset is consistent with increasing regulation throughout the economy with the implementation of President Johnson’s Great Society agenda in the late 1960s and thereafter (22). A study measuring regulation by the number of pages in the CFR from 1949 to 2005 reports a pattern of fast growth in the 1970s, slowing growth in the early 1980s, fast growth in the early 1990s, and a slowing of growth thereafter (23). Its authors conclude from the pattern that regulation increased due to the public’s attitude becoming amenable to regulation with no relation to the current economy (ref. 23, pp. 145–46). Increases in financial regulation in Fig. 1 are not, however, perfectly aligned with the reported general trend and, in contrast to that study’s conclusion, are associated with times of economic distress brought on by financial crises, with regulatory decreases occurring

during more favorable economic circumstances. Financial regulation would appear to be distinctive as it is associated with changing economic conditions, and therefore not simply explained by changing preferences for regulation of the electorate or government officials.

Legislators’ Behavior. A financial crisis opens a window for individuals (referred to in the literature as policy entrepreneurs) to promote their preferred policies as ready-made solutions to the problem at hand (13). Policy entrepreneurs are individuals willing to invest resources in order to obtain the implementation of policies they advocate. These individuals play a crucial role in the fashioning of crisis-driven financial legislation, as the interest group that would in normal times have significant input (given expertise and personal interest), financial institutions, is in disrepute, perceived as responsible for the crisis by a now-attentive public. Even legislators usually predisposed to be sympathetic to financial institutions will shun them, avoiding being perceived as responsive to their agenda.

There is a theoretical and empirical literature grounded in agency models of political representation that informs the scenario sketched out of legislators’ behavior when confronted with a crisis (24, 25). That literature indicates a close connection between an issue’s salience in the media, election outcomes, and policy implementation. Given the empirical relationships, for legislators, doing something in response to a crisis falls in the category of “must-do.” Such responsiveness is congruent with the conventionally posited objective of legislators of seeking to enhance reelection prospects.

The heightened issue saliency, or in the vernacular “media frenzy,” accompanying the exigency of a financial crisis compels legislators not only to respond, but swiftly, even though they will be aware that they cannot possibly ascertain what would be the better policy to adopt under the circumstances: There would, for instance, be considerable uncertainty in the first place concerning what has occurred and why. However, without a working understanding of the causes of a crisis, regulatory fixes, except largely by fortuity, are bound to be, in some measure, inadequate to and ill-designed for the task, even when devised by the most conscientious legislator.

Paralleling the political-science literature’s explanation of how policy proposals move up on the congressional agenda, legislation adopted in financial crises also fits that literature’s depiction of the operation of policy entrepreneurship to a tee. Crisis-driven legislation at times contains recycled proposals fashioned to resolve quite unrelated problems, real or imagined, which policy entrepreneurs opportunistically and adroitly advance as ready-made solutions (albeit often created with different circumstances in mind). Adept policy entrepreneurs link the crisis to their reform proposals in the public discourse, providing like-minded legislators with “ready-to-go” provisions that can be placed immediately into the legislative hopper.

Adopting policies that may have an attenuated connection to the crisis at hand is facilitated by a common set of cognitive biases. Vividness on the part of voters, and hence legislators, by which attention is drawn to “stories about personal experiences and emotionally arousing information” and loss salience whereby individuals care more about financial losses than financial gains, are exploitable by antimarket and antibusiness ideologies, in crisis settings (26). These biases and ideologies not only provide opportunities for policy entrepreneurs to advance their preferred

solutions, but also work in tandem to generate, as Hirshleifer (26) puts it, much “dysfunctional” financial regulation.

Stickiness of Crisis-Driven Financial Legislation and Implementing Regulation. US political institutions were deliberately designed to make the enactment of legislation slow and effortful. The organizing constitutional principles of separation of powers and checks and balances create numerous veto points throughout the legislative process.

The political institutions that can make legislating difficult in normal times also render repeal or significant revision equally, if not more, arduous. Compounding the institutional bottlenecks making legislation sticky is the scarcity of time and legislative capacity: As there is a limited amount of time for plenary floor action, legislators will seek to move on to new matters, rather than return to ostensibly resolved issues, in the absence of exigency, expiring legislation (such as reauthorizations and appropriations), or other crises to which they perceive they must respond (27).

Further amplifying financial legislation’s stickiness is regulators’ proclivity to adhere to the status quo. Many well-known behavioral phenomena would seem to explain that behavior. Common cognitive biases and risk aversion tend to advantage the status quo. In laboratory experiments, for instance, psychologists find that framing specific options as the status quo results in those options being selected far more frequently than when there is a neutral framing of all options (28). That is, individuals tend to go along with what they perceive to be the status quo.

Risk aversion similarly has powerful effects on decisionmakers to favor the status quo. Were a financial institution to fail after such a rule change, a regulator more likely would encounter recrimination for her action, for example, being forced to testify before hostile congressional committees or ridiculed and castigated by the media, than were a failure to occur under the status quo, the safer course of action.

Reinforcing regulators’ preference for the status quo is the general absence of countervailing political demands in normal times from the public or legislators to change it. Financial regulation’s technical nature tends to result in the public’s and legislators’ ceding regulatory matters to experts, as they have a limited attention span and lose interest in an issue once the salience of a crisis recedes, legislation has been enacted and complex issues delegated to agencies for implementation.

Consequences of the Crisis-Driven Legislative Process. It is evident that financial legislation enacted in the wake of a crisis is likely to contain provisions that are problematic or inapt, due to a paucity of information available to legislators about causes of a crisis and hence, apposite solutions. The mismatch is compounded by the opportunism of policy entrepreneurs, who successfully advance their proposals with only a passing relation with the issues at hand.

Financial regulators’ status-quo bias and lack of public interest in financial regulation in the absence of a crisis further complicate the ability for the administrative apparatus to self-resolve regulatory errors generated by crisis-driven legislation. Once such legislation and its implementing regulations are promulgated, as earlier noted, there will be minimal, if any, initiative by regulators to revisit regulation and revise deficiencies, without explicit executive and legislative prompting. Moreover, even regulated firms may have an incentive to defend the status quo: Once they have invested resources to comply with postcrisis regulation, financial institutions, particularly the largest ones, might not

advocate regulatory reform, as economies of scale in compliance costs give them an edge over smaller firms and potential new entrants, constraining competition in the incumbents’ favor (29).

Not only will there be unintended consequences from the legislation and accompanying regulation, given a poor information environment at enactment, but the dynamism of financial markets can render ineffective or counterproductive initially plausible regulation. Although a rational response to these possibilities might seem to be to advocate legislative patience to delay responding to a crisis until more information is available regarding causes and solutions, it would deny, rather than acknowledge, “human nature as we know it,” to invoke Frank Knight’s apt phrase (4), legislators’ perceived need to act in the shadow of a crisis. Hence, legislative solutions, except largely by fortuity, are bound to contain shortcomings or errors, even when devised by the most conscientious legislators.

Sunsetting

Sunsetting—requiring that a statute expires on a specified date unless reenacted—can ameliorate the legislative dilemma caused by legislators’ incentive to act at an inopportune time in relation to a crisis. It puts into place an automatic, mandated reassessment of crisis-driven legislation and accompanying regulation, at a fixed point in time thereafter, when passions are less inflamed and far more information is available. Sunsetting has been used by Congress and state legislatures in the United States since the nation’s founding, although its use as a lawmaking strategy has ebbed and flowed over time. Sunsetting does not mean that legislation must disappear—only that it must be reenacted, perhaps with modification. In evolutionary biology, plasticity is the first response to a changing environment. Plasticity, however, has its limits, and there are costs to retaining the capacity for change. Thus, natural selection found reproduction, a fresh start in which offspring replace parents, with genotypes modified from the parental types through mutation or various forms of recombination. Recombination and reuse are also familiar tools in creating new legislation. Wilkerson et al. (1) explore this idea in depth, using “text reuse” methods to elucidate the evolution of policy ideas in legislation; and Li et al. (2) apply a similar approach to investigate bills related to the financial crisis in the first decade of this century.

Sunsetting similarly looks first to modify and adapt outdated portions of statutes; when that fails, existing legislation must give way to new legislation (or no legislation), possibly mutated or recombined forms of existing legislation. For example, the Gramm–Leach–Bliley Act of 1999 overturned a provision separating commercial and investment banking of the Banking Act of 1933 (known as Glass–Steagall) and the Riegel–Neal Interstate Banking and Branching Efficiency Act of 1994 sealed the coffin on the restriction on interstate banking of the McFadden Act of 1927. We note that, in both cases, economic and political consensus had emerged a number of years earlier that the restrictions were inefficient, leading to a less resilient banking system, and within the legislative strictures, regulators had provided exceptions to Glass–Steagall for some institutions while states had already begun to eliminate branching restrictions before Congress acted (21, 30). Under a legislative process requiring sunset reviews, these policy reversals could have been accelerated by moving the issue up on the legislative agenda and thereby overcoming the stickiness of the status quo.

Furthermore, one size does not fit all; the life spans of organisms span orders of magnitude, and sunset provisions similarly should not have a fixed timescale applicable to all cases.

Legislators are aware of this necessity, as historically statutory expiration dates vary considerably, e.g., as follows:

- 1) 6 y: Aldrich–Vreeland Emergency Currency Act of 1908 (Aldrich–Vreeland) (Congress’s response to the financial panic of 1907), extended 1 y to permit organization of the Federal Reserve;
- 2) 5 y: the independent counsel, created in the Ethics in Government Act of 1978, after several reauthorizations allowed to expire;
- 3) 4 y: enhanced surveillance procedures authorized by the USA Patriot Act of 2001, a response to the bombings of the World Trade Center;
- 4) 2 y: Federal Energy Administration Act of 1974 (FEAA) (which created the Federal Energy Administration [FEA] to direct national energy programs), extended for 1 y more at expiration; and
- 5) 1 y: Emergency Economic Stabilization Act of 2008s (EESA) time frame in which the Treasury Department was authorized to spend up to \$700 billion to purchase distressed assets from financial institutions (a response to the global financial crisis).

Under sunseting, banking statutes and implementing regulations would, contain an expiration date, albeit extendable, as occurred in several of the previous examples. Legislators are not likely to be able to identify optimal sunseting dates, and extensions may be warranted if, for instance, additional time were required to complete a review, or for new institutional arrangements to be implemented. However, to prevent efforts to nullify a sunseting requirement by endless extensions, it would be prudent to limit the number or time span of extensions that could be approved.

Historical Experiences with Sunseting. In the late 1970s, sunset legislation coursed through the states, with 35 enacting sunset laws to review administrative agencies and programs that were perceived to be ineffective and wasteful (31, 32). Congress considered, but did not enact, a broad sunset statute, yet it still participated in the trend by sunseting the newly created Commodity Futures Trading Commission (CFTC) in the Commodity Futures Trading Commission Act of 1974 and the FEA in the FEAA. The CFTC remains, periodically reauthorized, while the FEA was merged into a newly established permanent cabinet department in the Department of Energy Organization Act of 1977. By the 1990s, enthusiasm for administrative agency sunseting waned, given the time and cost of reviews, and several states dropped their programs. Still, depending on the study, anywhere from 30 to 41 states have some form of active sunset review (33, 34). Assessments of the outcome of state sunset reviews indicate that while agencies and programs are rarely terminated, many agencies and programs are revised in varying degrees (32, 34, 35).

While states’ sunseting efforts have focused on administrative agencies and programs, there are instances of sunseting specifically related to financial legislation. As mentioned, the CFTC, which regulates financial derivatives, is a sunset agency. In addition, all major banking legislation in Canada is subject to sunseting. Finally, Congress’s response to the financial panic of 1907, Aldrich–Vreeland, was a sunseting statute, which led to the creation of the Federal Reserve.

The Aldrich–Vreeland experience is particularly instructive for how sunseting could work well in the context of crisis-driven legislation. Along with a 6-y expiration date, the statute established a National Monetary Commission to report to Congress “what changes are necessary or desirable in the monetary system

of the United States or in the laws relating to banking and currency” (36). Commission members traveled to Europe to study central banking systems, the Commission sponsored publication of numerous reports about other banking systems’ operation and causes of the 1907 banking crisis, and drafted legislation that was the progenitor of what would become the Federal Reserve Act of 1913, which created the US central bank (37). Sunseting worked as one would wish: A crisis response was enacted as a temporary measure with the possibility that there would be better information to craft a more enduring solution when the statute expired, by creating a national commission to investigate banking law reform. Of course, the outcomes of all sunseting statutes may not be as successful as that of Aldrich–Vreeland, but it holds out the promise of the mechanism for public policy.

Evolutionary Biology Perspective on Sunseting. Evolutionary biology is, to large extent, about how genomes respond to changing environments. Were there only a single organism in the world, that changing environment would undoubtedly have rendered it obsolete long ago, but generation of multiple copies of oneself, with variation, creates a mechanism for dealing with change. Ironically, perhaps, that variation and replacement is a major source of new environmental variation itself, and thereby speeds the evolutionary process.

The key variables in life history evolution are survival and reproduction, to some extent representing the processes of exploitation of a known model and exploration of new ones. The evolutionary process deals with the resolution of trade-offs between the two and explains why selection for long life is not unconstrained. Evolutionary investment in older individuals is investment in yesterday’s solutions and limits the ability to explore new solutions in a changing environment. Indeed, beyond trade-offs, evolutionary pressures might be such as to favor mortality as a way to reduce competition with new types. Even in the development of a single organism, apoptosis, the death of cells, is a natural part of growth and development.

Apoptosis and organism death are of course forms of sunseting, allowing for new types to arise. In concert with this, processes like mutation, reassortment (the recombination of viral segments), and sexual recombination have arisen to increase the generation of variation on which natural selection can operate. At another level, the process of elimination and replacement has allowed pathogens like influenza to continue as scourges to the human population over millennia. Financial regulation must similarly replicate this process of renewal if it is to be effective.

The modes of evolutionary responses to changing environments are many, ranging from easily reversible behavioral responses, like shivering in cold environments, to irreversible ones like the death of the organism and its replacement with a genetically different type (38), leading to evolutionary change within the species, or even the replacement of one species by another. Apoptosis, death, and extinction are part of a spectrum of responses but are essential features of the evolutionary play (39). So too, financial regulation must rely on a spectrum of responses at different levels of reversibility, but sunseting is an inescapable necessity in the toolbox and is to some extent reversible. In addition, just as evolution essentially places fixed limits on the life spans of organisms, so too must fixed lifetimes exist for most if not all financial regulations. Moreover, sunseting may be more forgiving to an institution than apoptosis is to natural organisms, affording multiple levels of reversibility. A sunset review need not

result in a statute's extinction; it may reenact an expired statute intact, or with minor revisions, or reverse direction entirely.

Of course, in any evolutionary process, trade-offs exist such as that between exploitation of a known strategy, and exploration to determine whether there might be even better strategies. Some exploration is essential because environments are changing, in part because processes, like mutation and recombination, that generate variation are thereby creating environmental change.

The fundamental mechanisms in evolution involve selection processes that winnow variation to find better choices among available strategies, and variation-generating mechanisms that provide adaptive capacity for future improvements. Balancing these depends upon the rate of environmental change, and indeed there is second-order selection on mutation and recombination rates that shape the optimal strategies in particular environments. Similar trade-offs, in some cases referred to as parent-offspring conflict, shape the balance between organismal investment in growth and survival versus reproduction. Similarly, sunseting comes at a cost, but brings benefits; the analogy to the biological principle of exploitation (retaining the rule intact) and exploration is strong. The pace of financial innovation is a primary driver of environmental change, but such innovation will vary depending on the instruments and agents. Thus, the timescale for sunseting varies across the spectrum of regulations.

How Sunseting Resolves Key Problems of Crisis-Driven Financial Legislation. There are multiple rationales for sunseting statutes, including improving the information available to legislators and policymakers for reassessing legislation (40); enhancing legislative oversight over executive agencies to reduce administrative "drift" whereby an agency is following policies contrary to congressional preferences (34); and meeting budgetary requirements in tax laws by limiting duration of a tax credit or reduced rate (41). The rationales are not equally laudable: For instance, tax provisions set to expire are perpetually extended, and sunseting thereby simply facilitates evading budgetary restrictions (41). However, concern over such a use of sunseting is orthogonal to our context. Of the rationales for adopting a sunseting strategy, the key justification in the financial regulatory domain is that sunseting mitigates the predicament of legislating with minimal information in the aftermath of a crisis. It sets into motion a process by which postenactment information can be incorporated into regulation.

While Congress has included sunset provisions in a variety of contexts, and a broad application may well be reasonable, our advocacy of sunseting is narrowly focused on financial legislation and its implementing regulations; sunseting fits the shortcomings of crisis-driven financial legislation well. It not only resolves the informational deficiency of the legislation's crisis-driven enacting environment, but also manages effectively the other two challenges of crisis-driven legislation. It eliminates the stickiness of legislation and implementing regulations because it alters the status quo, requiring legislative action for existing rules to continue in effect. It also facilitates a regulatory response to the dual problems characterizing financial regulation, that financial markets are subject to both radical and dynamic uncertainty. Economic and technological conditions may well have dramatically changed in the interim between enactment and sunset review, with financial innovation occurring apace, undermining the efficacy of regulation. An altered environment, which may render a statutory or regulatory provision unwittingly destabilizing of the financial system, can be addressed in the legislative second look

mandated by sunseting. As lessons from evolutionary biology make plain, these aspects of sunseting are crucial for the long-term effectiveness of regulation.

For example, the risk weights of bank capital regulation preferring securitized mortgages established in the late 1980s were not updated in the mid-2000s despite the innovation of subprime mortgages, which operated differently from prime mortgages with greater risk, and the shift in repo transactions and commercial paper markets—wholesale financing markets for financial institutions—to be collateralized by subprime mortgage-backed securities rather than government securities, the instruments and markets that sparked the global financial crisis (42). This does not mean that the risk weights would have been changed had sunseting been in effect for the Basel regime. The timing of the sunset review matters—the prevalence of subprime mortgages occurred well over a decade after the initial Basel accord. However, had the accord been subject to a periodic sunseting requirement, there would at least have been the possibility that the preferencing of mortgages would have been reconsidered before they sparked a global crisis, as the characteristics of securitized mortgages changed over time and their increased risk became more visible to Basel committee members.

The natural world continuously evolves through processes not coterminous with the life of a single organism or the attaining of a specific state. The dynamic environment in which financial institutions operate similarly would be best served by continuing, periodic sunset reviews, not just one-time review a number of years postenactment. In this regard, the functioning of the ex post reviews that sunseting requires highlights a difference in the legislative parallel to evolutionary adaptive processes in that it is intentionally undertaken, and the outcome determined by informed deliberation over how best to achieve specifically desired ends.

Although sunseting is well suited to address the issues presented by crisis-driven financial legislation, the sunset review process needs to be crafted so as to ensure its effectiveness. The states' experience in sunset reviews of administrative agencies and programs in the 1970s is instructive in this regard. Studies of state sunset reviews suggest a need to establish: 1) evaluative criteria to focus a review so that it does not devolve into a pro forma process (32); 2) a review panel of independent experts (or a legislative panel with expert staff) that assesses efficacy of legislation and regulation, and recommends revisions, if any, as legislators have neither the time nor expertise to undertake a comprehensive evaluation, and attending to the issues of the day will be of greater concern to them than reviewing "old" legislation (35);⁵ and 3) a timetable for Congress to act upon the panel's recommendations, with procedural safeguards to ensure that a minority cannot block a vote on legislation and thereby cause a law supported by the majority to expire (43).

Rather than leave effectiveness to chance, ideally, framework legislation should be enacted that sets forth the procedures to be followed in sunset reviews, including a timetable for continuing periodic reviews of financial statutes and regulations after the initial sunseting upon an original statute's or regulation's expiration date. Such an approach would also short-circuit the

⁵Contemporary state sunset reviews mitigate that issue as they are undertaken by a variety of entities, including legislative committees, advisory commissions, legislative advisory commission staff, nonpartisan legislative staff, and legislative auditors (34).

possibility that a legislative coalition enacting a crisis-driven statute would craft criteria for a sunset review that would enshrine their particularistic agenda. A helpful illustration of such framework legislation is the Texas Sunset Act of 1977, which established a process for the sunset of all administrative agencies and programs in the state, and sets forth criteria to be used in the reviews, a statute still in effect and a process operating to this day.

The criteria for reviewing statutes will vary with their differing objectives. For example, the global financial crisis raised the issue of whether banking regulations focused sufficiently on systemic risk as opposed to individual institutions' soundness, suggesting that whether the postcrisis legislation and resultant regulations reduced systemic risk would be an appropriate criterion. However, that would not be apt for evaluating statutes enacted in response to the S&L crisis, which were addressed to resolving problems in the operation of the thrift sector.

It is obviously impossible to attribute a single objective to any congressional action: Members support or oppose legislation for different reasons, and even if they had the same goal in mind, such as maximizing probability of reelection, given the diversity in constituents, a uniform goal would not likely be identifiable. In addition, the nature of crisis-driven legislation, as we have noted, may produce statutory provisions quite unrelated to the crisis at hand (e.g., Dodd-Frank's required disclosures of the sources of "conflict" minerals in firms' products have no connection to a goal of affecting systemic risk). Accordingly, there are general precepts of use in any sunset review, which can mitigate a challenge in discerning congressional intent in specific instances, such as whether an agency regulation is cost-effective or meets a cost-benefit test, or is the least-restrictive means of attaining an end. These criteria mesh with a goal of getting financial regulation right, i.e., striking a balance between regulatory benefits of reducing the risk of future crises against regulatory costs of reducing innovation and economic growth, as the most likely means of increasing social welfare, and provide a framework for making sense of the messiness of multiple congressional objectives informing complex financial legislation.

The principal procedural devices that can ensure a timely vote on a sunset statute are as follows: 1) requiring that the review panel's recommendations be automatically discharged, within a specific time frame, as a bill for a floor vote if the banking committees do not bring legislation to the floor; 2) requiring each chamber to respond within a specified time frame upon receipt of the sunset legislation from the other chamber; and 3) requiring the Senate's consideration to be conducted under rules, similar to those applied to voting on reconciliation of the budget, which limit debate and preclude filibusters. To ensure meaningful review, the review panel must be adequately funded, and have powers to question witnesses, and conduct investigations and examinations, just as Congress empowered the National Monetary Commission in 1908. Finally, standing congressional committees charged with overseeing the sunset review process, as exist in some states with large-scale administrative agency sunset programs, would be valuable for developing advocates among legislators for automatic inclusion of sunset provisions in crisis-driven financial legislation, along with the procedural devices that constrain legislators' prerogatives but are necessary for an effective sunset process.

The impact of sunset crisis-driven financial legislation on lobbying by affected parties cannot, of course, be predicted with confidence. Considerable lobbying efforts by self-interested parties may well occur during a sunset review. However, by

having an ex post review panel whose report would be subject to media, hence public, scrutiny, when presented to Congress, lobbying will be far more transparent than in the little-publicized administrative rulemaking process in which interest groups have an advantage.

Finally, a complement to sunset would be opening up financial regulation to experimentation, in which regulators could introduce diversity in regulation through the use of waivers or exemptions to classes of institutions, subsets therein, or randomly among institutions, to generate information about what regulations are most effective. One of us has proposed mechanisms for introducing experimentation and diversity into domestic and international financial regulation (42, 44); evolutionary biology's lessons regarding the importance for system resiliency of diversity and the trial and error of experimentation are fundamental. We note simply that the results of such experiments, which have value in their own right, could also inform sunset reviews, increasing their efficacy. The federal organization of the US government, with multiple banking regulators, as well as those of the states, makes it more amenable to such an approach than other, more centralized forms of political organization. To paraphrase Justice Brandeis, a single regulator could "serve as a laboratory; and try novel... experiments without risk to the rest of the country" (45).

Feasibility of Implementing Sunsetting. We have sketched out a mechanism by which Congress could mitigate potentially adverse consequences of crisis-driven financial regulation. Some observers of the legislative process may be skeptical, however, regarding the likelihood that Congress would ever implement sunset on the systematic basis that we are advocating.

For instance, there could be a prudential concern among legislators that sunset financial legislation would impose costs on financial institutions and those transacting with them by increasing regulatory uncertainty as an expiration date approaches. This is not as troubling a possibility as it might initially appear. In the financial regulatory context, the multiyear interval before sunset comes into play is generally long enough for the completion of business planning surrounding financial instruments or strategies, given how rapidly the financial environment changes. The time span of a financial product's innovation is not, for instance, similar to the long-tail development of a pharmaceutical drug. Moreover, the CFTC's having to operate under a system requiring reauthorization on a periodic basis, rather than being subject solely to the routine appropriations process, has not hindered remarkable innovation in financial derivative products that are under the agency's jurisdiction. These data suggest that costs from increased regulatory uncertainty are likely to be offset by benefits from improvements in regulatory decision-making due to sunset's overcoming legislative stickiness and facilitating a well-informed regulatory reassessment.

In addition to sunset the CFTC, four financial crisis-driven statutes in Table 1 have provisions with time limits, such as the previously noted termination date of the EESA; as do statutes enacted in ordinary times, such as the Financial Institutions Supervisory Act of 1966, which specified an expiration date for authority granted agencies to issue cease-and-desist orders and suspend and remove officers of financial institutions. Congress's use of sunset, albeit most often on a much smaller scale than we propose (individual provisions rather than an entire statute) in this context, importantly suggests that the principal source of resistance to our proposed approach would not be legislators' concern over increasing regulatory uncertainty but rather its

interference with their ability to retain control over policy over the long haul. Namely, by overcoming the stickiness of political institutions, sunseting shifts decisional control over the content of a statute from current to future legislators, creating a powerful disincentive for a current majority to agree to permit a second look, given it might not be the majority at the time of the sunset review.

As a rule of thumb, party leadership includes sunset provisions when it has no other option and it must do so to obtain the requisite votes for passage, but that is not an issue in most crisis-driven financial legislation. The final passage of over 80% of the statutes in Table 1 was approved in at least one chamber by a majority of both Republicans and Democrats, and in total by a supermajority over two-thirds. In addition, the two statutes that failed on both of those dimensions, the Resolution Trust Corporation Completion Act and Dodd–Frank, were enacted in Congresses in which there were large Democratic majorities and cohesive party voting enabling the majority to enact legislation without the need of the minority's support. With a comfortable voting margin in hand, majority party leaders have no incentive to sunset legislation. Rather, their incentives go in the opposite direction: Sunseting would facilitate, if not accelerate the reworking of their legislation, if majority control were to have shifted at the expiration date, a scenario they would most plausibly view as unwelcome. Although legislation can, in theory, be revisited at any time, it rarely occurs given the stickiness of our political institutions, which is thought to produce an "ideological asymmetry" whereby new initiatives are expansionary, not contracting, of government (22).

How can setting out a procedure for the automatic sunseting of crisis-driven financial legislation be prioritized on the legislative agenda given lawmakers having incentives that are not well aligned with such an approach? There is no good answer to this question. One answer is by educating the citizenry about sunseting as the sine qua non of good government, which seems to have worked in the 1970s to drive a wave of sunseting reforms across the states. However, a stagnating economy was no doubt a critical corollary driver of that trend, as regulation was perceived to be a source of the era's economic malaise.

Lupia (46) contends that the key to educating individuals involves the information provider both gaining their attention and being a credible information source. Source credibility entails perceived common interests (among information provider and audience) and perceived greater knowledge (of the provider

compared to the audience). In the 1970s, Common Cause, a respected nonprofit organization focused on good government, assisted Colorado in drafting the first state sunseting statute, a movement that rapidly thereafter swept through the states (32). Invoking Lupia's insight, identifying equivalent publicly spirited organizations today, and persuading them that sunseting crisis-driven financial legislation and implementing regulation is in the public interest as it will improve the quality of decision-making, so that they mobilize and advocate its adoption, could be a valuable mechanism for galvanizing the media and informing the public on the net benefits of sunseting. Once their attention is engaged, legislators will respond. We are not under the illusion that a citizen educational agenda is the magic bullet to put sunseting on Congress's agenda. However, one has to start somewhere, and it is at least a start. Sunseting is not, in fact, totally off-limits to contemporary legislators' thinking. In a recent editorial, Senator Ben Sasse (47) endorsed sunseting all legislation as one of a number of reforms to improve the functioning of the Senate, which is a far more expansive proposal than the circumscribed and targeted one that we are advocating.

Conclusion

Congress is quick to react to financial crises, enacting legislation that fosters a regulatory ratchet, despite crises being problematic times for action. In the wake of a crisis, little is known about the extent of contributing causes, let alone how best to adapt the regulatory system to reduce the likelihood of recurrences. Moreover, the dynamic innovation that is a persistent feature of financial markets renders ineffective over time even regulation that was initially quite sensible. Accordingly, such crisis-driven financial legislation will contain at least some provisions that are inapt or inadequate, or that will have consequences that are not well understood or even knowable. However, US political institutions make revising legislation arduous, and regulators tend to favor the status quo, rarely reassessing regulations without external prompting by, for instance, legislative directive. This paper advocates, as a mechanism to mitigate those difficulties, sunseting financial legislation and implementing regulation. There is a core lesson to be learned from evolutionary biology when considering how to design financial legislation. Setting an expiration date for financial legislation comports with processes that enable evolutionary adaptation to a changing environment.

Data Availability. All data are publicly available in refs. 14, 15, 48.

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