2016

Through the Lens of Complex Systems Theory: Why Regulators Must Understand the Economy and Society as a Complex System

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Recommended Citation
James M. Giudice, *Through the Lens of Complex Systems Theory: Why Regulators Must Understand the Economy and Society as a Complex System*, 51 U. Rich. L. Rev. Online 7 (2016).

THROUGH THE LENS OF COMPLEX SYSTEMS THEORY: WHY REGULATORS MUST UNDERSTAND THE ECONOMY AND SOCIETY AS A COMPLEX SYSTEM

INTRODUCTION

Complex systems are constantly creating unpredictable phenomena that change and shape the world around us. These systems are comprised of relatively simple components whose interactions, controlled by no central authority, are guided by simple rules that give rise to complex behavior patterns and adaptation.[1] Historically, scientists used reductionism as the primary means of understanding complex problems. This method attempts to make sense of the whole by dividing it into its smallest components, studying them from simplest to most complex, and putting them back together until the complete picture is seen. Over the past century, scientists began to realize the limits of the reductionist method when it became apparent not all systems are linear. Results in a non-linear system could not be predicted using reductionism because the whole can be greater than the sum of its parts.[2] Through an appreciation and basic understanding of complex systems theory, lawmakers and regulators can more efficiently and effectively ensure harmony in the world they seek to order, while simultaneously avoiding the costly pitfalls of overly complicated regulatory schemes.

Society, the economy, the immune system, and even ant colonies are a few examples of complex systems. The very air we breathe is a key element of one of the most complex systems currently under scientific scrutiny, the Earth's climate. Nature provides limitless examples of complex systems where simple and advanced social organisms come together to create elegant and elaborate structures.[3] These communities work together to increase the survivability of the population as a whole. Out of these

1. *See* discussion *infra* Part I.
2. *Id.*
3. *See* discussion *infra* Part I.A.

interactions occurrences develop that are difficult if not impossible to predict. As explored in more detail below, society and the economy are complex systems that exhibit such evolutionary behavior. The science of complex systems is an interdisciplinary approach to understand these interactions and the systems they create.[4]

A key characteristic of complex systems is the existence of "large networks of individual components . . . following relatively simple rules with no central control or leader."[5] With respect to the economy, individuals and businesses seek to maximize their profitability by adapting to the environment around them with no central authority dictating their actions. To achieve public policy goals and exert a degree of control over these systems, government imposes various regulatory schemes. These regulatory systems impact our lives every day, permeating every aspect of society,[6] and are among the most powerful drivers of individual and system-wide adaptation.

Effective regulation of the collective actions of free individuals requires an understanding of what complex systems are, how they work, how they can be studied, the impact internal and external stimuli have on the system as a whole, and how our regulatory agencies can be better suited to dealing with a complex world. There is a prolific body of legal scholarship discussing the substantive characteristics and purpose of government regulation;[7] that is not the focus of this article. The purpose of this article is to illustrate the value complex systems theory could create if applied to the regulatory decision making process.

Part I provides a basic introduction to complex systems theory to establish a foundation from which to discuss its application to modern regulatory problems. This part will also differentiate between simple, complicated, and complex problems and how to deal with them. The utility of modern computer modeling is discussed to show the potential direction and application of complexity theory in the social sciences. Finally, it will briefly define and

4. *See* J. Doyne Farmer, *Economics Needs to Treat the Economy as a Complex System*, INST. FOR NEW ECON. THINKING, 4 (May 3, 2012), http://ineteconomics.org/uploads/papers/farmer_berlinpaper.pdf.

5. MELANIE MITCHELL, COMPLEXITY: A GUIDED TOUR 12 (2009).

6. *See* Joseph P. Tomain & Sidney A. Shapiro, *Analyzing Government Regulation*, 49 ADMIN. L. REV. 377, 378 (1997) (discussing the pervasive nature of modern government regulation).

7. *Id.*

explore the characteristics of regulatory systems and their role in providing stability and predictability.

In Part II we will shift to a discussion of the Tax Code as a complicated regulatory system. The Tax Code was chosen because of the average reader's familiarity with this system, and also because it provides prime examples of complicated legal rules and their unintended consequences.

Part III will bring the concepts of complexity theory to bear on the modern regulatory process to offer very broad observations of how to simplify the Code. Furthermore, it discusses how regulators can achieve their desired end states at the lowest possible cost; to not just solve a problem, but to solve it efficiently and find the "elegant solution."[8]

Part IV concludes that looking at these problems through the lens of complexity theory will provide a broader understanding of complex problems and lead to better regulatory decisions after weighing the costs and benefits of complicated rules. Lawmakers should weave the complex systems approach into the fabric of the regulatory process.

I. COMPLEX SYSTEMS THEORY: "A HIGH-LEVEL PRIMER"[9]

For over 400 years reductionism was the leading approach to understanding the world around us.[10] This method of scientific inquiry is quite simple: divide the problem into its smallest parts, study them from the simplest to the most complex, and gradually build until you have a complete picture and understanding of the issue.[11] In the 1940s and 1950s scientists began to acknowledge that for systems in which individual actors have free will and the ability to reason, interactions led to many unpredictable results for which reductionism provided insufficient answers.[12] It appeared the reductionist method had found its limits until modern

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8. *See* discussion *infra* Part III.

9. The idea for this section title came from Eric L. Talley, *Corporate Inversions and the Unbundling of Regulatory Competition*, 101 VA. L. REV. 1649, 1658 (2015).

10. *See* MITCHELL, *supra* note 5, at ix.

11. *See id.*

12. *See, e.g.*, MITCHELL, *supra* note 5, at x (discussing several examples of complex systems that have stymied the reductionist method); *see* Sean Snyder, *The Simple, the Complicated, and the Complex: Educational Reform Through the Lens of Complexity Theory* (OECD, Education Working Paper No. 96, 11 (2013), http://dx.doi.org/10.1787/5k3txnpt1lnr-en; .

technology allowed the use of computers to aid in the study of complex systems.[13]

Even with modern supercomputers, there are still systems such as climate, disease, adaptive living organisms, and the world economy that cannot be understood through the application of reductionism alone.[14] To move beyond these limits and find a deeper understanding of these types of systems, scientists began to realize an interdisciplinary approach was needed to develop a scientific foundation to attack these problems.[15] Though it has gone by several different titles in the past, today this discipline is widely known as the science of complexity theory.[16]

Complexity theory is an attempt to understand the structure and behavior of complex systems, with particular focus on the cooperative interactions of individual components that give rise to unpredictable outcomes and events.[17] "Complex systems is the study of how interesting emergent phenomena arise from the interactions of low-level building blocks."[18] To fully grasp what is meant by "emergent phenomena," a brief discussion of linear versus non-linear systems is warranted. "[I]f [an] interaction is linear, the whole is just the sum of the parts."[19] "This is the realm of the known" where cause and effect are clearly understood and therefore A always leads to B.[20] However, if the results from the interactions of the parts are non-linear, the whole becomes more than the sum of its parts.[21] Situations emerge in which outcomes are *qualitatively* different than the sum of the parts. Such outcomes are characterized as emergent phenomena.[22] Complex systems are environments where the collective actions of individual parts generate outcomes that are difficult, if not impossible, to foresee or predict.[23] These systems have the ability to adapt and

13. *See* Farmer, *supra* note 4, at 4.

14. MITCHELL, *supra* note 5. at x.

15. *Id.*

16. *See id.*

17. PEDRO FERREIRA, TRACING COMPLEXITY THEORY, RESEARCH SEMINAR IN ENGINEERING SYSTEMS 1 (2001); *see* Eberhard Bodenschatz, *Complex Systems,* RESEARCH PERSPECTIVES OF THE MAX PLANCK SOCIETY 56 (2010).

18. Farmer, *supra* note 4, at 2.

19. *Id.*

20. Snyder, *supra* note 12, at 7.

21. Farmer, *supra* note 4, at 2.

22. *Id.*

23. *What are Complex Systems?*, COMPLEX SYS. SOC'Y http://cssociety.org/about-us/what-are-cs (last visited Aug. 8, 2016).

change over time with stimuli from their environment.[24] Some illustrations from nature will help to visualize these phenomena. Three classic examples of such systems are ant colonies, flocking birds, and the economy.[25]

A. *Examples of Complex Emergent Behavior in Nature*

Ant colonies provide a great example of unsophisticated organisms, collectively engaged in complicated decision-making and complex problem solving, with no apparent central authority guiding them.[26] Take for example how these colonies work together in search of food. Each individual ant leaves the nest in a random search for food.[27] When a food source is found, the ant returns to the nest laying down a chemical trail that attracts its fellow foragers.[28] Each ant that uses the trail reinforces the scent, which leads the colony as a whole to efficiently gather food in the absence of any centralized planning or decision-making.[29] Each ant performing its tasks in accordance with very simple rules leads the colony to surprisingly sophisticated accomplishments.[30]

Flocking birds are another example of sophisticated emergent behavior brought about by simple rules. A flock of starlings, called a murmuration, is an astonishing sight. Such a flock can contain thousands of birds flying at incredible speeds, making abrupt and extreme turns, yet able to avoid all collisions.[31] On the level of the individual bird, three simple rules govern behavior: steer to avoid flock mates, steer towards the average heading of

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24. *See* Murray Gell-Mann, *Simplicity and Complexity in the Description of Nature*, 51 ENG'G & SCI. 2, 8 (1988).

25. *See* MITCHELL, *supra* note 5, at 4–13 ("Complex systems researchers assert that different complex systems in nature, such as insect colonies, immunes systems, brains, and economies, have much in common."); Michael Dubakov, *Simple Rules, Complex Systems and Software Development*, TARGET PROCESS, https://www.targetprocess.com/blog/2009/03/simple-rules-complex-systems-and/ (last visited Aug. 8, 2016) (illustrating how systems based simple rules can lead to complex and intelligent behavior).

26. *See* Balaji Prabhakar et al., *The Regulation Of Ant Colony Foraging Activity Without Spatial Information*, 8 PLOS COMPUTATIONAL BIOLOGY 1, 6 (2012).

27. *See id.*

28. Dubakov, *supra* note 25.

29. MITCHELL, *supra* note 5, at 4; Dubakov, *supra* note 25.

30. MITCHELL, *supra* note 5, at 4. For an in-depth discussion of how dynamical networks like ant colonies produce sophisticated collective behavior, see generally Prabhakar et al., *supra* note 26, and Deborah Gordon, *The Emergent Genius of Ant Colonies*, TED (2003).

31. *See* Brandon Keim, *The Startling Science of a Starling Murmuration*, WIRED (Nov. 11, 2011) http://www.wired.com/2011/11/starling-flock/.

the group, and steer to move towards the average position of the group.[32] Following these simple rules starlings perform incredibly complex aerial maneuvers, all in the absence of central leadership or control.

The complex behavior of free market economies emerges from choices made by individuals, households, companies, and other organizations seeking to maximize their self-interests.[33] Driven by these key individual components acting in pursuit of their own maximum benefit, consumption and production patterns seek equilibrium[34] allowing the economy as a whole to move towards a more efficient state.[35] This concept is commonly understood as the "invisible hand" of the market, a phrase coined by the renowned economist Adam Smith.[36]

An ant colony, flocking birds, and the economy are each complex systems that seem quite different on the micro level, but on the macro level have several key properties in common.[37] First, each system exhibits complex collective behavior that arises from large networks of individual actors following simple rules.[38] Second, this behavior is accomplished in the absence of any central authority exerting control over the network.[39] Third, each of these systems is adaptive and will change over time by reacting to internal and external stimulus from their environments.[40] How does this emergent behavior come about? That is the central question complexity science seeks to answer. The central question complexity science seeks to answer is how this emergent behavior comes about.[41] But before we further explore the applicability of complexity theory to government regulation we must delve deeper into what is meant by complexity.

32. Dubakov, *supra* note 25.
33. *See* MITCHELL, *supra* note 5, at 10.
34. *Id* at 9–10; Ferreira, *supra* note 17 at 16.
35. MITCHELL, *supra* note 5, at 10.
36. *Id*.
37. *Id.* at 4.
38. *Id*. at 12.
39. *Id.*
40. *Id.* at 13.
41. *Id*.

B. *Simple, Complicated, and Complex Problems: What's the Difference?*

There is no consensus within the scientific or academic community on the *precise* meaning of complexity,[42] but to better understand the applicability of complexity theory to the design of regulation, we must draw a distinction between simple, complicated, and complex problems.[43] Simple problems can be solved and their outcomes predicted with great precision because the individual components can be understood, they are usually few in number, and the results of their interactions are consistent over time.[44] Furthermore, a non-expert can achieve uniform results if she accurately follows a set formula because, in the realm of simple problems, "cause equals effect."[45]

Formulas are equally critical in solving complicated problems,[46] but, unlike simple problems where a layperson can achieve similar results, a high level of expertise is required to ensure success.[47] The challenge of complicated problems is found not only in the sheer number of the component parts, but also by the scale of the problem itself.[48] While complicated problems contain many subsets of simple problems, they are more than a mere assembly of the simpler components.[49] However, once a complicated problem has been solved, it will generally remain solved.[50]

For the most part, when solving simple and complicated problems, we are in the realm of knowns where cause equals effect. Complex problems exist in the realm of unknowns where a given cause does not always lead to the same predictable effect.[51] It is

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42. MITCHELL, *supra* note 5, at 13–14 (exploring the struggle to establish foundational definitions in the evolving science of complexity); Snyder, *supra* note 12, at 6. *See generally* Murray Gell-Mann, *What is Complexity? Remarks on Simplicity and Complexity by the Nobel Prize-Winning Author of* The Quark and The Jaguar, 1 COMPLEXITY, (1995) 161, 16–19 (discussing the various qualitative and quantitative factors scientists have used in an attempt to define complexity).

43. *See* Snyder, *supra* note 12, at 7.

44. EBERHARD BODENSCHATZ, COMPLEX SYSTEMS 1 (2009), http://www.mpg.de/36885/cpt08_ComplexSystems-basetext.pdf.

45. Snyder, *supra* note 12, at 7.

46. SHOLOM GLOUBERMAN & BRENDA ZIMMERMAN, COMM'N ON THE FUTURE OF HEALTH CARE IN CAN., COMPLICATED AND COMPLEX SYSTEMS: WHAT WOULD SUCCESSFUL REFORM OF MEDICARE LOOK LIKE? 2 (2002).

47. *Id.*

48. *Id.* at 1.

49. *Id.*

50. *Id.* Snyder, *supra* note 12, at 7.

51. *Id*. at 7–8.

this unpredictable nature that government regulators must understand to achieve public policy goals in complex systems like society and the economy. Unfortunately, regulatory schemes are often found wanting, because they force *complicated* solutions on *complex* problems. These solutions are ill-equipped to cope with the adaptive nature of complex systems, and the complex problems they seek to address. Table 1 below provides an example and a side-by-side comparison of some key features of these different types of problems.

Table 1. Simple, Complicated, and Complex Problems[52]

Simple	**Complicated**	**Complex**
Following a Recipe	**Launching a Rocket**	**Raising a Child**
Recipe is easily replicated.	One successful launch increases likelihood of future success.	Formulae have limited or no application.
A standardized product can be produced by a non-expert.	High level of expertise required across an array of disciplines.	Experience is valuable, but does not ensure future success.
Good results can be expected every time.	Each launch is similar in fundamental ways.	Each child is unique and must be approached individually.
	High degree of certainty in outcome once original issues are solved.	Uncertainty of outcome remains.

C. *Studying Complex Systems in the Age of Super Computers*

The advent of modern computer technology has allowed for more realistic modeling of systems as complex as the economy. Complex systems can finally be studied through the collection of large amounts of data, the creation of ever more accurate simulations, and the solicitation of expertise from a wide array of disciplines.[53]

52. GLOUBERMAN & ZIMMERMAN, *supra* note 46, at 2 (adapting chart from Zimmerman); Snyder, *supra* note 12, at 7.
53. *What are Complex Systems?*, *supra* note 23.

Pulling from the examples discussed above, imagine creating a computer model of an ant colony. Each individual ant would be programed to follow a simple set of rules, which in turn would lead to the complex and sophisticated decision-making behavior of the colony.[54] Because the rules of interaction, such as the use of chemical trails to lead other workers to food sources, are well understood, their behavior can be more clearly studied and predicted.[55] But this example begs the question, "What about more sophisticated organisms like humans who make emotional decisions, have free will, and disparate interests?" This is where modern computing power may be the key that unlocks our ability to create accurate and reliable models for systems like the economy by realistically replicating human behavior in computer based simulation.[56]

As the speed of computers has increased, it has allowed researchers in both the natural and social sciences to use models to better understand cooperation between self-interested individuals.[57] Computers have quite literally revolutionized the way we understand and study the natural sciences by their ability to simulate complex systems.[58] They have not only increased the amount of data that can be gathered and stored, but also revolutionized the speed at which people can collaborate.[59] Prior to the rise of this technology, non-linear problems generally could not be solved, and the testing of such problems was limited to crude models that provided poor analogies for the real world.[60] Today, computer models are indispensible to scientific inquiry in a broad array of disciplines including "weather, traffic, epidemics, fluid turbulence, general relativity, earthquakes, and neural systems."[61] Now and in the future, computer-based simulations will be critical to understanding complex systems because they allow

54. *See* MITCHELL, *supra* note 5, at 147 (providing an example of individual light bulbs working in a system).

55. *See* Farmer, *supra* note 4, at 11 (explaining how reductionism makes studying complex systems easier).

56. *See* Alex Pentland & Andrew Liu, *Modeling and Prediction of Human Behavior*, 11 NEURAL COMPUTATION 229, 229 (1999) (proposing that human behavior can be accurately simulated by using dynamic models that can create realistic human behaviors by sequencing decisions together in networks).

57. MITCHELL*, supra* note 5, at 212.

58. Farmer, *supra* note 4, at 11.

59. *See id.* (referencing how computers permit scientists to study complexity by breaking systems down into low level building blocks).

60. *Id.*

61. *Id.*

the principles of reductionism to be brought to the study of complexity.[62] As such, regulatory agencies should work hand-in-hand with computer scientists, social scientists, and economists to create accurate models to better understand potential ramifications of regulatory decisions. Modern computers have given regulators the ability to churn out increasingly numerous and complicated rules and regulations. To properly apply complexity theory and realize its true value, it is critical these complex systems are studied *before* the implementation of wide reaching and complicated government regulation.

D. *The Need for Stability and Flexibility in Regulatory Systems*

To regulate is to bring order, hold to a constant standard, and provide a degree of control and predictability.[63] Regulation is not limited exclusively to the sphere of government. Markets also exhibit self-regulating behavior.[64] However, the focus here will be on government regulation. A regulatory system is a specialized subsystem designed to monitor, influence, and control behavior of the broader system.[65] Government is a prime example of a regulatory system in action.

One goal of government regulation is to provide a safe and stable environment that allows society and the economy to function harmoniously.[66] As an example, economic and financial regulations seek to create a stable system through which individuals and businesses are free to enter into voluntary and mutually beneficial agreements. In the modern world of fast paced technology and rapidly changing conditions, government regulation must not only create stability, but must also be flexible so it can adapt and respond to changes in the systems it seeks to control.[67] To complicate matters further, government regulation does not have the sole aim of stability. Rather, it also tries to encourage and discourage certain behaviors. The three mechanisms needed for a regulatory system to function properly are sensors, actuators, and

62. *Id.*
63. Howard Baetjer, Jr., *Regulating Regulators: Government vs. Markets*, 35 CATO J. 627, 627 (2015).
64. *Id.*
65. *Regulatory Systems*, COMPLEXITY ACAD. (Jul. 15, 2015), http://complexityacademy.io/regulatory-systems/.
66. *See id.*
67. Andreas Duit et al., *Governance, Complexity, and Resilience*, 20 GLOB. ENVTL. CHANGE, 363, 366–67 (2010).

a controller.[68]

The sensor monitors the underlying system for changes and communicates information to the controller.[69] Armed with up-to-date information, the controller, as "the brains of the operation," uses the information to make decisions that will be acted upon by the actuator.[70] It is important for each of these components to work together harmoniously for the *regulated* system to remain under control and for the *regulatory* system to be agile enough to react to changes in the environment.[71] Finally, it is critical for the regulatory system to be governed by a set of instructions that allow it to function effectively.[72] The information processing structures of government agencies is beyond the scope of this paper; rather, the complicated set of instructions, statutes, rules, and regulations will be the focus.

II. THE TAX CODE: FORCING COMPLICATED REGULATION ON A COMPLEX PROBLEM

The modern Tax Code is one of the most powerful control systems used by the government to shape and influence society. Since its inception, the income tax regime, particularly corporate income tax, has been used as a tool to incentivize certain behaviors.[73] It has been lauded by past presidents such as William Howard Taft for its ability to achieve "supervisory control of corporations which may prevent a further abuse of power."[74] Moreover, it has been said that "[t]ax complexity is itself complex,"[75] and is born through the various sets of *complicated* statutes, rules, and regulations that comprise the Tax Code.[76]

The overarching purpose of the Tax Code is to raise revenue for the government, but that is not its only purpose.[77] One driver—arguably the key driver—of complexity in the Code is government's use of the Tax Code as a vehicle to achieve other redis-

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68. *Regulatory Systems*, *supra* note 65.
69. *Id.*
70. *Id.*
71. *Id.*
72. *Id.*
73. Reuven S. Avi-Yonah, *The Three Goals of Taxation*, 60 TAX L. REV. 1, 22 (2006).
74. *Id.* (citing 44 CONG. REC. 3, 3344 (1909) (statement of President Taft)).
75. Deborah L. Paul, *The Sources of Tax Complexity: How Much Simplicity Can Fundamental Tax Reform Achieve?*, 76 N.C. L. REV. 151, 153 (1998).
76. *See id.* at 154.
77. Avi-Yonah, *supra* note 73, at 3.

tributive and regulatory goals.[78] These two functions are employed to "reduc[e] the unequal distribution of income and wealth . . . [and] to steer private sector activity in the directions desired by governments."[79] Some well-known examples of the Tax Code being used to encourage certain behavior are deductions for charitable giving,[80] deductions for personal mortgage interest,[81] and the beneficial tax treatment of investment accounts related to saving for college tuition.[82]

It is so widely accepted that the Tax Code is "extraordinarily complex"[83] that it need not be expounded upon here, but understanding why it is so complex is important. The sources of tax complexity can be difficult to pinpoint.[84] To facilitate our conversation we will begin by establishing a common understanding of the criteria by which taxes are evaluated. Equity, efficiency, and simplicity are widely recognized as the customary standard used to evaluate taxes.[85] The equity principle states similarly situated taxpayers should be treated similarly, and differently situated taxpayers should be treated differently.[86] This principle is primarily concerned with the fairness of a given tax.[87] The efficiency principle demands a given tax impact behavior and the market as little as possible.[88] This standard exists almost exclusively in theory, because all taxes affect behavior in one way or another.[89] Finally, simplicity, which is often viewed as a sub-category of both equity and efficiency, states that complex rules are inherently unfair because they allow more sophisticated taxpayers to manipu-

78. *Id.*; *see also* Stephanie J. Willbanks, *Simplifying the Internal Revenue Code Through Reallocation of Decisionmaking Responsibility*, 6 AM. J. TAX POL'Y 257, 258 (1987) (citing Congress's use of the Tax Code as a vehicle for non-tax objectives as a source of complexity).

79. Avi-Yonah, *supra* note 73, at 3.

80. 26 U.S.C. § 170 (2012) (allowing an itemized deduction for qualified charitable contributions).

81. 26 U.S.C. § 163 (2012) (allowing the taxpayer to deduct interest expenses from a loan obtained for a qualified residence).

82. 26 U.S.C. § 529 (2012) (creating an exemption for qualified tuition programs).

83. MICHAEL J. GRAETZ & DEBORAH H. SCHENK, FEDERAL INCOME TAXATION: PRINCIPLES AND POLICIES 30 (6th ed. 2008); *see also* Gregory Korte, *Even the IRS Chief Says Tax Code is Too Complex*, USA TODAY (Apr. 3, 2014, 8:56 AM), http://www.usatoday.com/story/news/politics/2014/04/02/irs-commissioner-urges-congress-to-simplify-tax-code/7215107/.

84. *See* Paul, *supra* note 75, at 153.

85. GRAETZ & SCHENK, *supra* note 83, at 29–31.

86. *Id.* at 28.

87. *Id.* at 28–29.

88. *Id.* at 29.

89. *Id.*

late the complexities to their advantage.[90]

A. *Sources of Complexity*[91]

Governments enact regulation in an attempt to bring order, create harmony, and right wrongs in society. This revered quest for justice creates a latent demand for the ever-elusive perfect solution to every problem.[92] This pursuit of perfection has led to a significant increase in the number of legal rules and their complexity. It also ignores one of the fundamental teachings of complexity science—that sometimes the most complicated systems are governed by the simplest rules.[93] As complexity increases, so do opportunities for individuals to game the system and gain an unfair advantage through the exploitation of loopholes.[94] It is this adaptation on the individual level that makes society a fluid and ever-changing system, requiring economists to move away from deterministic models focused on equilibrium and embrace the subject as inherently complex.[95]

Individuals in every society must compete against each other for scarce resources.[96] Because resources are scarce each individual actor is led to act in his own self-interest, putting himself and those he cares about first.[97] This self-interest has good qualities such as high achievement in the arts, sciences, and business but may also be the source of crime, fraud, and abuse.[98] Laws and regulations generally seek to reinforce the good aspects of individual competition while punishing and counteracting dangerous human impulses.[99] As discussed earlier, complex systems are adaptive in nature, and society is constantly changing because these impulses lead to evolving behavior and unpredictable outcomes.

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90. *Id.* at 30.

91. For an in-depth discussion of some of the key drivers of complexity in the Tax Code, see generally Willbanks, *supra* note 78.

92. RICHARD A. EPSTEIN, SIMPLE RULES FOR A COMPLEX WORLD 38 (1995).

93. Dubakov, *supra* note 25.

94. EPSTEIN, *supra* note 92, at 38–39.

95. *See* M. MITCHELL WALDROP, COMPLEXITY: THE EMERGING SCIENCE AT THE EDGE OF ORDER AND CHAOS 37–38 (1992) (discussing the difference in approaches of the "old and new" economics, differentiated by the view of the economy as a complex system).

96. *See* EPSTEIN, *supra* note 92, at 22.

97. *Id.*

98. *Id.*

99. *Id.*

Key metrics of the complexity of legal rules is the extent to which "processes, institutions, and supporting culture possess four features: density, technicality, differentiation, and indeterminacy or uncertainty."[100] Focusing primarily on density and technicality, the more numerous and encompassing a set of regulations, the more *dense* they are.[101] A regulation is *technically* complex if special expertise is required to understand and apply it.[102] According to Deborah Schenk, Professor Emerita at New York University School of Law and Editor-in-Chief of the *Tax Law Review*,[103] "the complexity of the U.S. Tax Code leads many filers to make . . . serious mistakes."[104] Furthermore, she points to Congress's inclination to use the Tax Code as a vehicle to provide incentives as one of the key drivers of its complexity.[105] The Code provides an excellent example of a set of rules that is complex from both a density and technical standpoint.[106]

The National Taxpayer Advocate ("NTA") is a non-partisan organization that is required to submit an annual report to the IRS and Congress, identifying the most serious problems facing taxpayers and making administrative and legislative recommendations to mitigate them.[107] In its 2010 Annual Report to Congress, the NTA identified the "overwhelming complexity" of the Tax Code as a key challenge facing the IRS in the decade ahead.[108] Furthermore, in that same report, the NTA identified the complexity of the Tax Code as the most serious problem facing taxpayers.[109] The compliance burden of these rules is staggering. "[T]axpayers and businesses spend 6.1 billion hours a year complying with tax-filing requirements" which is equivalent to the

100. Peter H. Schuck, *Legal Complexity: Some Causes, Consequences, and Cures*, 42 DUKE L.J. 1, 3 (1992).

101. *Id.*

102. *Id.* at 4.

103. NYU LAW, FACULTY PROFILES: DEBORAH SCHENK, https://its.law.nyu.edu/facultyprofiles/index.cfm?fuseaction=profile.overview&personid=20265 (last visited Aug. 8, 2016).

104. *Schenk Tells NPR that the U.S. Tax Code is so Complex that Most Filers Make Mistakes*, NYU L. http://www.law.nyu.edu/news/schenk_npr (last visited Aug. 8, 2016); *see generally Filing Taxes: It Shouldn't be so Hard*, THE ECONOMIST: DEMOCRACY IN AMERICA (Apr. 2, 2013, 2:01 PM), http://www.economist.com/blogs/democracyinamerica/2013/04/filing-taxes (discussing the compliance burden and costs of tax complexity of U.S. taxpayers).

105. *Schenk Tells NPR that the U.S. Tax Code is so Complex that Most Filers Make Mistakes*, NYU L. http://www.law.nyu.edu/news/schenk_npr (last visited Aug. 8, 2016), *supra* note 104.

106. 26 U.S.C. (2012); Schuck, *supra* note 100, at 4.

107. 26 U.S.C. §7803(c)(2)(B)(ii) (2012).

108. NAT'L TAXPAYER ADVOC., 2010 ANNUAL REPORT TO CONGRESS viii (2010).

109. *Id.* at 2

annual work hours of three million full-time employees.[110]

An entire industry has formed around complying with the tax code. Paid professionals prepare 60 percent of tax returns, and 29 percent of taxpayers use software programs to file their returns.[111] Beyond the compliance burden placed on U.S. taxpayers and businesses, perhaps the most harmful effect of the Tax Code is its discriminatory effects on individuals.[112] In pursuit of equitable wealth distribution in society, Congress has chosen to use the Tax Code to achieve its redistributive and regulatory goals.[113] Unfortunately, in many instances the outcome has been the polar opposite, because more sophisticated taxpayers are able to effectively understand and manipulate the tax rules.[114] Generally the most sophisticated taxpayers happen to be wealthier individuals and corporations that can use the ambiguities and complicated rules to reduce their tax liability.[115] The effect of complexity not only benefits those most able to pay, it also penalizes honest taxpayers who diligently attempt to comply with the code. Typically, these are people without knowledge or financial means to take advantage of loopholes.[116] Tax simplification is an effective way to mitigate these harmful effects,[117] and viewing this issue as a *complex* problem will equip regulators with the insight to make better, more efficient regulatory decisions.

One of the unifying characteristics of complex systems is they have no central controller and follow a simple set of rules.[118] Regulatory systems, such as the Tax Code, must also have simple rules that ensure not only stability but also agility to respond to a changing world.[119] A main driver of the increasing complexity found in modern legal rules is the pursuit of "perfect justice" and the idea that law must account for and address every possible scenario in society.[120] In the pursuit of perfect justice, regulators

110. *Id.*
111. *Id.*
112. *See id.*
113. Avi-Yonah, *supra* note 73, at 3.
114. GRAETZ & SCHENK, *supra* note 83, at 30.
115. *See id.*
116. *See id.*
117. NAT. TAXPAYER ADVOC., *supra* note 108, at 2 (2010).
118. MITCHELL, *supra* note 5 at 12.
119. *See* Duit et al., *supra* note 67, at 367.
120. *See* EPSTEIN, *supra* note 92, at 38 (exploring the diminishing returns of ever increasing legal complexity in the pursuit of "perfect justice"); Willbanks, *supra* note 78, 258–59 (identifying tax provisions that try to cover every conceivable situation as a major source of complexity in the Code).

are trying to account for every possible situation. In so doing, they create ever more complicated rules in an attempt to exert control over a non-linear complex system, resulting in costly, unintended consequences.

III. RESETTING THE BALANCE: THE PURSUIT OF AN ELEGANT SOLUTION

Complexity in the Tax Code is not inherently evil, but when it begins to undermine the core values of equity, efficiency, and simplicity it becomes so.[121] If government regulators want to achieve their desired end state at the lowest possible cost, and also avoid the harmful unintended consequences of overly complex regulation, they must seek the "elegant solution."

> [The term] *elegant solution* is used in mathematics, engineering, and software development to refer to a solution that solves the problem in the simplest and most effective manner. In many cases, it is possible for developers to create code that is more complicated than it needs to be. In such cases, this less-than-elegant solution is more likely to cause other issues. For most developers, finding an elegant solution is a greater challenge than simply solving a problem.[122]

Finding such a solution is no easy task, but it is what the taxpaying citizen deserves. It is more difficult than simply solving the problem—an elegant solution solves the problem efficiently, effectively, and at the lowest possible cost. Those in search of such a solution must first understand the characteristics of the problem they wish to solve, which is why complexity theory brings great value to the regulatory process.

A. *Regulatory System that Works*

Viewing regulatory issues through the lens of complexity facilitates the application of the principles discussed above. Doing so allows government regulators to better understand who is doing what and why.[123] With that knowledge in hand, they can draft regulations that bring about the desired results while avoiding unforeseen pitfalls. In order to put the practices in place, regulators must be able to monitor an ever-changing society, use that

121. Willbanks, *supra* note 78, at 259.

122. *Elegant Solution,* TECHOPEDIA, https://www.techopedia.com/definition/14357/elegant-solution (last visited Aug. 8, 2016) (emphasis added).

123. Waldrop, *supra* note 95, at 332.

information to make decisions, have a mechanism to take action, and follow a set of standards that guide this process.

The Tax Code did not become a behemoth overnight, nor will it be fixed in a day, but viewing the problem through the lens of complex systems theory could lead to simplification over time. While it is clear that the complexity of modern society has caused regulators to react with an ever more complicated Tax Code, sometimes the opposite is true and a complicated code increases complexity in the system unnecessarily. Complicated regulation encourages free-willed individuals and businesses to change their behavior, sometimes in undesirable ways, to maximize their own benefit and reduce compliance costs.[124] The aims of regulation are usually noble, and may be accomplished more effectively by adopting simple rules that are easy to comply with.[125]

The corporate income tax is a prime example of an overly complicated regulatory scheme that has led to unintended and undesirable consequences.[126] When corporations determine they can better return value to shareholders by leaving the country, they go through a process called a corporate inversion.[127] A corporate inversion is accomplished by operation of law when a company decides to switch its citizenship.[128] Post-inversion, corporate operations remain unchanged, but the company will pay income tax in accordance with the law of its new place of incorporation.[129] Put simply, inversions are about saving money on taxes.[130]

The pace of inversions has increased significantly since 2010,[131] and as Judge Learned Hand explained there is nothing illegal or

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124. *See* Chester S. Spatt, *Complexity of Regulation*, 3 HARV. BUS. L. REV. ONLINE 1 (2012), http://www.hblr.org/wp-content/uploads/2012/06/Spatt-Complexity-of-Regulation.pdf (discussing the cost of complicated regulation of the financial industry and how complicated regulation leads to modified behavior seeking to reduce compliance costs). "Financial regulation benefits from an emphasis on simple rather than complicated rules that avoid creating needless distortions, undertake serious cost-benefit analyses, use transparent rule-making processes, and emphasize disclosure and incentives." *Id.* at 9.

125. *Id.* at 1.

126. Martin Lobel, *Simplifying the Tax System Will Help Our Economy*, TAX ANALYSTS 66 (2009).

127. James Mann, *Corporate Inversions A Symptom of a Larger Problem, The Corporate Income Tax*, 78 S. CA. L. REV. 521 (2005); Mathew Lee, *The Recent Wave of Tax Inversions and Implications of the Corporate Income Tax*, DEV. IN BANKING L. 93 (2015).

128. Mann, *supra* note 127, at 521–22.

129. *Id.* at 524.

130. *Id.* at 523; Corporations are taxed based upon their location of incorporation, which means that U.S. corporations can be put at a significant disadvantage relative to their foreign competitors due to U.S. corporate income tax. *Id.* at 524.

131. Lee, *supra* note 127, at 97.

inherently "sinister in so arranging one's affairs as to keep taxes as low as possible."[132] Moreover, restructurings of this kind are no simple undertaking, but when the compliance burden becomes great enough, it makes sense for large U.S. multi-national corporations to seek more beneficial tax treatment.[133] In their pursuit to increase corporate tax revenue, regulators have created an environment in which corporations will go through the inversion process to reduce these burdens. Proposing a specific solution to this issue is beyond the scope of this paper, but corporate inversions are just one example of an overly complicated tax scheme that has led to unintended consequences. However, there are some common sense ways to begin the process of simplification.

B. *Attack One Problem at a Time*

The complexity of the Tax Code has been discussed ad nauseam[134] and is a hot topic in every major election cycle,[135] but few feasible plans have been put forward. The question of how to raise revenue incites passionate debate from both sides of the aisle, therefore the issues of revenue generation and Code simplification should be dealt with separately. The NTA proposes a two-step process.[136] First, Congress and regulators should focus on simplifying the code itself, and then address revenue needs by adjusting tax rates.[137] By separating the quest of simplification into these two distinct steps, its chances of success will increase.

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132. Comm'r v. Newman, 159 F.2d 848, 850–51 (2d Cir. 1947) (Hand, J., dissenting).

133. *See* Yariv Brauner, *An International Tax Regime in Crystallization*, 56 TAX L. REV. 259, 305 (2003).

134. "Unfortunately, the Internal Revenue Code—our nation's tax law—is extraordinarily complex." GRAETZ & SCHENK, *supra* note 83, at 30. *See generally Comparing the 2016 Presidential Tax Reform Proposals*, TAX FOUNDATION (2016), http://taxfoundation.org/comparing-2016-presidential-tax-reform-proposals (citing tax policy as a major issue in 2016 presidential campaigns); *Tax Reform in America: Simpler, Fairer, Possible*, THE ECONOMIST (July 13, 2013), http://www.economist.com/news/leaders/21581738-imperfect-proposal-could-still-improve-americas-awful-tax-code-back-it-mr-president-simpler (discussing the need for tax reform in the U.S. Tax Code); William Gale & Benjamin Harris, *Tax Simplification: What are the Benefits of Simpler Taxes?*, TAX POL'Y CTR. (Dec. 14, 2007), http://tpcprod.urban.org/briefing-book/improve/simplification/benefits.cfm (discussing key ways in which simpler taxes could improve the Tax Code).

135. *See, e.g.*, Eliza Collins, *Rand Paul Takes a Chainsaw to the Tax Code*, POLITICO (July 7, 2015, 2:07 PM), http://www.politico.com/story/2015/07/rand-paul-tax-code-chainsaw-120416.

136. NAT'L TAXPAYER ADVOC., *supra* note 108, at 3.

137. *Id.*

CONCLUSION

A foundational understanding of complexity theory holds important lessons for legislators and regulators. Those who author statutes, rules, and regulations must better understand the ramifications of complicated rules applied to a complex system. Looking at these problems through the lens of complexity theory will give them a broader understanding of the complex problems they are trying to solve and lead them to make different regulatory decisions after weighing the costs and benefits of complicated rules. Lawmakers should ensure the complex systems approach becomes central to the regulatory process.

This transformation of the regulatory process will not occur overnight, but over time, if an interdisciplinary approach is taken, it is possible to weave complex systems analysis into the framework of our regulatory process. Professor Schuck said it best, "[a]s we learn more about legal complexity's consequences, we should infuse that learning into the political economy of complexity, reminding anyone who will listen about the elusive virtues of simplicity in law."[138] If lawmakers can find the humility to realize perfect justice is an illusion, the pursuit of which often leads to costly unintended burdens, they may be able to find the elegant solution ensuring the spread of harmony and prosperity.

James M. Giudice

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138. Schuck, *supra* note 100, at 52.