There is No Spoon: Reconsidering the Tax Compliance Puzzle

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by

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Abstract

For over 40 years theorists have sought the effects of tax audits on voluntary compliance rates by studying individual taxpayer motivations. Yet no single theory has produced a taxpayer incentive model that both comports with experience and explains the effects of audits on compliance. This quandary is often termed the "tax compliance puzzle." Consequently, some theorists have called for more capacious models that make room for the panoply of individual compliance motivations. This Article proposes that a more complex model is unnecessary. To the contrary, complex compliance and enforcement data can result from extremely simple behavioral rules of individual taxpayers and government examiners interacting over time.

This Article describes an agent-based computational model that uses a single, simple rule of action for each taxpayer and examiner. The model produces three interesting effects supporting the conclusion that there may be no tax compliance puzzle to solve. First, the results comport with known U.S. compliance and audit rates. Second, the results suggest that while audit probability influences individual compliance decisions, it has negligible effects on system-level compliance patterns. Third, the results support the theory that the perceived strength of the tax authority correlates directly—but nonlinearly—with voluntary compliance rates. The model is not complete enough to determine conclusively that this last effect is due to perceived strength of the tax authority alone and might be due instead to factors such as social norms and other behaviorist theories.

I.   INTRODUCTION

Voluntary compliance is fundamental to a government with a self-reporting tax administration policy enforced by a relatively small number of audits.[1] For example, approximately ninety-eight percent of the tax revenues the U.S. government collects is from taxpayers who voluntarily file their returns and timely pay the tax legally due.[2] The remaining 2.86 percent of

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1. *See* I.R.C. §§ 6001 (flush language) (requiring taxpayers to make returns and to keep records adequate for the government to examine returns), 6201(a) (requiring the tax authority to make "inquiries, determinations, and assessments of all taxes"), 6202 (authorizing the tax authority to establish regulations governing proper modes of assessment); Reg. § 301.6201-1 (tax authority regulations establishing audits as a proper mode of assessment).

2. The average voluntary compliance rate in the United States is approximately 83.4 percent, which means the average noncompliance rate is approximately 16.6 percent. *See, e.g.*, INTERNAL REVENUE SERV., FACT SHEET 2005–14, UNDERSTANDING THE TAX GAP (Mar. 2005), http://www.irs.gov/uac/ Understanding-the-Tax-Gap. This measure is for *all* taxpayers (i.e., corporate income tax, individual income tax, excise tax, estate tax, etc.). For *individual* income tax underreporting, which is the subject taxpayer population for this Article, the voluntary compliance rate is approximately 82 percent and the underreporting rate is approximately 18 percent. *See* INTERNAL REVENUE SERV., INDIVIDUAL INCOME TAX UNDERREPORTING GAP ESTIMATES (Feb. 2007), http://www.irs.gov/pub/irs-

collected tax revenues is a result of government audit enforcement.[3] By design, a self-report or audit tax policy seeks to minimize the number of audits and maximize taxpayer compliance; that is, the government seeks to spend the minimum amount necessary on audit enforcement and maximize the level of voluntary tax compliance.[4] Such a strategy gives the government the highest possible return on investment. While there are direct costs of collecting the small percent of total revenue received through enforcement, the government obtains almost all of its tax revenues without paying any direct enforcement costs.

A basic assumption of a self-report or audit policy is that the direct audit costs *indirectly* contribute to the revenue received through voluntary compliance.[5] In other words, the assumption is that the audit rate contributes—to some unknown degree—to a higher level of voluntary compliance than would exist without enforcement.[6] As a result, the

utl/tax_gap_update_070212.pdf [hereinafter IRS, INDIVIDUAL INCOME TAX UNDERREPORTING GAP ESTIMATES] (estimating the taxable year 2001 Net Misreporting Percentage for the individual income tax underreporting gap at 18.0 percent). Following the conventions used by almost all government reports examining Internal Revenue Service (IRS) data, this Article assumes a two percent maximum margin of error and considers digits to be significant to three decimal places. *See* U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-09-555, REQUIRING INFORMATION REPORTING FOR CHARITABLE CASH CONTRIBUTIONS MAY NOT BE AN EFFECTIVE WAY TO IMPROVE COMPLIANCE 2 (2009) ("We . . . reviewed data from IRS's Statistics of Income (SOI) individual files . . . . Since the estimates we provide using these data sources are based on samples, they involve margins of error. Unless otherwise noted, all percentage estimates have margins of error of 2 percentage points or less . . . .").

3. For 2006, the government collected $2.21 trillion from voluntary compliance. It collected an additional $65 billion from enforcement and late payments. As a result, the $65 billion represents 2.86 percent of the total revenue collected from voluntary compliance, enforcement, and late payments, or $65B/($2,210B + $65B). *See* IR-News Rel. 2012-4, 13 U.S. Tax Rep. (RIA) ¶ 61,084.

4. *See* Maciej H. Kotowski, David A. Weisbach & Richard J. Zeckhauser, *Audits as Signals*, 81 U. CHI. L. REV. 179, 179 (2014) [hereinafter Kotowski et al., *Audits as Signals*] ("The apparent purpose of [a self-report or audit strategy] is to reduce enforcement costs. If only a fraction of reports have to be audited, costs may be lower than the alternative of directly monitoring a population.").

5. *See* Lee Osofsky, *Concentrated Enforcement*, 16 FLA. TAX REV. 325, 336–37 (2014); Leigh Osofsky, *Concentrated Enforcement in a Best-Case Tax Enforcement Regime*, Social Science Research Network (July 3, 2014) http://ssrn.com/abstract=2462147, citing Internal Revenue Service, *The Determinants of Individual Income Tax Compliance: Estimating the Impacts of Tax Policy, Enforcement, and IRS Responsiveness*, Publication 1916 (Rev. Nov. 1996).

6. Traditional deterrence theory is based on the "economics-of-crime" model first introduced by Gary Becker in 1968. Gary S. Becker, *Crime and*

government's investment in direct enforcement supposedly produces both the two percent of collected revenue plus an unknown amount of the ninety-eight percent resulting from voluntary compliance. Therefore, a crucial policy question is exactly what effect, if any, audit rates have on compliance.[7] If this question can be answered, one can then create policies to achieve the minimum audit rate necessary to maximize voluntary compliance.[8]

Punishment: An Economic Approach, 76 J. POL. ECON. 169 (1968) [hereinafter Becker, *Crime and Punishment*]. Four years later, Michael Allingham and Agnar Sandmo applied this model to tax evasion, which was shortly thereafter refined by Shlomo Yitzhaki. *See* Michael G. Allingham & Agnar Sandmo, *Income Tax Evasion: A Theoretical Analysis*, 1 J. PUB. ECON. 323 (1972) [hereinafter Allingham & Sandmo, *Income Tax Evasion*]; Shlomo Yitzhaki, *A Note on "Income Tax Evasion: A Theoretical Analysis,"* 3 J. PUB. ECON. 201 (1974) [hereinafter Yitzhaki, *Income Tax Evasion*]. The Allingham/Sandmo/Yitzhaki approach is generally regarded as the traditional deterrence model that correlates audit probability and penalty magnitude with voluntary tax compliance. For a thorough review of the deterrence model and its variants, see FRANK A. COWELL, CHEATING THE GOVERNMENT: THE ECONOMICS OF EVASION (1990) [hereinafter COWELL, CHEATING THE GOVERNMENT]; James Alm, *Measuring, Explaining, and Controlling Tax Evasion: Lessons from Theory, Experiments, and Field Studies*, 19 INT'L TAX & PUB. FIN. 54 (2012) [hereinafter Alm, *Measuring*]; Joel Slemrod & Shlomo Yitzhaki, *Tax Avoidance, Evasion, and Administration*, (Nat'l Bureau of Econ. Research, Working Paper No. 7473, 2000) [hereinafter Slemrod & Yitzhaki, *Tax Avoidance*]; James Andreoni, Brian Erard & Jonathan Feinstein, *Tax Compliance*, 36 J. ECON. LITERATURE 818 (1998) [hereinafter Andreoni et al, *Tax Compliance*].

    7. *See* Margaret McKerchar, Kim Bloomquist & Jeff Pope, *Indicators of Tax Morale: An Exploratory Study*, 11 ELEC. J. TAX RES. 5, 5–6 (2013), https://www.yumpu.com/en/document/view/15687226/volume-11-number-1-2013-australian-school-of-business- ("[As] we observe tax administrators seeking to improve the efficiency of their revenue collections, there is growing recognition of the need to have a deeper understanding of why taxpayers do comply voluntarily."), citing Marjorie E. Kornhauser, *A Tax Morale Approach to Compliance: Recommendations for the IRS*, 8 FLA. TAX REV. 599 (2007).

    8. This statement assumes, as does the theory contained herein, that a certain level of noncompliance must be tolerated with a self-reporting tax policy. The results given in this Article do not seek to answer the normative question posed by theorists such as Joel Slemrod as to how much noncompliance *should* be tolerated. Rather, it concludes that the tax compliance-enforcement system, as it exists, will produce a minimum level of noncompliance based on enforcement due to the system-generated order parameters. This Article seeks to find the "sweet spot" where this minimum noncompliance level exists and what level of enforcement (audit rate) is necessary to maintain the minimum noncompliance allowed by the system's order parameters. *See* Joel Slemrod, *Cheating Ourselves: The Economics of Tax Evasion*, 21 J. ECON. PERSPECTIVES 25, 44 (2007) [hereinafter Slemrod, *Cheating Ourselves*] ("In sum, no one has yet compellingly translated the

This question is particularly relevant to the U.S. government today. Congress has significantly reduced appropriations for its tax authority, the Internal Revenue Service (IRS), resulting in a substantial decrease in funding for its audit enforcement operations.[9] Both current and past Commissioners of Internal Revenue along with the National Taxpayer Advocate have warned Congress that a continued decrease in funding for enforcement operations in addition to those already brought on by budget cuts and sequestration will have a lasting negative effect on taxpayer voluntary compliance, thereby significantly reducing the low-cost revenue historically produced by voluntary compliance.[10] The IRS essentially argues that reduced enforcement will lead taxpayers to realize that there's no "cop on the beat," thereby removing taxpayers' incentives to voluntarily comply.[11]

theoretically correct characterization of optimal enforcement into a statement about how much evasion *should* be tolerated.") (emphasis added).

9. Anna Bernasek, *At the I.R.S., Trying to Collect More With Less*, N.Y. TIMES, Feb. 9, 2014, at BU11 ("In the name of saving money, Congress has cut funding for the agency whose job is to collect revenue and fill government coffers.... In current dollars, the I.R.S. enforcement budget declined from $5.9 billion in 2010 to $5 billion in 2013, including the effects of the government fiscal sequestration. That's a 15 percent cut in inflation-adjusted spending. . . . The budget cuts have meant less staffing, with reductions in the ranks of auditors, collections officers and criminal investigators. Last year alone, staff positions in enforcement dropped 6.4 percent, to the lowest total in a decade: 19,531."). The U.S. House of Representatives voted on July 16, 2014, to cut the overall IRS budget by $1.14 billion for fiscal year 2015, which would result in a 13 percent overall reduction from fiscal year 2014. *See* H.R. 5016, 113th Cong. (2014).

10. *See* WRITTEN TESTIMONY OF JOHN A. KOSKINEN, COMMISSIONER, INTERNAL REVENUE SERVICE, BEFORE THE SENATE APPROPRIATIONS COMMITTEE, SUBCOMMITTEE ON FINANCIAL SERVICES AND GENERAL GOVERNMENT ON THE FY 2015 IRS BUDGET 11–16 (Apr. 30, 2014), http://www.appropriations.senate.gov/sites/default/files/hearings/IRS%20Koskinen%20Statement.pdf; *IRS Budget: The IRS Desperately Needs More Funding to Serve Taxpayers and Increase Voluntary Compliance*, 2013 NAT'L TAXPAYER ADVOCATE 2013 ANNUAL REPORT TO CONGRESS 20 (2014), http://www.taxpayeradvocate.irs.gov/userfiles/file/2013 FullReport/IRS-BUDGET-The-IRS-Desperately-Needs-More-Funding-to-Serve-Taxpayers-and-Increase-Voluntary-Compliance.pdf; WRITTEN TESTIMONY OF DOUGLAS H. SHULMAN, COMMISSIONER, INTERNAL REVENUE BEFORE THE HOUSE WAYS & MEANS SUBCOMMITTEE ON OVERSIGHT FILING SEASON AND FY 2013 BUDGET REQUEST 4 (Mar. 22, 2012), http://waysandmeans.house.gov/uploadedfiles/finalwaysandmeanscommissioner21march2012.pdf.

11. At the same time, almost paradoxically, some members of Congress are demanding the IRS further increase voluntary compliance. For example, Senator Max Baucus asked the IRS for a ninety percent voluntary compliance goal by taxable year 2017. INTERNAL REVENUE SERV., REDUCING THE FEDERAL TAX GAP: A REPORT ON IMPROVING VOLUNTARY COMPLIANCE 18 (Aug. 2, 2007), http://www.irs.gov/pub/irs-news/tax_gap_report_final_080207_linked.pdf. The IRS

The question of how audits impact voluntary compliance has also plagued tax theorists for almost a half century. Studies of state income tax data suggest that a decline in audit rates over approximately ten years correlate to a decrease in tax revenues.[12] Some small group studies conclude that individual voluntary compliance increases with a greater perceived probability of being audited. Controlled "laboratory" experiments show that an increase in the audit rate increases individual compliance by approximately 5:1.[13] Still other experiments show that the impact of audit rates on voluntary compliance levels is small and nonlinear.[14] In short, there is no clear answer.

Almost all of the literature seeks the relationship between audit and compliance rates by investigating the behavioral motivations of individual taxpayers faced with the decision under uncertainty whether to comply with tax laws. Such motivations include taxpayer rationality,[15] nonrationality,[16]

Oversight Board previously adopted an eighty-six percent voluntary compliance rate goal by 2009. *Id.*

12.   Jeffrey A. Dubin, Michael J. Graetz & Louis L. Wilde, *The Effect of Audit Rates on the Federal Individual Income Tax, 1977-1986*, 43 NAT'L TAX J. 395 (1990); *see also* JEFFREY A. DUBIN, THE CAUSES AND CONSEQUENCES OF INCOME TAX NONCOMPLIANCE 81–110 (2012) (concluding reduced criminal tax enforcement correlates to reduced tax compliance).

13.   James Alm, Betty R. Jackson & Michael McKee, *Estimating the Determinants of Taxpayer Compliance with Experimental Data*, 45 NAT'L TAX J. 107 (1992) (finding an increase in the audit rate of ten percent yielded an increase in compliance of two percent for the subject group).

14.   James Alm, Gary H. McClelland & William D. Schulze, *Why Do People Pay Taxes?*, 48 J. PUB. ECON. 21 (1992) [hereinafter Alm et al., *Why Do People Pay Taxes*]; *cf.* Govind S. Iyer, Philip M. J. Reckers & Debra L. Sanders, *Increasing Tax Compliance in Washington State: A Field Experiment*, 63 NAT'L TAX J. 7 (2010).

15.   *See, e.g.*, Agnar Sandmo, *The Theory of Tax Evasion: A Retrospective View*, 58 NAT'L TAX J. 643 (2005) [hereinafter Sandmo, *The Theory of Tax Evasion*]; Keith Crocker & Joel Slemrod, *Corporate Tax Evasion with Agency Costs*, 89 J. PUB. ECON. 1593 (2005); Kurt J. Beron, Helen V. Tauchen & Ann Dryden Witte, *The Effect of Audits and Socioeconomic Variables on Compliance*, *in* WHY PEOPLE PAY TAXES: TAX COMPLIANCE AND ENFORCEMENT 67 (Joel Slemrod ed., 1992); Steven Klepper & Daniel Nagin, *The Anatomy of Tax Evasion*, 5 J.L. ECON. & ORG. 1 (1989); Mitchell Polinsky & Steven Shavell, *The Optimal Tradeoff between the Probability and Magnitude of Fines*, 69 AM. ECON. REV. 880 (1979).

16.   *See, e.g.*, BRUNO S. FREY, NOT JUST FOR THE MONEY: AN ECONOMIC THEORY OF PERSONAL MOTIVATION (1997); Sanjit Dhami & Ali al-Nowaihi, *Why Do People Pay Taxes? Prospect Theory Versus Expected Utility Theory*, 64 J. ECON. BEHAVIOR & ORG. 171 (2007) [hereinafter Dhami & al-Nowaihi, *Why Do People Pay Taxes*]; Lars P. Feld & Bruno S. Frey, *Trust Breeds Trust: How Taxpayers Are Treated*, 3 ECON. GOVERNANCE 87 (2002) [hereinafter Feld & Frey, *Trust Breeds*

morality,[17] social and cultural norms,[18] trust in government,[19] and even the alignment of the government's policies with those of the citizenry.[20] Each

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Trust]; John T. Scholz & Mark Lubell, *Cooperation, Reciprocity, and the Collective Action Heuristic*, 45 AM. J. POLI. SCI. 160 (2001).

17. *See, e.g.*, BENNO TORGLER, TAX COMPLIANCE AND TAX MORALE: A THEORETICAL AND EMPIRICAL ANALYSIS (2007); Benno Torgler, *Moral Suasion: An Alternative Tax Policy Strategy? Evidence from a Controlled Field Experiment in Switzerland*, 5 ECON. GOVERNANCE 235 (2004) [hereinafter Torgler, *Moral Suasion*]; Brian Erard & Jonathan S. Feinstein, *The Role of Moral Sentiments and Audit Perceptions in Tax Compliance*, 49 PUB. FIN. 70 (1994); Massimo Bordignon, *A Fairness Approach to Income Tax Evasion*, 52 J. PUB. ECON. 345 (1993); James P. Gordon, *Individual Morality and Reputation Costs as Deterrents to Tax Evasion*, 33 EURO. ECON. REV. 797 (1989); Richard D. Schwartz & Sonya Orleans, *On Legal Sanctions*, 34 U. CHI. L. REV. 274, 291 (1966). *See also* Allison Christians, *Avoidance, Evasion, and Taxpayer Morality*, 44 WASH. U. J.L. & POL'Y 39 (2014) (cautioning policymakers to distinguish between the moral discussion on tax noncompliance that constitutes illegal evasion and legally-compliant tax avoidance).

18. *See, e.g.*, Christian Traxler, *Social Norms and Conditional Cooperative Taxpayers*, 26 EUROPEAN J. POL. ECON. 89 (2010); Marsha Blumenthal, Charles Christian & Joel Slemrod, *Do Normative Appeals Affect Tax Compliance? Evidence from a Controlled Experiment in Minnesota*, 54 NAT'L TAX J. 125 (2001); Josef Falkinger, *Tax Evasion, Consumption of Public Goods, and Fairness*, 16 J. ECON. PSYCH. 63 (1995); FRANK COWELL, CHEATING THE GOVERNMENT: THE ECONOMICS OF EVASION 219 (1990) (reporting a failure of experiments to link feelings on inequity and unfairness in the tax system to tax noncompliance).

19. *See, e.g.*, VALERIE BRAITHWAITE, DEFIANCE IN TAXATION AND GOVERNANCE: RESISTING AND DISMISSING AUTHORITY IN A DEMOCRACY (2009); Margaret Levi, *A State of Trust*, *in* TRUST AND GOVERNANCE 77, 91 (Valerie Braithwaite & Margaret Levi eds., 1998); Jan Hanousek & Filip Palda, *Quality of Government Services and the Civic Duty to Pay Taxes in the Czech and Slovak Republics, and other Transition Countries*, 57 KYKLOS 237 (2004); Benno Torgler, *Tax Morale, Rule-Governed Behaviour and Trust*, 14 CONST. POL. ECON. 119 (2003); Joel Slemrod, *Trust in Public Finance*, *in* PUBLIC FINANCE AND PUBLIC POLICY IN THE NEW CENTURY 49 (Sijbren Cnossen & Hans-Werner Sinn eds., 2003).

20. *See, e.g.*, Diana Falsetta, Jennifer Kahle Schafer & George T. Tsakumis, Social Science Research Network, *Tax Evasion: Audit Probability and the Moderating Role of Goal Conflict* (Jan. 28, 2010), http://ssrn.com/abstract=1153829; Steven M. Sheffrin & Robert K. Triest, *Can Brute Deterrence Backfire? Perceptions and Attitudes in Taxpayer Compliance*, *in* WHY PEOPLE PAY TAXES: TAX COMPLIANCE AND ENFORCEMENT 193, 203 (Joel Slemrod ed., 1992). Martin Daunton points out that individual judgment on the acceptability of government policies can be complicated since, for example, taxpayers might be more tolerant of warfare expenditures in a patriotic period, but much less so during a period characterized by an opposite extreme such as antimilitarism. Martin Daunton, *Trusting Leviathan: British Fiscal Administration from the Napoleonic Wars to the Second World War*, *in* TRUST AND GOVERNANCE 102–34 (Valerie Braithwaite & Margaret Levi eds., 1998).

approach seeks to model the responses of a hypothesized, individual taxpayer to the compliance decision at the small-scale (micro), and then aggregate those responses to the large-scale (macro) in an attempt to explain the tax system's known compliance and enforcement rates.[21] According to this general reductionist approach, if audit rates do affect individual taxpayer compliance decisions, one should be able to observe the effect of audits on compliance at both the micro and macro levels. Regrettably, these models have not been successful in producing aggregate results close enough to known macro-level enforcement and compliance data to be considered accurate. If audits affect compliance rates at the micro-level, it does not seem apparent at the macro-level.

As a result, the question still remains, "How do audit rates affect voluntary compliance?"[22] Put another way, how does one explain the relatively high voluntary compliance rate given the relatively low audit rate in the United States? This apparent difficulty is sometimes referred to as the "tax compliance puzzle."[23] With the effects of higher audit rates on voluntary compliance still an open question, one is unsure if a high government investment in more tax audits—as recommended by the IRS—will produce the increased voluntary compliance revenue necessary to justify such an expense in the current economic and political environment.

One possible conclusion from this apparent "puzzle" is that the traditional reductionist technique of adding up the behaviors of the parts to find the behavior of the whole does not work. Instead of searching for a more capacious micro-level model that makes room for even more individual motivations, perhaps a model with simpler behavioral rules can better

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21. *See, e.g.*, Alm, *Measuring*, *supra* note 6 (seeking to explain the behavioral patterns of taxpayers and how policymakers can control tax compliance based on an understanding of taxpayer behavior); *see also*, Paul J. Beck, Jon S. Davis & Woon-Oh Jung, *Experimental Evidence on Taxpayer Reporting Under Uncertainty*, 66 ACCT. REV. 535 (1991).

22. *See, e.g.*, James Alm & Michael McKee, *Audit Certainty, Audit Productivity, and Taxpayer Compliance*, 59 NAT'L TAX J. 801, 803 (2006) [hereinafter Alm & McKee, *Audit Certainty*] ("Despite the many insights of [the tax compliance] literature . . . the effect of higher audit rates on compliance remains unanswered.").

23. *See* J. Manhire, *Toward a Perspective-Dependent Theory of Audit Probability for Tax Compliance Models*, 33 VA. TAX REV. 629, 631 (2014) [hereinafter Manhire, *Toward a Perspective-Dependent Theory*], citing Michele Bernasconi, *Tax Evasion and Orders of Risk Aversion*, 67 J. PUB. ECON. 123, 128 (1998) [hereinafter Bernasconi, *Tax Evasion*] ("This is the puzzle of tax compliance. Although incontrovertible evidence on the extent of tax evasion is hard to obtain, it is clear that not everybody cheats . . . ."); Henrik Jacobsen Kleven et al., *Unwilling or Unable to Cheat? Evidence from a Tax Audit Experiment in Denmark*, 79 ECONOMETRICA 651, 652 (2011) ("In other words, taxpayers, despite being able to cheat, are unwilling to do so for noneconomic reasons.").

explain the macro-level patterns observable in the system. Although this approach appears counterintuitive at first, intricate emergent properties at the system level based on very simple behavioral rules of interactive parts are typical in the complex adaptive systems literature, and is perhaps applicable to tax compliance dynamics.[24]

This Article considers the compliance-enforcement dynamic as a complex adaptive system, which is a collection of interacting, autonomous, learning decision makers embedded in an interactive environment.[25] Complex adaptive systems are common in nature and human society.[26]

Properties of complex adaptive systems can be difficult to deduce from individual behaviors alone. This means the system cannot be properly described by the machine model. Machines have parts that can be analyzed separate from the whole. The basic assumption of the machine model is that by understanding how each part works, one can understand the whole. The assumption of the complex adaptive systems model is that the whole is not necessarily more than the parts, but something different from the aggregation of the parts. For the complex adaptive systems model, understanding the parts only guarantees an understanding of the parts. To understand the whole, one must not begin with the parts and aggregate up to the whole. Instead, one must start with the whole and seek to understand the relationship that emerges *between* the parts, even if this relationship is not at all apparent when studying the parts alone.[27]

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24. *See generally* JOHN F. PADGETT & WALTER W. POWELL, THE EMERGENCE OF ORGANIZATIONS AND MARKETS (2012); SCOTT E. PAGE, DIVERSITY AND COMPLEXITY (2010); JOHN H. MILLER & SCOTT E. PAGE, COMPLEX ADAPTIVE SYSTEMS: AN INTRODUCTION TO COMPUTATIONAL MODELS OF SOCIAL LIFE (2007); Nigel Goldenfeld & Leo P. Kadanoff, *Simple Lessons from Complexity*, 284 SCI. 87 (1999). This Article uses the term "simple rules" as the soil from which complex systems spring. The term is not used synonymously with the efficient running of organizations based on simple rules that allow employees more freedom of decision, as highlighted in Donald Sull & Kathleen M. Eisenhardt, *Simple Rules for a Complex World*, HARV. BUS. REV. 69 (Spring 2012).

25. *See* JOHN H. HOLLAND, EMERGENCE: FROM CHAOS TO ORDER (1998).

26. *See, e.g.*, J. A. SCOTT KELSO, DYNAMIC PATTERNS: THE SELF-ORGANIZATION OF BRAIN AND BEHAVIOR (COMPLEX ADAPTIVE SYSTEMS) 97–184 (1995) (arguing that the creation of patterned behavior in the human brain is governed by the generic processes of self-organization common to complex adaptive systems); THOMAS C. SCHELLING, MICROMOTIVES AND MACROBEHAVIOR 135–65 (1978) (showing how segregation in U.S. neighborhoods can arise from a set of individual behavioral rules given a relatively low level of overall racial prejudice in a society).

27. *See generally* Michael J. North, *A Theoretical Formalism for Analyzing Agent-Based Models*, 2 COMPLEX ADAPTIVE SYSTEMS MODELING 3 (2014), http://www.casmodeling.com/content/pdf/2194-3206-2-3.pdf [hereinafter North, *A Theoretical Formalism*].

For the tax compliance-enforcement system, phenomena such as individual taxpayers and government tax examiners constitute the parts. Studying just the parts—as with the machine model—can only inform one as to the nature of those parts (i.e., the behavioral motivations of individual taxpayers and examiners). To understand the system *qua system*, one must try to understand the relationships between these parts. The compliance-enforcement system is not independent of the specific behavioral motivations of the individuals acting within it. Nonetheless, since the system finds its own order separate from the functioning of the parts, the order cannot be accurately extrapolated from even the most granular understanding of individual motivations—including the most extensive model that includes all applicable compliance motivations of individual taxpayers. Still, since an order does exist, a model that reasonably reflects the system should be able to discover the relationship and general effects—or lack thereof—of one part of the system on another; namely, the effect of the audit rate (the examiners' decisions) on voluntary compliance (the taxpayers' decisions).

Complex adaptive systems can be difficult to model with traditional mathematics. This is primarily because each individual acting in the system is unique and diverse. There is no single hypothesized individual who represents the "typical" individual in the system. In this way, models of complex adaptive systems attempt to capture the dynamics of diversity and individual choice that is common in the real world. One technique for modeling these systems is to use exploratory computer-based models, such as an "agent-based model."[28] By representing the decision makers in the real-world system as individual agents in the model, one can better observe the effects of the decision makers' diversity. Individual characteristics and uncoordinated behaviors are what establish the order of the system as a whole. Like individuals in the real world, agents in the model have unique traits and behaviors. They interact with and influence each other. They learn

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28. Complex adaptive systems are difficult to model with traditional equation-based models because the systems are dynamic and nonlinear. Agent-based models are generally regarded as a better way to capture the dynamics of systems created by interacting decision makers. *See* H. Van Dyke Parunak, Robert Savit & Rick L. Riolo, *Agent-based Modeling vs. Equation-based Modeling: A Case Study and User Guide*, *in* Proceedings of Multi-Agent Systems and Agent-Based Simulations 10–25 (Jaime S. Sichman et al. eds., 1998) (concluding that agent-based modeling is best to reflect individual choices, and equation-based modeling is best for "geographically concentrated problems driven by well-defined mathematical rules"); *see also*, Hazhir Rahmandad & John D. Sterman, *Heterogeneity and Network Structure in the Dynamics of Diffusion: Comparing Agent-based and Differential Equation Models*, 54 Mgm't Sci. 998 (2008) ("Whereas [differential equation] models assume homogeneity and perfect mixing within compartments, [agent-based] models can capture heterogeneity across individuals and in the network of interactions among them.").

from their experiences and adapt their behaviors to their environment. As a result, agent-based models can better reflect the dynamics of experience.[29]

These models have a great deal in common with the popularized "thought experiment."[30] Yet agent-based models can provide more insight than the traditional thought experiment since it retains the same mental rigor without the mental bias. Like thought experiments, agent-based models typically define special cases. Consequently, the models lie somewhere between pure mathematical theory and real-world experiments.[31]

Most tax compliance theories assume that individual taxpayer behaviors should be predictive of system-level patterns; that is, by understanding the parts, one can understand the whole. Yet, these assumptions might not accurately approximate system-level patterns that emerge from the conditional behaviors of individual taxpayers. The fact that adding up the parts results in a perceived "tax compliance puzzle" at the system level suggests that the study of the compliance-enforcement system as a whole—not decomposed into constituent parts—could lead to a more accurate understanding of the system's governing dynamics including the general effect of audits on voluntary compliance.[32] Instead of studying the parts to find the whole, beginning with the whole could be a more fruitful approach. In the end, one might find that there is no puzzle to solve.

This Article attempts insights into the effect of audits on compliance, both locally and globally, by way of an agent-based model. Like all models, the one developed here is a generalization. It does not seek to fully replicate the U.S. tax administration system, but instead to generate certain characteristic phenomena and core dynamics to help understand the effects of audits on both individual compliance decisions and system-level compliance patterns.

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29. *See* North, *A Theoretical Formalism*, *supra* note 27, at 31–32.

30. John H. Holland, *Studying Complex Adaptive Systems*, 19 J. Syst. Sci. & Complexity 1, 3 (2006) [hereinafter Holland, *Studying Complex Adaptive Systems*]. Popular examples include "Schrödinger's cat" highlighting a consequence of quantum probability that the hypothesized feline is at the same time both alive and dead in a sealed box, and "Maxwell's demon" explaining how an imaginary creature can violate the second law of thermodynamics. *See* Erwin Schrödinger, *The Present Situation in Quantum Mechanics*, 23 Naturwissenschaften 807 (1935); James Clerk Maxwell, Theory of Heat (1871); *see also*, Maxwell's Demon 2: Entropy, Classical & Quantum Information, Computing 370 (Harvey S. Leff & Andrew F. Rex eds., 2002).

31. Holland, *Studying Complex Adaptive Systems*, *supra* note 30, at 3 (noting that agent-based computational models explore the consequences of interactions in carefully-controlled settings that are typically not possible to set up in a laboratory; hence, the laboratory "resides in the head").

32. *See* E. Ahmed, A. S. Elgazzar & A. S. Hegazi, *An Overview of Complex Adaptive Systems*, 32 Mansoura J. Math. 6059, 6059–60 (2005).

This approach might very well be wrong, but with the difficulties previous theories have had in reconciling real-world data with models based only on assumed taxpayer motivations, a different—even seemingly strange—approach should be welcomed.[33] The Article proceeds with an overview of some previous theories on the relationship between audits and compliance, a description of the computational model and its elements, and finally, some possible implications of the model's results for tax policy.

II. THE PUZZLE

Since 1972, there has been an extensive and varied assortment of attempts to explain the observed levels of tax compliance.[34] A shared assumption in the literature is a self-report or audit tax system.[35] This system is popular in many countries including the United States. Simply put, a self-report or audit system relies on individuals to assess the tax they owe by way of a recurring—usually annual—report to the tax authorities, and to timely pay the proper tax due. The tax authority regularly audits a very small sample of these reports and assesses additional penalties against taxpayers who underreport tax.[36] Since revenues resulting from audits cost the tax authority money and revenues from voluntary compliance do not, governments have an interest in minimizing the former while maximizing the latter. A self-report or audit system is usually more profitable than a direct monitoring system due to the costs of checking hundreds of millions of tax returns every year.[37]

Because of the self-report or audit assumption, a taxpayer's decision whether to file accurate reports with the tax authority is one made under

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33. *Cf.* Erwin Schrödinger, *An Undulatory Theory of the Mechanics of Atoms and Molecules*, 28 PHYSICAL REV. 1049, 1049–50 (1926) (suggesting that his admittedly-extreme theory that material points are nothing but wave systems was "not only not dangerous but even desirable" given that the theories to date had led to "grave difficulties" in atomic mechanics).

34. Although Allingham and Sandmo's 1972 model is generally regarded as the first theoretical analysis of taxpayer behavior, the study of tax compliance began a few years earlier. *See* Richard D. Schwartz & Sonya Orleans, *On Legal Sanctions*, 34 U. CHI. L. REV. 274 (1967).

35. For more detail on the self-report/audit model in general, see Jennifer F. Reinganum & Louis L. Wilde, *Income Tax Compliance in a Principal-Agent Framework*, 26 J. PUB. ECON. 1 (1985), and Kim C. Border & Joel Sobel, *Samurai Accountant: A Theory of Auditing and Plunder*, 54 REV. ECON. STUD. 525 (1987).

36. The tax authorities also assess penalties against taxpayers who do not timely pay the tax due in full; however, issues of underpayment are beyond the scope of this Article.

37. *See, e.g.*, INTERNAL REVENUE SERV., INTERNAL REVENUE SERV. DATA BOOK, 2011, tbl. 9a (reporting approximately 141,000,000 individual income tax returns filed for taxable year 2010).

uncertainty.[38] Taxpayers know neither the information the tax authority has about their tax situation (e.g., accurate amounts of income, deductions, credits, etc.) nor the exact probability that any underreported tax will be discovered by way of an audit. Given this setup, most theorists seek first the motivations driving individual compliance decisions and then attempt to scale this behavior from that of the specific, hypothesized taxpayer to the general taxpayer population. Since most theorists also recognize that human incentives can be diverse, the trend in explaining known tax compliance data is to develop more extensive models that make more and more room for the multiform motivations of individuals. Even the recent trend toward modeling group behavior based on social norms is ultimately centered on the intentions of the individuals within a group who are each separately motivated by these societal standards.[39] The idea is that if one can understand all the complex motivations and incentives of the individual taxpayer, an aggregation of these should explain the macro-level compliance data.

The proposition of this Article is that observed tax compliance rates are not explainable by more commodious models of human incentives and behavioral rules. To the contrary, complex tax compliance trends can result from extremely simple—even overly-simple—individual behavioral rules in the context of iterative interactions between taxpayers and the auditing forces of the tax authority. As a result, one can conclude that a tax system such as that in the United States is more than—or at least different than—the sum of individual behavioral rules.

Still, these rules remain the generating force underlying the emergent properties of the system. For this reason, it is important to review the literature that attempts to explain tax compliance as a function of intentional individual decisions and the motivations behind those decisions. The remainder of this Part reviews three theoretic explanations for voluntary tax compliance: deterrence theory, behaviorist theory, and the perceived strength of a tax authority's auditing force.[40]

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38. *See* Allingham & Sandmo, *Income Tax Evasion*, *supra* note 6, at 324. This uncertainty does not concern the taxpayer's uncertainty over the proper interpretation of complex tax laws, although such confusion certainly reflects reality.

39. *See* Alm, *Measuring*, *supra* note 6, at 74–75 (predicting that the focus of new theories for tax noncompliance will shift from modeling individual behavior toward modeling group behavior). For additional information on group theory, see *infra* Part II.B.

40. The literature reviewed here focuses on that which is relevant to the theory espoused. For a more complete review of the tax compliance literature, see Slemrod & Yitzhaki, *Tax Avoidance*, *supra* note 6, at 1423, James Alm, *Tax Compliance and Administration*, *in* HANDBOOK ON TAXATION 741 (W. Bartley Hildreth & James A. Richardson eds., 1999), and Andreoni et al., *Tax Compliance*, *supra* note 6.

A.   Deterrence Theory

One of the first tax compliance theories was articulated by Michael Allingham and Agnar Sandmo in 1972 and focused on compliance as a byproduct of deterrence.[41] It was an application of Gary Becker's 1968 "economics-of-crime" model to the tax compliance discipline.[42] In this model, tax compliance is essentially a gamble.[43] Taxpayers are motivated by the desire to maximize their expected utility given the punishment for cheating and the probability of getting caught. Two years later, Shlomo Yitzhaki extended the model by showing that if the punishment for cheating is proportional to the underreported *tax*, not just the underreported *income*, then the tax rate becomes a trivial consideration to the gamble.[44]

In a nutshell, deterrence theory holds that tax compliance depends on direct enforcement. The degree of this relationship is the focus of some theoretical disagreement. A deterrence "purist" might conclude that individuals only comply because they are afraid of getting caught.[45] Many theorists find this hardline difficult to toe. Without admitting that deterrence plays no role in an individual's intention to comply, such skeptics minimize the degree to which tax compliance depends on enforcement.[46] For example,

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41.   Allingham & Sandmo, *Income Tax Evasion*, *supra* note 6, at 331–37.

42.   Becker, *Crime and Punishment*, *supra* note 6.

43.   The renowned polymath Daniel Bernoulli was one of the first theorists to formalize a sort of paleo-expected utility model for playing games of chance. Although his original paper was published in 1738, a modern translation can be found in Daniel Bernoulli, *Exposition of a New Theory on the Measurement of Risk*, 22 ECONOMETRICA 23, 24 (1954). The driving intuition behind the Allingham/Sandmo model is that tax evasion is akin to a game of chance. Bernasconi, *Tax Evasion*, *supra* note 23, at 123 ("Evading tax is like gambling. This was the central intuition of Allingham and Sandmo . . . ."). More generally, however, most of the literature attributes expected utility theory to John von Neumann and Oskar Morgenstern, sometimes referred to as the Von Neumann-Morgenstern utility theorem. *See* JOHN VON NEUMANN & OSKAR MORGENSTERN, THEORY OF GAMES AND ECONOMIC BEHAVIOR (1947).

44.   Yitzhaki, *Income Tax Evasion*, *supra* note 6. As a result of this extension, the traditional deterrence theory approach to tax compliance is often referred to as the Allingham/Sandmo/Yitzhaki model.

45.   For a game theoretic model that internalizes enforcement in an iterative compliance-enforcement game, see Michael J. Graetz, Jennifer F. Reinganum & Louis F. Wilde, *The Tax Compliance Game: Toward an Interactive Theory of Law Enforcement*, 2 J.L. ECON. & ORG. 1 (1986).

46.   *See, e.g.*, Feld & Frey, *Trust Breeds Trust*, *supra* note 16, at 90 (asserting that it is "more difficult to account for tax compliance in terms of expected punishment"); Alm et al., *Why Do People Pay Taxes*, *supra* note 14, at 21–22 (concluding that enforcement does have a small and nonlinear impact on compliance, but any deterrent effect diminishes as the audit rate increases).

James Alm points out that the percent of individual income tax returns subject to a rigorous audit are relatively small in the United States, averaging about one percent of all individual returns filed.[47] Consequently, a purist deterrence analysis of an individual's compliance motivations should result in almost all returns containing underreported tax, which is inconsistent with observable compliance in the United States.[48] Although compliance rates are difficult to estimate with precision, it is clear that not all individual taxpayers are cheating on their returns.[49] Additionally, critics of deterrence theory often cite experimental results indicating that the impact of audit enforcement on compliance is nonlinear with the deterrent effect of high audit rates on compliance eventually diminishing.[50] Alm finds it implausible that government enforcement accounts for the relatively high levels of U.S. voluntary compliance.[51] The deterrence model alone is too shallow to explain the compliant behavior of taxpayers and, according to Alm, one is left puzzled by the deterrence theory as to why *any* taxpayer voluntarily complies.[52]

Others disagree and find the so-called "tax compliance puzzle" at least partially solvable by deterrence. For example, Joel Slemrod points to empirical evidence supporting the contention that deterrence plays a significant role in tax compliance.[53] He finds the "cross-sectional variation in noncompliance rates across types of income and deductions" compelling

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47. Alm & McKee, *Audit Certainty*, *supra* note 22, at 804 ("[A] standard result [of deterrence theory models] is that, given actual audit and fine rates, most people should rationally choose to cheat.").

48. *See* Mark D. Phillips, *Reconsidering the Deterrence Paradigm of Tax Compliance*, *in* I.R.S. PUB. 1500, NEW PERSPECTIVES ON TAX ADMINISTRATION: AN IRS-TPC RESEARCH CONFERENCE 99 (2011) [hereinafter Phillips, *Reconsidering the Deterrence Paradigm*], citing Erich Kirchler, Stephan Muehlbacher, Barabara Kastlunger & Ingrid Wall, *Why Pay Taxes? A Review of Tax Compliance Decisions*, *in* DEVELOPING ALTERNATIVE FRAMEWORKS FOR EXPLAINING TAX COMPLIANCE (James Alm, Jorge Martinez-Vazquez & Benno Torgler eds., 2010) ("[T]hough the [deterrence theory] provides useful tools for tax policy . . . empirical evidence for its validity is rather weak.").

49. *See* Bernasconi, *Tax Evasion*, *supra* note 23, at 128 ("This is the puzzle of tax compliance. Although incontrovertible evidence on the extent of tax evasion is hard to obtain, it is clear that not everybody cheats . . . .").

50. Alm et al., *Why Do People Pay Taxes*, *supra* note 14.

51. Alm, *Measuring*, *supra* note 6, at 61.

52. James Alm, *What is an "Optimal" Tax System?*, *in* 1 TAXATION: CRITICAL PERSPECTIVES ON THE WORLD ECONOMY 245 (Simon R. James ed., 2002).

53. *See*, *e.g.*, Slemrod, *Cheating Ourselves*, *supra* note 8, at 37 (finding such dismissive arguments against the positive impact of enforcement on compliance unpersuasive).

evidence in support of this.[54] According to Slemrod, the work of Steven Klepper and Daniel Nagin from more than twenty years ago suggests that, "across line items, noncompliance rates are related to proxies for the traceability, deniability, and ambiguity of items, which are in turn related to the probability that evasion will be detected and punished."[55] He is unpersuaded by the "dismissive" argument that the high compliance and low audit rates in the United States presents a significant problem for deterrence theory.

> [T]he low average audit coverage rate vastly understates the chances that the average dollar of unreported net income would be detected. A wage or salary earner whose employer submits the employee's taxable income and Social Security number electronically to the Internal Revenue Service, but who does not report that income on his own personal return, will be flagged for further scrutiny with a probability much closer to 100 percent than to 1 percent. Thus, the low rates of noncompliance for labor income . . . by no means patently contradict the deterrence theory.[56]

A recent and interesting variant of deterrence theory is Sarah Lawsky's "uncertainty model," which takes into account a taxpayer's degree of uncertainty about the probability of audit, as well as a taxpayer's overall attitude toward uncertainty itself.[57] Her theory conceives of an individual

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54. *Id*. ("Line item by line item, there is a clear positive correlation between the rate of compliance and the presence of enforcement mechanisms such as information reports and employer withholding.").

55. *Id*., citing Steven Klepper & Daniel Nagin, *The Anatomy of Tax Evasion*, 5 J. LAW, ECON., & ORG. 1 (1989).

56. Slemrod, *Cheating Ourselves*, *supra* note 8, at 39. Still, theorists such as Slemrod cannot be seen as deterrence purists. For one, they conclude that the tax compliance data strongly suggest that individual compliance decisions are based on more than just cold economic calculations even if enforcement is a primary factor that motivates compliance. *Id*. ("Nonetheless, considerable experimental (and anecdotal) evidence suggests that the story of tax evasion involves more than amoral cost-benefit calculation."). Secondly, theorists like Slemrod have contributed significantly to alternative theories of taxpayer motivation, such as normative theories involving concepts of fairness and tax incidence. *Id.* at 41–45.

57. Sarah B. Lawsky, *Modeling Uncertainty in Tax Law*, 65 STAN. L. REV. 241 (2013) [hereinafter Lawsky, *Modeling Uncertainty*]; *see also*, Terrence R. Chorvat, *Ambiguity and Income Taxation*, 23 CARDOZO L. REV. 617, 618–19 (2002). In many ways Lawsky's uncertainty model is reminiscent of the subjectivist theory of probabilities made famous in the nineteenth and early twentieth century. *See, e.g.*, PIERRE SIMON LAPLACE, A PHILOSOPHICAL ESSAY ON PROBABILITIES (1814); JOHN M. KEYNES, A TREATISE ON PROBABILITY (1921); FRANK P. RAMSEY, THE

taxpayer's decision whether to comply with the tax laws as one based on how unsure the taxpayer is about the chance of getting caught and the taxpayer's comfort level with the risk of not knowing these probabilities with certainty (as opposed to not knowing merely the outcomes).[58] The uncertainty model seeks to supplement, but not supplant, the traditional considerations of deterrence such as the probability of getting caught if noncompliant, the penalty for noncompliance, and the taxpayer's comfort levels with the risk associated with unknown outcomes. The difference for Lawsky is that her model addresses uncertainty in the sense of unknown *probabilities*, as opposed to traditional theories that discuss uncertainty by focusing on unknown *outcomes*.[59]

B.   *Behaviorist Theory*

In part because of the theoretical disagreement over the degree to which enforcement motivates individual tax compliance decisions, expansions on the traditional deterrence model have been multiform. Some have kept Becker's expected utility notion as a theoretical core and incorporated additional elements that still orbit the "economics-of-crime" corpus.[60] Others have expanded the investigation into what motivates individual choice in tax compliance decisions by looking at the "behavioral economics" that other social sciences consider when investigating the motivations behind individual and group behavior. Most behavioral theories concerning individual motivations fall under the rubric of "non-expected utility theory," while those concerned with group behaviors fall under the "social interactions theory" heading.[61]

FOUNDATIONS OF MATHEMATICS AND OTHER LOGICAL ESSAYS 156–98 (1931); RUDOLF CARNAP, LOGICAL FOUNDATIONS OF PROBABILITY (1950) (coining the terms *probability 1* and *probability 2* for subjective and frequency probabilities, respectively); LEONARD J. SAVAGE, THE FOUNDATIONS OF STATISTICS (1954); Bruno de Finetti, *Foresight: Its Logical Laws, Its Subjective Sources*, *in* STUDIES IN SUBJECTIVE PROBABILITY 93–158 (Henry E. Kyburg & Howard E. Smokler eds., 1964) (originally published in 1937).

58.   Lawsky, *Modeling Uncertainty*, *supra* note 57, at 244–45.

59.   *Id*. at 244 n.10.

60.   For a detailed discussion on these and other expected utility extensions, see TORGLER, MORAL SUASION, *supra* note 17, COWELL, CHEATING THE GOVERNMENT, *supra* note 6, Slemrod, *Cheating Ourselves*, *supra* note 8, Sandmo, *The Theory of Tax Evasion*, *supra* note 15, Slemrod & Yitzhaki, *Tax Avoidance*, *supra* note 6, at 1423, and Andreoni et al., *Tax Compliance*, *supra* note 6.

61.   Although this Article lists non-expected utility theory and social interactions theory under the same subheading, it is important to note that the two theories are often at odds with each other. *See, e.g*., Bernasconi, *Tax Evasion*, *supra* note 23, at 133 (The results of his non-expected utility model "shed doubt on the importance of social factors, like ethical norms or moral sentiments, in explaining

The impetus for most behavioral models has been the general frustration of theorists with the deterrence theory approach to explaining the intentional actions of individuals.[62] Psychological and neurological evidence strongly suggest that people often misperceive rationally objective measures when faced with decisions.[63] This evidence suggests taxpayers are more human than Vulcan. It is not simply the case that people do not always make the most rational choice available. It appears there are certain psychological and neurological limitations that make it so people sometimes *cannot* choose that which objectively maximizes one's utility.[64]

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observed rates of tax compliance. This does not mean that a taxpayer necessarily attaches no moral value to compliance. But it means that one need not appeal to moral sentiments or ethics to obtain compliance").

62.   *See, e.g*., Daniel Kahneman & Amos Tversky, *Prospect Theory: An Analysis of Decision under Risk*, 47 Econometrica 263 (1979) (spending almost half of the paper criticizing expected utility theory before presenting their alternative theory); Bernasconi, *Tax Evasion*, *supra* note 23, at 133 (noting the wide variance in deterrence models leaves one wondering if expected utility models are of any value at all); John D. Hey & C. Orme, *Investigating Generalizations of Expected Utility Theory Using Experimental Data*, 62 Econometrica 1291 (1994) (concluding likewise).

63.   In reviewing the literature, James Alm notes that behavioral models recognize that self-interest is clearly not the sole motivator of intentional action. Instead, decisions are also influenced by collective notions such as "social norms, social customs, fairness, trust, reciprocity, tax morale, and even patriotism, as well as by individual notions of guilt, shame, morality, altruism, or alienation." Alm, *Measuring*, *supra* note 6, at 63. Nigar Hashimzade, Gareth D. Myles, and Binh Tran-Nam review recent models that apply behavioral economics to the individual taxpayer's compliance choice. Nigar Hashimzade, Gareth D. Myles & Binh Tran-Nam, *Application of Behavioural Economics to Tax Evasion*, 27 J. Econ. Surveys 941 (2013). *See also* Michael Wenzel, *Motivation or Rationalisation? Causal Relations between Ethics, Norms and Tax Compliance*, 26 J. Econ. Psychol. 491 (2005).

64.   As an example, there is evidence of a conflict between the *intrinsic* and *extrinsic* motivations of an individual. Under intrinsic motivations, a taxpayer might voluntarily comply with tax obligations because of a motivator such as civic virtue, duty, or patriotism. Extrinsic motivation could cause the taxpayer to comply because of threat of punishment. Bruno Frey suggests that increasing extrinsic motivation with policies such as increased penalties might "crowd out" intrinsic motivation by making people feel that they voluntarily comply with tax laws because they have to, instead of wanting to comply. Bruno S. Frey, *A Constitution for Knaves Crowds Out Civic Virtues*, 107 Econ. J. 1043 (1997). *See generally* Amos Tversky & Daniel Kahneman, *Judgment under Uncertainty: Heuristics and Biases*, 185 Sci. 1124 (1974).

Behavioral economics also include a "social interactions theory" that focuses more on the group influencing individual decisions.[65] Essentially, a social norm is a behavioral pattern that is judged in a similar way by others within a community and sustained, at least in part, by social approval—or disapproval of a pattern judged negatively by the group. This theory holds that one is essentially an unwitting victim to what parents might refer to as "good peer pressure." If those in the individual's group behave according to some socially accepted norm, then the individual will behave accordingly. Likewise, if others do not behave according to the norms, then the individual will not follow the norms.

Social norms can be, but are not always, synonymous with concepts such as social customs, ethical norms, tax morale, appeals to patriotism, and feelings of altruism, morality, guilt, and alienation.[66] This branch of behavioral theory suggests that individuals will comply with the tax laws as long as they believe that compliance is the social norm. If noncompliance becomes both ubiquitous and socially acceptable, the social norm of

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65. The literature is replete with applications of social interaction theory and various compliance behaviors. *See, e.g.*, Lior Jacob Strahilevitz, *How Changes in Property Regimes Influence Social Norms: Commodifying California's Carpool Lanes*, 75 IND. L.J. 1231 (2000) (traffic rules); Dan M. Kahan & Eric A. Posner, *Shaming White-Collar Criminals: A Proposal for Reform of the Federal Sentencing Guidelines*, 42 J.L. & ECON. 365 (1999) (criminal sentencing); Elizabeth S. Scott & Robert E. Scott, *A Contract Theory of Marriage*, *in* THE FALL AND RISE OF FREEDOM OF CONTRACT 201 (F. H. Buckley ed., 1999) (family law); Michelle J. White, *Why It Pays to File for Bankruptcy: A Critical Look at the Incentives under U.S. Personal Bankruptcy Law and a Proposal for Change*, 65 U. CHI. L. REV. 685 (1998) (bankruptcy); Lisa Bernstein, *Merchant Law in a Merchant Court: Rethinking the Code's Search for Immanent Business Norms*, 144 U. PA. L. REV. 1765 (1996) (contract and commercial law); Richard H. McAdams, *Cooperation and Conflict: The Economics of Group Status Production and Race Discrimination*, 108 HARV. L. REV. 1003 (1995) (civil rights law). *See also* JON ELSTER, THE CEMENT OF SOCIETY: A STUDY OF SOCIAL ORDER (1989); Jon Elster, *Social Norms and Economic Theory*, 3 J. ECON. PERSPECTIVES 99 (1989).

66. For examples of social interactions theory as applied to tax evasion, see Frank A. Cowell & James P. F. Gordon, *Unwillingness to Pay: Tax Evasion and Public Good Provision*, 36 J. OF PUB. ECON. 305 (1988) (fairness), James P. F. Gordon, *Individual Morality and Reputation Costs as Deterrents to Tax Evasion*, 33 EUROPEAN ECON. REV. 797 (1989) (trust), Gareth D. Myles & Robin A. Naylor, *A Model of Tax Evasion with Group Conformity and Social Customs*, 12 EUROPEAN J. POL. ECON. 49 (1996) (reciprocity), Youngse Kim, *Income Distribution and Equilibrium Multiplicity in a Stigma-Based Model of Tax Evasion*, 87 J. PUB. ECON. 1591 (2003) (social customs), Bernard Fortin, Guy Lacroix & Marie-Claire Villeval, *Tax Evasion and Social Interactions*, 91 J. PUB. ECON. 2089 (2007) (tax morale), and Christian Traxler, *Social Norms and Conditional Cooperative Taxpayers*, 26 EUR. J. POL. ECON. 89 (2010) (patriotism).

compliance disappears and the taxpayer has no further incentive to voluntarily comply. Note that the disappearance of the old norm is not the same as the creation of a new norm to proactively not comply with the tax laws. The disappearance creates a void, not a new standard. This theory suggests that the compliance decisions of an individual taxpayer are influenced by the nature of the social interactions one has with other taxpayers in the group with which one identifies.[67]

Eric Posner offers a twist on the social norm literature by concluding that signaling, not norms, drives individual tax compliance behavior.[68] Although the impetus for his theory is to explain social norms as they relate to tax compliance, Posner concludes that a taxpayer's decision to comply is based on how the taxpayer believes others will perceive and judge such actions (the "signals") instead of norms of the group being internalized to cause feelings of guilt or remorse as a consequence of a decision not to comply.[69]

Slemrod goes even further and regards these social behavioral theories as a form of "reciprocal altruism" where the behavior of an individual taxpayer "depends on the behavior, motivations, and intentions not of any subset of other individuals, but of the government itself."[70] Contrary to Alm, however, he determines that the data shows little correlation between government attempts to influence social norms (i.e., outside of deterrence policies) and levels of taxpayer compliance.[71]

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67. Alm concludes that these models "generate the 'correct' comparative statics responses" because the models "break the link between evasion and tax rates in payoffs." *See* Alm, *Measuring*, *supra* note 6, at 64. He also concludes that behavioral models accurately predict compliance rates if they allow for subjective probabilities, although the cost of these theoretical benefits is complexity in the model. *Id*. For a discussion of subjective probabilities and their application to the tax compliance domain, see Sarah B. Lawsky, *Probably? Understanding Tax Law's Uncertainty*, 157 U. PENN. L. REV. 1017 (2009).

68. ERIC A. POSNER, LAW AND SOCIAL NORMS (2000); Eric A. Posner, *Law and Social Norms: The Case of Tax Compliance*, 86 VA. L. REV. 1781 (2000).

69. *Id*. at 1818–19.

70. Slemrod, *Cheating Ourselves*, *supra* note 8, at 40; *see also* Dhami & al-Nowaihi, *Why Do People Pay Taxes*, *supra* note 16 (arguing that a social framework based on Tversky and Kahnemann's prospect theory that also takes into account a "stigma cost" for discovered evasion more accurately explains the level of observed tax compliance).

71. Slemrod, *Cheating Ourselves*, *supra* note 8, at 40–41 (citing two recent studies finding moral suasion has no more than a negligible effect on compliance); *see also* Marsha Blumenthal, Charles Christian & Joel Slemrod, *Do Normative Appeals Affect Tax Compliance? Evidence from a Controlled Experiment in Minnesota*, 54 NAT'L TAX J. 125 (2001); Torgler, *Moral Suasion*, *supra* note 17.

C. Perceived Enforcement Strength

Whereas Posner argues that taxpayers voluntarily comply to signal socially-acceptable behavior in a community, some argue that the tax authority is also concerned with signaling as a means of motivating voluntary compliance. This third theory views a compliance incentive as the taxpayers' perceived strength of the tax authority's auditing function. This model differs from traditional deterrence theory in that it does not depend on the calculated probability of a noncompliant taxpayer experiencing an audit. Rather, it focuses on the taxpayers' perception of the government as a "strong" auditor, meaning the tax authority has a reputation both for accurately selecting tax returns for audit that contain noncompliance, and the audits themselves are very effective at discovering noncompliance on an audited tax return.[72] In other words, taxpayers perceive that the tax authority's audit strength makes it very difficult to get away with underreporting tax.[73]

Maciej Kotowski, David Weisbach, and Richard Zeckhauser argue that such a reputation-based compliance incentive is critical to a tax system based on a self-report or audit strategy.[74] A strong tax authority need not have the most auditors, just the best—or at least they must be perceived as the best by the taxpayer population. Consequently, a tax authority perceived as "strong" might actually have a lower audit rate than a tax authority perceived as "weak" since the strong authority need not employ as many auditors. In fact, a high audit rate might actually be an attempt by a "weak" authority to appear "strong" by employing more auditors.[75]

The crux of the "perceived strength" argument is that there exists a two-way information asymmetry.[76] Taxpayers know their true tax liability, the tax authority does not.[77] There is also a reciprocal epistemological problem. Tax authorities know their true auditing strength, taxpayers do not.

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72. Kotowski et al., *Audits as Signals*, *supra* note 4, at 180. The IRS appears to meet these criteria—strong audit selection and strong detection of underreporting—based on the published enforcement data of the IRS Statistics of Income division. *See* Manhire, *Toward a Perspective-Dependent Theory*, *supra* note 23, at 636–37 (discussing the methodology for calculating the probability of the IRS detecting underreported tax if it selects a return for audit).

73. Kotowski et al., *Audits as Signals*, *supra* note 4, at 181–82.

74. *Id*. at 183; *see also* A. Mitchell Polinsky & Steven Shavell, *The Theory of Public Enforcement of Law*, *in* 1 HANDBOOK OF LAW AND ECONOMICS 403, 405–54 (A. Mitchell Polinsky & Steven Shavell eds., 2007).

75. Kotowski et al., *Audits as Signals*, *supra* note 4, at 194–95.

76. *Id*. at 180–81; *see also* Mark B. Cronshaw & James Alm, *Tax Compliance with Two-Sided Uncertainty*, 23 PUB. FIN. Q. 139, 161–63 (1995); Inés Macho-Stadler & J. David Pérez-Castrillo, *Auditing with Signals*, 69 ECONOMICA 1, 10–12 (2002).

77. Kotowski et al., *Audits as Signals*, *supra* note 4, at 180–81.

When making compliance decisions, taxpayers must rely on heuristics—or mental shortcuts—as to the strength of the tax authority and, therefore, their estimated probability of being audited if they underreport tax.[78] Taxpayers can only estimate what the tax authority actually knows.

Kotowski, Weisbach, and Zeckhauser argue that it is this signaling, and the taxpayer's interpretation of the authority's signal, that drives an individual taxpayer's choice to voluntarily comply with the tax laws in a self-report or audit system. The tax authority's overall reputation for audit strength is ultimately more critical than the number of audits the authority performs. According to the theory, the tax authority's perceived strength, and not the probability of detection based on the audit rate, should be the paramount focus of any government seeking to maximize voluntary compliance and minimize audit costs.[79]

D.   Conclusions from the Literature

The United States has chosen a tax administration policy of voluntary compliance and assessment reinforced by occasional audit enforcement. An extreme alternative to this policy would be for the tax authority to individually monitor and assess the tax liability of every individual subject to its jurisdiction. Even if one assumes that such an extreme alternative would eliminate tax noncompliance—which it might not—the direct and indirect administrative costs associated with carrying out that policy would be crippling. It certainly would not be ideal no matter how one defines the term.[80] Therefore, tax noncompliance is a reality inherent to a self-report or audit tax policy. Since tax noncompliance will always exist to some degree, policies should be concerned with either maximizing voluntary compliance, minimizing audit costs, or—to the extent possible—both.

An intuitive solution to noncompliance is to increase the audit rate since—as the IRS itself suggests—enforcement levels are directly associated with compliance levels.[81] Yet, such a conclusion remains instinctual conjecture without a better understanding of the dynamics governing the

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78.   *Cf.* Manhire, *Toward a Perspective-Dependent Theory*, *supra* note 23, at 643–45.

79.   This might explain why the IRS publicizes multiple tax fraud cases it has successfully prosecuted immediately prior to the April 15 tax return filing deadline. *See* Joshua D. Blank & Daniel Z. Levin, *When Is Tax Enforcement Publicized?*, 30 VA. TAX REV. 1, 15–18 (2010).

80.   *See* Jonathan Baldry, *Income Tax Evasion and the Tax Schedule: Some Experimental Results*, 42 PUB. FIN. 357 (1987).

81.   *See* sources cited *supra*, note 10 (citing official testimonies of Commissioners and the National Taxpayer Advocate).

U.S. self-report or audit strategy.[82] This understanding can assist tax policymakers in their goal of maximizing voluntary compliance and minimizing audit costs, since it is possible that the effects of enforcement on compliance are not as direct as deterrence theory suggests.

One can conclude from the literature that although theorists disagree as to the degree of influence enforcement has on compliance, all agree that deterrence in one form or another remains a key motivation when it comes to *individual* compliance decisions. This appears to be so whether the theory is rational, behavioral, or reputational. Even empirical evidence by those who support a behaviorist theory suggests that individual taxpayers comply more often when immediately faced with a higher probability of audit.[83] This sensitivity to increased audit probability can be due to a rational calculation of costs and benefits based on specific audit probability, the aversion to do something "wrong" in the eyes of others, or the fear that the overall (but not specific) probability of "getting caught" is greater with a strong tax authority. All three act as possible deterrents against tax noncompliance, or, put another way, all three are possible motivations for voluntary compliance.

One can further conclude from the disagreement in the literature and the known compliance data in the United States that instead of the hypothesized individual taxpayer beginning in a noncompliant "state of nature" and then transitioning to compliance only after realizing the heightened threat of government enforcement, it is the other way around.[84]

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82. Theorists such as Yitzhaki and Slemrod argue that this intuition is incorrect. *See* Joel Slemrod & Shlomo Yitzhaki, *The Optimal Size of a Tax Collection Agency*, 89 SCANDINAVIAN J. ECON. 183 (1987). They claim the additional investment in audit enforcement should be equal to the increased marginal *social benefit* of reduced tax noncompliance. Slemrod, *Cheating Ourselves*, *supra* note 8, at 43. Not surprisingly, measuring social benefit well enough to determine an increase or decrease is extremely difficult, thereby making the task of correlating an increase in social benefit to an increase in audit enforcement all the more difficult. Slemrod readily admits this difficulty. *Id.* For this reason, Yitzhaki and Slemrod's recommendation seems relegated to the realm of philosophy until such time as social benefit can be adequately measured.

83. Alm & McKee, *Audit Certainty*, *supra* note 22, at 811 (finding that greater certainty of audit reduces noncompliance). Slemrod, *Cheating Ourselves*, *supra* note 8, at 38 ("[T]here has been no compelling empirical evidence addressing how noncompliance is affected by the *penalty* for detected evasion, as distinct from the *probability* that a given act of noncompliance will be subject to punishment.") (emphasis added). *Cf.* Manhire, *Toward a Perspective-Dependent Theory*, *supra* note 23, at 645–50.

84. For sources of the allusion "state of nature," see THOMAS AQUINAS, DE VERITATE, Q. 19, Art. 1, A. 13 (1230–1244); THOMAS HOBBES, LEVIATHAN, Ch. XIII–XIV (1651); DAVID HUME, A TREATISE OF HUMAN NATURE, Book III, Part II, § II (1739); JOHN B. RAWLS, A THEORY OF JUSTICE (1971) (replacing "state of nature" with "original position").

Compliance is, perhaps, the original position and noncompliance the exception.[85] Although tax noncompliance is a perpetual reality for any self-report or audit strategy, this does not necessarily mean noncompliance is the norm.[86] Instead of asking why taxpayers comply, perhaps the more relevant question is why—and under what conditions—do taxpayers choose noncompliance, all the while noting that certain deterrents can drive the noncompliant taxpayer back to a state of compliance, even if temporarily.

This Article's purpose is to better understand the governing dynamics of a self-report or audit system, and how these dynamics influence voluntary tax compliance. The Article assumes that any successful model of tax compliance must incorporate the conclusions from the literature that deterrents generally affect individual taxpayer compliance decisions and that most taxpayers tend toward compliance even in the absence of directly observable deterrents. This means the tendency toward compliance might result from social norms, perceived tax authority strength, and a number of other non-deterrent motivations.

III.   THE MODEL

The tax compliance model proposed here attempts to take into account deterrence theory and its variants, behaviorist theory, and perceived enforcement strength. It is based on Joshua Epstein's agent-based computational model of civil violence.[87] The model is a two-dimensional

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85.   *Cf.* Benno Torgler, *Speaking to Theorists and Searching for Facts: Tax Morale and Tax Compliance in Experiments*, 16 J. ECON. SURVEYS 657, 658 (2002) ("Tax compliance is the finally observed action. Complying or not [*sic*] is not only a function of opportunity, tax rates, and probability of detection, but also a function of an individual's willingness to comply or evade.").

86.   This is further supported by psychological experiments on human obedience to authority, such as the classic yet controversial experiments by Stanley Milgram that began in 1961. Stanley Milgram, *Behavioral Study of Obedience*, 67 J. ABNORM. PSYCHOL. 371 (1963) [hereinafter Milgram, *Behavioral Study of Obedience*] ("Obedience serves numerous productive functions. Indeed, the very life of society is predicated on its existence.").

87.   Joshua M. Epstein, *Modeling Civil Violence: An Agent-based Computational Approach*, 99 PROCEEDINGS NAT'L ACADEMY SCI. 7243 (2002) [hereinafter Epstein, *Modeling Civil Violence*]. Epstein's computational project models a decentralized rebellion against a central authority and takes place on a two-dimensional lattice. If the level of political grievance against the central authority of the citizens ("agents") is beyond a certain threshold, and the agents' perceived risk is low enough, the agents openly rebel. A second population acting on behalf of the central authority ("cops") seeks to suppress the rebellion. The cops move about the lattice randomly and arrest people who are actively rebelling. The software programming used to simulate and modify the original Epstein model for this Article was designed by Uri Wilensky of Northwestern University's Center for Connected

matrix (lattice structure) that analyzes two categories of interacting populations: taxpayers and examiners.

In the model, taxpayers are those required to comply with the tax laws. Some comply, others do not. Examiners are the enforcement agents of the government tax authority.[88] Examiners seek out and audit taxpayers who are not compliant with the tax laws. Taxpayers and examiners each have a single, simple rule of behavior. These simple rules are discussed in more detail, below. Only the taxpayer has a conditional rule—meaning an "if/then" action. The following describes the model's specifications for taxpayers and examiners.

A.   Taxpayer Mechanics

In the model, as in the world of experience, a taxpayer's compliance can be in one of two states: voluntarily compliant (*V*) or noncompliant (*N*). The model begins with a population of taxpayers who are each in one of these two states and then plays out interactive scenarios between taxpayers and examiners to see what might drive a taxpayer to transition (or flip) from one state to the other.

The model assumes that the decision to be compliant or noncompliant—and the further decision to flip from one state to another—depends on a simple rule constructed from elements of deterrence theory, behaviorist theory, and perceived enforcement strength theory. These elements establish a unique *compliance threshold* (θ) for each taxpayer. When events both internal and external to the taxpayer drive certain factors above the individual's compliance threshold, the taxpayer becomes noncompliant. When these events drive factors below or even right up to the threshold level, taxpayers become (or remain) compliant. Again, these compliance decisions are dictated by a simple, conditional rule of action for every taxpayer, the elements of which are next discussed in detail.

1.   Actionable Tax Grievance

The tax compliance model assumes that each taxpayer has a unique measure of *actionable tax grievance* (*G*). Simply stated, one's tax grievance is a personal feeling of resentment over being taxed. This grievance need not be ideologically based. The grievance is actionable in that it becomes a cause

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Learning and Computer-Based Modeling. *See* Uri Wilensky, *Rebellion*, NetLogo (2004), http://ccl.northwestern.edu/netlogo/models/Rebellion.

88.   Because similar models use the term "agent" to describe any actor, this Article uses the label "examiner" instead of "agent" to avoid confusion. This term is technically correct since what the general population calls IRS "audits" are technically "examinations" of tax returns.

for practical demonstration in the world, regardless of whether the basis for this practical action is real or imagined.[89] In other words, tax grievance is actionable in that the taxpayer can act upon this grievance through intentional noncompliance with the tax laws.

The model presents an extremely simple treatment of a taxpayer's actionable tax grievance with two highly idealized components: *tax disdain* (*D*) and the *perceived enforcement strength* of the tax authority (*S*). Tax disdain is the taxpayer's innate level of contempt for the idea of being taxed by any government force—the internal part of any actionable grievance. For the model, tax disdain is not specific to the government's current laws, tax administration policies, or political figures in certain official positions. The model assumes tax disdain to be dissimilar across all taxpayers, meaning everyone has their own unique level of tax disdain. Each individual taxpayer's tax disdain value is drawn from a discrete uniform distribution on the interval (0,1), meaning one can have a measure of tax disdain anywhere between zero (0) and one (1), and any one measure for a specific taxpayer is just as likely as any other measure for another taxpayer.

In general, one's personal and internal disdain for taxes, by itself, is not a cause for tax noncompliance.[90] Another important component of actionable tax grievance is the perceived strength of the government tax authority (*S*), as articulated by Kotowski, Weisbach, and Zeckhauser.[91] Whereas tax disdain is unique for each taxpayer (local), the perceived strength of the government tax authority is a shared perception among all taxpayers (global).

Perceived strength regards the tax authority's overall forte as an effective administrator—and enforcer—of the tax laws. Note that this strength has no objective measure separate from the taxpayer population perceiving it. Perceived enforcement strength is just that—a perception. The fact that it is generally shared makes it almost equivalent to the tax authority's enforcement reputation. This reputation, consistent with Kotowski, Weisbach, and Zeckhauser's hypothesis, might be a result of the tax authority's signaling of strength. For concision, the model does not comment on the cause of the perception, just that the perception of strength (shared reputation) exists. Since the perception is shared globally, the model

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89. "Actionable" is used in its most general sense and not in the strictly legal sense that one's tax grievance gives reasonable cause to take legal action against the government.

90. For example, the United States is a country historically built, in part, on tax disdain, and one might argue being "anti-tax" to some degree is part of each American's politico-genetic makeup; yet, the U.S. tax system regularly witnesses voluntary compliance rates between 80 and 85 percent.

91. *See* Kotowski et al., *Audits as Signals*, *supra* note 4, at 186.

regards the perceived strength of the government tax authority as having a shared index measure from zero (0) to one (1).[92]

This globally-applicable index of perceived tax authority strength (*S*) and each individual taxpayer's uniformly distributed level of tax disdain (*D*) together constitute the measure of actionable tax grievance (*G*) that any taxpayer might have given a set of initial conditions that are both internal and external to an individual taxpayer. For the model, the measure of actionable tax grievance is a combination of a taxpayer's level of tax disdain and the index measure of the tax authority's perceived *lack of strength* ("weakness"). If the taxpayer personally has a high level of tax disdain and the tax authority is generally regarded as weak (a low level of strength), then the taxpayer's actionable tax grievance will be high. If the level of disdain is high and the tax authority is generally regarded as strong, the taxpayer's actionable tax grievance will be lower. At the same time, if the taxpayer's individual level of tax disdain is low, a weakly-perceived tax authority will produce higher actionable tax grievance levels, and a strongly-perceived tax authority will produce lower actionable tax grievance levels.[93]

2. Net Risk

The level of actionable tax grievance is but a single component of one's decision whether to comply with tax laws. Another factor is a taxpayer's inclination toward risk, or as Lawsky argues, one's comfort level with uncertainty itself.[94] The model refers to this as *net risk* (*Z*). If one's net risk level is low, that taxpayer is more likely to comply with tax laws than another taxpayer with a higher net risk level and the exact same level of actionable tax grievance. Net risk comprises two elements: *risk aversion* (*R*), and one's *perspective-dependent audit probability*, or one's subjective expectation of being audited (*P*).

The model assumes the levels of risk aversion (*R*) are diverse and differ for each taxpayer. Like tax disdain, risk aversion is measured in a range between zero (0) and one (1), and is uniformly distributed over all taxpayers (i.e., any one measure of risk aversion is equally as likely as any other measure). The model also assumes that one's risk aversion level is a

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92. For experimental runs of the model, one can adjust this index as an initial condition. Since the model produces one hundred percent tax compliance at *S* ≥ 0.90, the highest *S*-value that still produces tax noncompliance is (0.90 – ϵ), or 0.8999 for practical purposes. See *infra* Table 2, for a list of initial conditions used for the model's runs discussed in this Article.

93. This is stated formally as $G = D(1 - S)$. Note that actionable tax grievance (*G*) is the product of the level of tax disdain (*D*) and the tax authority's perceived weakness (1 – *S*).

94. *See* Lawsky, *Modeling Uncertainty*, *supra* note 57, at 258.

unique feature of each taxpayer as a person (not just as a taxpayer) that does not change over time. In other words, it is immutable and invariant.[95]

According to deterrence theory and its variants, another factor in deciding whether to comply with the tax laws is each taxpayer's estimation of being audited by the tax authority if the taxpayer is noncompliant (P).[96] The model artificially represents this subjective belief of audit probability levels by creating a *scope of information* (φ) in its matrix. This scope of information is the number of matrix positions (up, down, left, right from the taxpayer's perspective) that the taxpayer is able to "see" (i.e., information the taxpayer is able to take in by way of personal knowledge, media coverage, rumors, etc.). For simplicity, the model assumes that the scope of information is the same for all taxpayers and that information is limited and local, meaning a taxpayer only has the information she can readily "see" and taxpayers do not communicate tax enforcement information with each other. This is consistent with Kotowski, Weisbach, and Zeckhauser's observation that tax compliance is a game by which a taxpayer reveals some, but not all, information to the tax authority, and the tax authority reveals some, but not all, of its information to taxpayers.[97]

To replicate each taxpayer's estimation of being audited by the tax authority if the taxpayer is noncompliant (P), the model assumes the estimate of audit probability increases with the ratio of government audit forces to the number of noncompliant taxpayers in the subject taxpayer's scope of information, which is consistent with the perspective-dependent theory of audit probability, argued elsewhere.[98] In other words, if a taxpayer subjectively believes that the probability of being audited will be higher if she is noncompliant (P), that taxpayer is less likely to be noncompliant even if her personal risk aversion level (R) is identical to that of another taxpayer who does not subjectively believe the personal probability of audit is higher.

In the model, a taxpayer with otherwise high levels of actionable tax grievance asks herself, "What is the probability that I will be audited *if I am noncompliant*?"[99] To give the taxpayer an answer, the model takes into account the number of examiners the taxpayer can "see" at the moment she asks this question. The ratio of examiners to noncompliant taxpayers that the taxpayer can "see" contributes directly to the subjectively-perceived probability of being audited if the taxpayer is noncompliant (since the taxpayer asking the question is considering noncompliance, there is always at

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95. *Cf. id.* at 259–61.
96. *See supra* Part II.A.
97. Kotowski et al., *Modeling as Signals*, *supra* note 4, at 180–81.
98. Manhire, *Toward a Perspective-Dependent Theory*, *supra* note 23, at 639–43 (arguing this probability is *perspective-dependent*, meaning the probability of experiencing an audit will vary depending on each taxpayer's conditional compliance actions and that the probability of audit does not equal the audit rate).
99. *See id.* at 640.

least one noncompliant taxpayer within the taxpayer's scope of information).[100] The intuition here is that a taxpayer with high levels of actionable tax grievance is still less likely to choose tax noncompliance if she believes she has a high probability of getting caught by choosing noncompliance.[101] This is consistent with the basic tenet of deterrence theory.

The model combines the taxpayer's levels of risk aversion (R) and estimated audit probability (P) and calls this combination the taxpayer's net risk (Z). The taxpayer's net risk is the product of the taxpayer's risk aversion and estimated audit probability levels.[102] This definition attempts to combine elements of deterrence theory and Lawsky's uncertainty model.

3.   *The Taxpayer Rule*

With these definitions, a taxpayer's behavioral rule (T) is summarized in Table 1, where Δ is the difference between a taxpayer's levels of actionable tax grievance and net risk.[103]

Table 1. Taxpayer State Transition

Taxpayer state	Δ	Taxpayer state transition
V	$> \theta$	$V \rightarrow N$
V	$\leq \theta$	$V \rightarrow V$
N	$> \theta$	$N \rightarrow N$
N	$\leq \theta$	$N \rightarrow V$

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100. The model denotes the ratio of government examination forces (ε) to existing noncompliant taxpayers (τn) in the subject taxpayer's scope of information as $(\varepsilon/\tau n)\varphi$. Given this definition, the model assumes a noncompliant taxpayer's estimated probability of audit as $P = 1 - \exp[-k(\varepsilon/\tau_n)_\varphi]$. The constant k is set to ensure a plausible estimate of audit probability if the observing taxpayer is noncompliant when both ε and τn are 1. Again, τn is always at least 1 since the subject taxpayer always counts herself as at least potentially noncompliant when computing the taxpayer's estimated probability of audit. Note that, according to this equation, if the measure of government audit forces remains constant and the number of currently noncompliant taxpayers goes down, the subject taxpayer's estimated probability of audit decreases since there is less audit activity in her scope of information.

101. The model attempts to reflect reality by assuming that risk neutral taxpayers ($R = 0$) will not care about their estimated probabilities of audit.

102. Formally, net risk is defined as $Z = RP$.

103. Formally, this difference is defined as $\Delta = G - Z$.

If the difference (Δ) between the levels of actionable tax grievance and net risk for a taxpayer who is already voluntarily compliant (*V*) is above that taxpayer's compliance threshold (*θ*), the taxpayer becomes noncompliant. Otherwise, the taxpayer remains compliant. If the difference for a noncompliant taxpayer (*N*) is above the compliance threshold, the taxpayer remains noncompliant. Otherwise, the taxpayer becomes compliant.

In short, a taxpayer's single rule of behavior (*T*) is simply: *Be compliant unless the difference between your actionable tax grievance and net risk levels is greater than your compliance threshold.*[104]

B.   Examiner Mechanics and the Rule of Motion

In the model, examiners are even simpler than taxpayers. Their attributes contain the examiner's scope of information (φ'), which like the taxpayer's scope of information (φ) is the number of matrix positions (up, down, left, right from the examiner's perspective) that the examiner can inspect. Again, for simplicity, the measure of this scope of information is the same for all examiners.

An examiner's scope of information need not be equal to the taxpayer's, but it will almost always be small in relation to the matrix size.[105] In this way, the model artificially replicates Kotowski, Weisbach, and Zeckhauser's observation that the examiner's information is limited to what the taxpayer chooses to share with the government in addition to that which is subject to the mandatory information reporting rules (e.g., Forms W-2, 1099, etc.). For this reason, the model considers an examiner's information, like a taxpayer's, to be local and limited.

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104. Note that this rule, which assumes a binary decision set of compliant or noncompliant behavior for taxpayers, is essentially a maximization of the taxpayer's expected utility. Taxpayer's are rational in that the expected utility maximization is *subjective* depending on the compliance threshold (*θ*) value. Additionally, since the model is constructed so that a consideration of audit probability is based on each individual's context in time and space (and does not equate the probability of audit with the general audit rate), any deterrence that occurs is local to the individual taxpayer and most likely does not have a global effect on the system. This is consistent with the perspective-dependent theory of audit probability described elsewhere. *See* Manhire, *Toward a Perspective-Dependent Theory*, *supra* note 23, at 645–50.

105. For simplicity, the computational runs discussed in this Article set the examiners' scope of information equal to the taxpayers' scope of information ($\varphi' = \varphi$).

Also like taxpayers, examiners have one simple rule of behavior. The behavioral rule for examiners (*E*) is: *Inspect all sites in your scope of information and audit a noncompliant taxpayer.*[106]

The motion rule for the tax compliance model is the same for both taxpayers and examiners. The simple motion rule (*M*) is: *Move to a random location within your scope of information.* The motion rule (*M*) can be disabled for taxpayers. Various runs of the model with the motion rule both enabled and disabled for taxpayers produce statistically identical results concerning the number of taxpayers who comply and the number who do not comply at the large-scale, system level.[107] For simplicity, the computational runs discussed in this Article operate with the motion rule disabled for taxpayers. Disabling the motion rule only means taxpayers do not move. The motion rule still applies to examiners, who continue to follow their behavioral rule (*E*) by moving to an empty matrix position and auditing a noncompliant taxpayer within their scope of information.

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106. The model assumes that examiners enforce tax laws equally in all cases to eliminate any selection or enforcement bias, although it is reasonable to assume that some individual examiner bias—especially enforcement bias—is inherent to a large administrative agency such as the IRS.

107. The Epstein model provides for a maximum jail term imposed on active rebels caught by the authorities. For tax compliance, there exists an analogy that does not include prosecution and jail time. Some studies suggest that taxpayers who are audited often exhibit a "good behavior" period after the audit, but then return to pre-audit patterns of noncompliance. *See* Michael W. Spicer & Rodney E. Hero, *Tax Evasion and Heuristics: A Research Note*, 26 J. PUB. ECON. 263 (1985); Paul Webley, *Audit Probabilities and Tax Evasion in a Business Simulation*, 25 ECON. LETTERS 267 (1987). *But see* Boris Maciejovsky, Erich Kirchler & Herbert Schwarzenberger, *Misperception of Chance and Loss Repair: On the Dynamics of Tax Compliance*, 28 J. ECON. PSYCHOL. 678 (2007) (finding that compliance decreases immediately after an audit, but gradually returns over time to pre-audit levels). The tax compliance model allows the user to select a maximum "good behavior" period if audited. Each "good behavior" period is then drawn randomly from the uniform distribution on interval (0, max_good). In principle, the "good behavior" period parameter should affect the dynamics in important ways by changing otherwise noncompliant behavior to compliant behavior during the "good behavior" period. Unlike the jail term in the Epstein model, the "good behavior" period does not offer a deterrent effect since unlike trials and imprisonment, audits and audit results are nonpublic. Also, given the relatively low audit rate in the United States, the number of taxpayers in the "good behavior" period at any one time make up anywhere from zero to one percent of the total noncompliant population, and about one-tenth of one percent of the overall taxpayer population. For this reason, the "good behavior" period effect is *de minimus* on the overall dynamics of the compliance rates for the model and is accordingly set to zero (0) for the runs discussed in this Article.

IV.   RESULTS

To begin each run of the model, one selects values for the perceived enforcement strength of the tax authority (*S*) and the initial examiner and taxpayer densities.[108] The input assumptions for all runs analyzed in this Article are provided in Table 2:

Table 2. Input Assumptions for Model Runs

Variable Name	Input Setting
Examiner information (φ')	1.0
Taxpayer information (φ)	1.0
Perceived tax authority strength (*S*)	0.8777
Max. good behavior period	0
Motion	None
Initial examiner density	0.88%
Number of examiners (ε)	19
Initial taxpayer density	93.85%
Number of taxpayers (τ)	1,986

The model assigns random, uniformly-distributed values for tax disdain (*D*) and risk aversion (*R*). Examiners and taxpayers—all of whom are initially compliant—are situated in random positions on the matrix with no two actors residing on the same matrix space. The model then runs forward in time according to the rules *T*, *E*, and *M* with each discrete time unit denoted as a *tick*. An examiner or taxpayer is selected at random and, under rule *M*, moves to a random location within his scope of information where he acts according to rule *T* if a taxpayer and rule *E* if an examiner.[109] The model iterates this simple procedure until the user decides to end the run and resets the matrix.

The tax compliance model is extremely simple with two behavioral rules for examiners (*E* and *M*), and one behavioral rule for taxpayers (just *T* since *M* is disabled for taxpayers). Aggregating these simple rules from the micro to the macro-level, one might predict that the simplicity would follow the scaling and result in one very large collection of simple rules. Yet one observes from the model's runs that macroscopic regularities arise from the purely local interaction of taxpayers and examiners.

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108. The scopes of information for taxpayers (φ) and examiners (φ'), the audit probability constant (*k*), and the taxpayer compliance threshold (θ) remain the same for all runs.

109. In this way, the model activates taxpayers and examiners asynchronously.

To use the lexicon of complexity theorists, the system generates unexpected *emergent phenomena* that are difficult to deduce from the simplistic rules of examiner and taxpayer behaviors. Additionally, some micro-level dynamics that one would reasonably expect to aggregate to the macro-level seem to have little to no effect on the system-level patterns and trends. These sometimes counterintuitive results of the model potentially shed light on the factors that impact overall tax compliance in the world of experience.

A.   *Congruence with Known Tax Data*

It is important for any model to generally align with experience or observable data.[110] One interesting result of this model after multiple runs with the input settings listed in Table 2 is that the ratio of the average number of taxpayers in the voluntarily compliant state (V) to the total number of taxpayers in the matrix population (1,633/1,986) yields an estimated voluntary compliance rate of 82.23 percent. This is statistically identical to the individual income tax compliance rate estimated by recent IRS "tax gap" studies (0.82 ± 0.02).[111]

Additionally, the model's average estimated probability of audit if one is noncompliant (P) has the measure of 3.97 percent, which is almost identical to the probability of experiencing an audit if one is noncompliant under the perspective-dependent theory of audit probability for years 1996 through 2010 (3.96 percent).[112] The initial examiner density of 0.88 percent

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110. A simulation model is usually considered valid if its results (output) favorably represent the real-world system it seeks to simulate. *See generally* AVERILL M. LAW, SIMULATION MODELING AND ANALYSIS (4th ed., 2007). More specifically for tax models, Sarah Lawsky makes a convincing argument that assumptions of a model must comport with the real world. *See* Sarah B. Lawsky, *How Tax Models Work*, 54 B.C. L. REV. 1657, 1681 (2012) [hereinafter Lawsky, *How Tax Models Work*] ("We can make the jump from the model to the real world only if the model is similar in relevant ways to the real world."). One can expand Lawsky's argument to conclude that a model's results—in addition to its assumptions—should match known experience if it is to be considered valid.

111. *See* IRS, INDIVIDUAL INCOME TAX UNDERREPORTING GAP ESTIMATES, *supra* note 2.

112. *See* Manhire, *Toward a Perspective-Dependent Theory*, *supra* note 23, at 641. This assumes a noncompliance rate of approximately 0.18, which is the approximate noncompliance rate per the IRS "tax gap" data; however, it is possible the proportion of noncompliant *returns* to all filed returns is different than the proportion of *revenue* missing due to noncompliance to the total revenue legally due. Since there is currently no better proxy for the number of noncompliant returns than the "tax gap" data, the latter proportion is used as a stand-in for the underreporting rate.

also matches the individual income tax audit rate for the same period.[113] This congruence—almost equivalence—of the data produced by the model and the known tax compliance and enforcement data suggests the model has credibility.

B.   Change in the Audit Rate

To test the deterrence theory, including the Lawsky variant, one must examine the model's probability of being audited if a taxpayer is noncompliant, which is in part a function of the number of examiners able to audit the taxpayer population. The initial conditions provided in Table 2 produce 19 examiners available to audit 1,986 taxpayers.[114]

Based on a theory of deterrence, one would expect the number of compliant taxpayers—and thus the compliance rate—to decrease as the number of examiners decreases, especially since the probability of audit if a taxpayer is noncompliant is a function of the number of examiners available to audit. Surprisingly, one finds no change in the number of compliant taxpayers—and thus no change in the compliance rate—as the number of examiners is reduced from 19 to zero.

Moving in the other direction, when the number of examiners is incrementally increased from 19 to 125, the macro-level compliance rate remains the same as when the number of examiners is zero.[115] This is depicted in Figure 1, below.

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113. *See* INTERNAL REVENUE SERV., INTERNAL REVENUE SERV. DATA BOOK, 1998-2012, tbl. 9a [hereinafter IRS DATA BOOK, 1998-2012] (reporting for 1,986,049,890 individual income tax returns received and 17,545,846 audits conducted on those returns for taxable years 1996 through 2010). The ratio of 17,545,846 to 1,986,049,890 produces a fifteen-year audit rate of approximately 0.008835, or 0.88 percent.

114. The model does not claim that nineteen examiners exist for every 1,986 taxpayers (or filed returns) in the real world. The model seeks to reflect experience by setting the examiner population density to match the fifteen-year audit rate of approximately 0.88 percent. The existence of nineteen examiners at a density setting of 0.88 percent is merely a byproduct of the model in an attempt to reflect the long-term audit rate of the U.S. individual income tax self-report or audit system.

115. Since the taxpayer population density is initially set at close to 94 percent, the examiner density must remain below six percent or else the matrix will be saturated with no room for examiner movement. When the initial examiner density is set at 5.9 percent, the system randomly distributes 125 examiners over the matrix.

Figure 1: Incremental Change in the Number
of Examiners
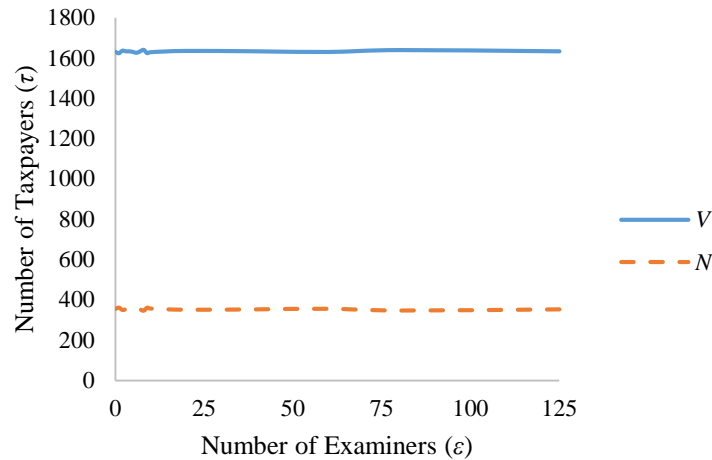
This unexpected result suggests that the probability of audit might play far less of a role (if any) in explaining the macro-level tax compliance rate in the United States. In fact, that the overall compliance rate effectively stays the same at 19 down to zero examiners bolsters the conjecture that strong tax authority signaling itself is perhaps the most important driver of voluntary compliance.[116]

C.   *Taxpayer Response to Audit Probability*

Even though changes to the overall audit rate appear to have little to no effect for the model on voluntary compliance at the macro-level, the micro-level perceived probability of a taxpayer experiencing an audit does seem to have an effect on individual compliance decisions. If one observes individual taxpayers as the model progresses in time, one notes that a taxpayer in the noncompliant state (*N*) transitions to the compliant state (*V*) when an examiner appears within the taxpayer's scope of information (*φ*), but then transitions back to the noncompliant state once the examiner leaves the taxpayer's information scope.

Of course, looking at the model's equations, the taxpayer's behavior in the simulation is better understood. If a taxpayer is in a noncompliant state

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116. That the compliance rate at nineteen examiners was the same at zero examiners also suggests that it pays for "weak" tax authorities to signal that they are strong tax agencies, as Kotowski, Weisbach, and Zeckhauser suggest, in order to maintain high levels of voluntary compliance. Kotowski et al., *Audits as Signals*, *supra* note 4, at 188.

and an examiner enters the taxpayer's scope of information, the examiner-to-noncompliant taxpayer ratio increases, which in turn increases the taxpayer's overall risk. These increases in turn *decrease* the taxpayer's difference value (Δ) below the individual's compliance threshold (θ) and the taxpayer transitions to a compliant state. Once the examiner leaves the taxpayer's scope of information, the examiner-to-noncompliant taxpayer ratio goes back down, which in turn decreases the net risk variable. These reductions return the Δ value above the taxpayer's threshold and the taxpayer again transitions to a noncompliant state (N). This compliance state transition is not necessarily predicted given the simple behavioral rules of the actors in the simulations.[117]

The individual taxpayer compliance state transitions are surprising given that the macro-level effects of the number of audits on overall compliance, as seen in Figure 1, seem *de minimus*. The inverse is also true. That is, it is reasonable for one to conclude from just the system-level compliance trends that audit probability in no way affects voluntary compliance; individual taxpayers do not make compliance decisions based on higher or lower levels of audit probability. In other words, deterrence theory is wrong. Yet, if one observes the individual taxpayer reactions to perceived changes in audit probability, it is clear that audit probability does affect compliance decisions. In other words, deterrence theory is correct.

The implication is that perhaps both the deterrence theory and the perceived tax authority strength theories have merit. The model is designed in such a way so that the taxpayer's immediate perception of audit potential is a factor separate from the taxpayer's perception of the tax authority's overall auditing strength. The audit potential (P)—the key factor to deterrence theory—is a part of the taxpayer's net risk calculation (Z). The perception of the tax authority's overall auditing strength (S)—the key factor to perceived strength theory—is part of the taxpayer's actionable tax grievance calculation (G). Individual taxpayers respond to the changing probabilities of audit in a way predicted by the calculations of deterrence theory. As the perceived probability of "getting caught" underreporting tax increases, the individual taxpayer who is otherwise predisposed to underreporting tax assesses the increased risk of underreporting and chooses to underreport less often than she would if the perceived audit risk was, at that moment, lower.[118]

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117. A similar phenomenon occurs in the original Epstein model of civil violence. Epstein, *Modeling Civil Violence*, *supra* note 87, at 7245.

118. *See* Manhire, *Toward a Perspective-Dependent Theory*, *supra* note 23, at 643–45 (speculatively describing how a taxpayer heuristic that perceives a significantly higher probability of audit if one underreports tax on a return might itself provide a "built in" deterrent against underreporting).

That taxpayers alternate between noncompliance and compliance as perspective-dependent audit probabilities change based on the individual's context might explain why these individual reactions have no apparent macro-level effect. In the aggregate, the various "on/off" switching of taxpayer states might cancel each other out. So while perceived increases in audit probabilities do deter individuals sporadically throughout the system, the net effect at the system level is neutralized and cannot be observed at the macro-level.

D.   Perceived Tax Authority Strength

The initial credibility of the tax compliance model also permits a test of the Kotowski, Weisbach, and Zeckhauser conjecture: that the perceived strength of a tax authority's auditing ability directly affects the level of tax compliance. Keeping all initial conditions the same as those listed in Table 2, and changing only the tax authority's perceived audit strength index (*S*) in 0.05 increments between 0.8999 and 0.00001 (almost zero), the number of taxpayers in the voluntarily compliant state (*V*) changes exponentially with each incremental change in *S*. This is displayed in Figure 2.[119]

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119. The approximate equation for this exponential change in compliant taxpayers for the model is $\tau c = \lambda/(1 - \mu evS)$, where $\lambda = 1.24151$, $\mu = 9.93811 \times 10\text{-}1$, and $v = 6.20113 \times 10\text{-}3$. If one multiplies this equation by 106, the resulting product represents the approximate number of compliant individual income tax returns that the IRS received from taxable years 1996 through 2010. Therefore, the equation approximating the number of compliant individual income tax returns the IRS received for taxable years 1996 through 2010 for the real-world system (ψ) becomes $V\psi = (\lambda \times 106)/(1 - \mu evS)$. The real-world fifteen-year voluntary compliance rate can then be estimated by $V\psi/(\tau \times 106)$, where τ is the total number of taxpayers distributed across the matrix in the model (1,986). The equation estimating the voluntary compliance rate (VCR) can be further simplified as:

$$VCR = \frac{\lambda}{\tau(1 - \mu e^{vS})}$$

The equation for the noncompliance rate then becomes $NCR = 1 - VCR$. *See* IRS DATA BOOK, 1998–2012*, supra* note 113 (reporting data for taxable years 1996 through 2010 upon which the fifteen-year rates are based).

This Article does not purport to derive the precise equation that explains the effect of perceived tax authority strength on voluntary compliance. The approximate equation given here is a "best fit" estimate to the results from experimental runs of the computational model. The model is designed around the available data to give the reader a place to stand in the exploration of tax compliance behaviors in the United States. For this reason, the equation predicting the U.S. voluntary compliance rate (VCR) is, at best, a practical *ad hoc* theory. It is entirely possible that the values of λ, μ, v, and τ would change based on initial conditions different from those given in this note. See *supra* Table 2, for a list of initial conditions for the experimental runs reported herein.

Figure 2: Effect of Perceived Tax Authority
Strength on Voluntary Tax Compliance
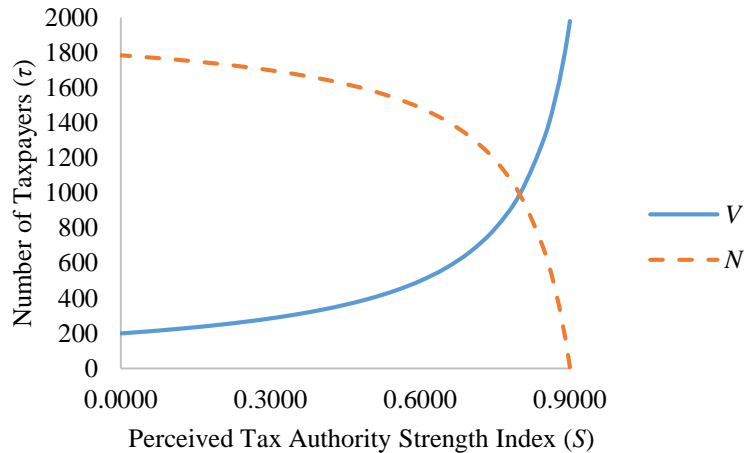
Note that the change in voluntary compliance is not a function of the number of audits performed, since the examiner-to-taxpayer ratio remains the same. Neither is the change in compliance due to a reduction in the estimated audit probability, since the examiner-to-noncompliant taxpayer ratio within the taxpayer's scope of information also remains unchanged. Instead, the level of actionable tax grievance (G) is the only component attribute affected by a steady reduction in the perceived auditing strength of the tax authority. This suggests that the Kotowski, Weisbach, and Zeckhauser conjecture has merit in that the perceived strength of the tax authority's auditing power is a primary driver of macro-level tax compliance patterns.

This result is also counterintuitive. Given that both the generally perceived strength of the tax authority's audit ability and the perceived probability of being audited if an individual underreports tax relate to the enforcement function of the tax authority, one might expect that the levels of perceived strength would produce compliance results equivalent to the individual's perceived audit probability. As the model shows, however, the dynamics are fundamentally different.

Note that taxpayers who are initially compliant are unaffected by the perceived increase in audit probability when examiners draw near. They apparently have incentives to comply other than a fear of getting caught if they were noncompliant. Yet when the perceived auditing strength of the tax authority—which is a global perception—decreases, the macro-level compliance patterns change accordingly. This suggests that taxpayers as a population voluntarily comply in response to the overall reputation of the tax

authority, not to individual risk analyses based on the chances of getting caught underreporting.[120]

While individuals here and there change their compliance behavior based on temporary increases or decreases in perceived audit probability, these small details do not appear to have an effect on the "big picture." It is not that one should ignore individual responses to changes in perceived audit probabilities in principle. They are real and they certainly have a sometimes significant impact on the particular taxpayers involved with audits. Yet, the effects of audit probabilities appear to be beyond the scale at which one observes system-level compliance trends. In short, they become superfluous information. For this reason, one probably doesn't need to consider the details of changes in perceived audit probability when investigating macro-scale compliance patterns.[121]

If macro levels of voluntary compliance correlate to levels of the perceived strength of the tax authority, the unavoidable conclusion is that the more taxpayers generally fear the tax authority, the higher the voluntary compliance rate will be. Consequently, tax authorities are compelled to consider policies that will maintain the current level of taxpayer fear. To increase voluntary compliance overall, such policies need to create even more fear.[122]

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120. This is consistent with what Cass Sunstein calls "probability neglect." Cass R. Sunstein, *Probability Neglect: Emotions, Worst Cases, and Law*, 112 YALE L.J. 61, 61 (2002) (arguing that people tend to neglect a small probability of a risk occurring when strong emotions of fear are triggered). Sunstein advocates against the use of fear as a government manipulator for any public policy even if that policy is objectively considered "good" (such as voluntary tax compliance). He regards fear itself as a significant problem that can lead to even more excessive problems if not controlled. Therefore, a government can be justified in attempting to mitigate the fear of its citizenry. *Id.* at 69–70. *See generally* Yuval Rottenstreich & Christopher K. Hsee, *Money, Kisses, and Electric Shocks: On the Affective Psychology of Risk*, 12 PSYCHOL. SCI. 185, 188 (2001) (concluding that changes in probability measures have little effect on behavior when strong emotions are triggered by experiment).

121. In the scientific community, this is sometimes called "effective theory." *See* LISA RANDALL, WARPED PASSAGES: UNRAVELING THE MYSTERIES OF THE UNIVERSE'S HIDDEN DIMENSIONS 28–29 (2005) [hereinafter RANDALL, WARPED PASSAGES] ("When biologists study a cell, they don't need to know about quarks inside the proton.").

122. Although some might observe that "perceived strength" and "fear" are not properly synonymous, they appear to be so in the context of taxpayers changing their voluntary compliance behaviors based on the perceived strength of the tax authority. Common sense dictates that the perception of strength does not elicit "respect" or "endearment" on behalf of taxpayers toward the tax authority. Consistent with experience, high levels of perceived strength appear to act as negative motivators against a taxpayer transitioning from voluntary compliance (*V*)

The implications of this result are surely unpopular, controversial, and for some, leaning unpalatably close to fascism. The fact that a significant increase in the voluntary compliance rate would require policies that are anathema to fundamental democratic sensitivities perhaps explains why the voluntary compliance rate has remained relatively unchanged in the United States for the past fifty years.[123] Taxpayers perceive essentially the same level of tax authority strength (i.e., are just as afraid of the tax authority) as they did half a century ago.[124]

One might conjecture that since the government has not implemented policies to create more fear of the IRS, voluntary compliance has remained relatively steady.[125] Even though the IRS occasionally comes

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to noncompliance (*N*) rather than a positive motivator toward increased voluntary compliance, or a state of transition from noncompliance to compliance.

123. *See* Richard B. Malamud & Richard O. Parry, *It's Time to Do Something about the Tax Gap*, 9 HOUS. BUS. & TAX L.J. 1, 8 (2008) (citing 1963 as the first year for which the IRS measured tax compliance). *See also* Wendy Rotz, Jeri Mulrow, & Eric Falk, Internal Revenue Serv., *The 1995 Taxpayer Compliance Measurement Program (TCMP) Sample Redesign—A Case History* 699 (last accessed May 1, 2013), http://www.amstat.org/sections/SRMS/Proceedings/papers/1994_119.pdf; *IRS Can Use Tax Gap Data to Improve Its Programs for Reducing Noncompliance: Hearing before the H. Subcomm. on Oversight*, 101st Cong. 6 (1990) (statement of Paul L. Posner, Assoc. Dir., Tax Policy & Admin. Issues, U.S. Gen. Accounting Office), http://archive.gao.gov/t2pbat11/141156.pdf. The IRS published tax gap reports for 1963, 1965, 1969, 1971, 1973, 1976, 1979, 1985, 1988, 1992, 1995, 1998, 2001, and 2006. *See* Malamud & Parry, at 8; *IRS and the Tax Gap*: *Hearing before the H. Comm. on Budget*, 110th Cong. 1, 1 n.3 (Feb. 16, 2007) (statement of Hon. J. Russell George, Treas. Insp. Gen. Tax Admin.), http://www.treasury.gov/tigta/congress/congress_02162007.pdf (concluding that a comparison of data from previous years' reports shows no notable difference in the tax gap).

124. In this way, fear possibly deters tax noncompliance, but it is not the deterrence theory of expected utility discussed in Part II.A. Instead, it is more akin to the deterrence theory of eighteenth and nineteenth century utilitarianism. Utilitarian deterrence theory justifies the punishment of one individual by arguing that the punishment deters the illegal act of a hypothesized second person. This second person supposedly foregoes an illegal act because he is afraid of receiving the same punishment he witnessed the government inflict on the first person. *See* MARTIN P. GOLDING, PHILOSOPHY OF LAW 72–76 (1974).

125. Based on the experimental results of the model, one can be 95 percent confident that the voluntary compliance rate for the individual income tax return filing population will be between 80.71 and 83.72 percent, with a mean of 82.2 percent. Based on data reported by the IRS SOI division, the voluntary compliance rate for the same population for taxable years 1996 through 2010 has a mean of 82.2 percent, with a 95 percent confidence interval (two standard deviations) that the voluntary compliance rate for that period was between 80.75 and 83.76 percent. IRS, DATA BOOK, 1998-2012, *supra* note 113 (reporting for taxable years 1996-2010).

under public scrutiny by way of congressional inquiries and hearings, these occasional censures might increase taxpayer dislike for the tax authority, but levels of fear might remain unchanged.[126] In other words, a taxpayer's existing levels of tax disdain might be temporarily vindicated by the occasional congressional inquiry, but such vindication does not reduce the general level of fear the same taxpayer has of the tax authority and its enforcement power.

E.   Limitations and Interpretations

As mentioned previously, the model deliberately separates the perceived strength index (*S*) from the expected probability of audit measure (*P*) so that the effects of each element can be analyzed independently. This means one can observe the effects of perceived strength on voluntary compliance while keeping the expected probability of audit fixed, and vice versa. This separation serves the primary purpose of this Article, but it also creates a potential limitation.[127] The model can analyze perceived strength and expected audit probability independently by holding one factor steady and manipulating the other. Yet, it is conceivable that—in the real world—a significant change in the audit rate might impact the tax authority's perceived audit strength index.

For example, if the tax authority chooses to audit significantly more tax returns each year so that the average audit rate climbs from one percent to, say, twenty percent, it is possible that such a dramatic increase would affect the tax authority's globally-perceived enforcement strength. In short,

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This is also consistent with previous tax gap studies for the general U.S. taxpayer population. *See, e.g.*, INTERNAL REVENUE SERV., PUB. 1415, INCOME TAX COMPLIANCE RESEARCH: NET TAX GAP AND REMITTANCE GAP ESTIMATES (SUPPLEMENT TO PUB. 7285) 2, tbl. 1 (1990), http://www.irs.gov/file_source/pub/irs-soi/p141590.pdf (estimating the following individual income tax voluntary compliance rates for the corresponding years within a two percent margin of error: (82.6%, 1973); (80.7%, 1976); (79.8%, 1979); (81.6%, 1981); (81.8%, 1982); (80.0%, 1984); (79.2%, 1986); (81.8%, 1987); (82.3%, 1988); (83.1%, 1992)).

126. *See, e.g.*, Peter Baker, *Clinton Signs IRS Overhaul into Law*, WASH. POST, July 23, 1998, at A01 (discussing legislative responses to the 1997 congressional hearings on reports of overzealous IRS tax auditors and collectors); Preview Statement of Chairman Darrell Issa, *IRS Obstruction: Lois Lerner's Missing E-Mails*, http://oversight.house.gov/wp-content/uploads/2014/06/Preview-Statement-of-Chairman-Darrell-Issa.pdf (discussing the "controversy-within-a-controversy" of the IRS allegedly losing emails associated with the year-long congressional hearings on reports of the IRS targeting conservative political groups).

127. A model's utility—especially in legal scholarship—often depends on one explicitly addressing the model's limitations. *See, e.g.*, Lawsky, *How Tax Models Work*, *supra* note 110, at 691–92. Included in this Part are the most obvious limitations, but it is very possible others still exist.

significant changes in expected audit probabilities (*P*) might affect the tax authority's perceived strength (*S*) in the real world. If one concedes this possibility—which reason dictates one must—then it is possible that a significant change in the audit rate will have an effect on perceived tax authority strength, and transitively, an effect on voluntary compliance.

But how might significant changes in the audit rate impact the tax authority's perceived strength? The initial intuition is that a significantly higher audit rate will increase the perceived strength of the tax authority, thereby increasing voluntary compliance. This is, of course, one possible result. Yet, if Kotowski, Weisbach, and Zeckhauser are correct, it is also possible that more audits will *decrease* perceived tax authority strength, which would lead to *less* voluntary compliance.

As previously mentioned, strong tax authorities do not necessarily audit more returns than weak authorities. This is because a strong authority can better maximize its revenue by auditing smarter, not harder. On the other hand, weak tax authorities might audit more returns—resulting in significantly higher audit rates—to compensate for their less effective auditing capabilities. This means that more audits do not necessarily signal a stronger tax authority.[128] As a result, a significantly increased audit rate might actually drive down the voluntary compliance rate since more audits could lead taxpayers to perceive the tax authority as weaker. If the perceived strength index decreases, the model predicts a nonlinear decrease in voluntary compliance.[129]

Yet, since this Article considers the tax enforcement-compliance dynamic as a complex adaptive system, a third possibility is that a significant change in the audit rate will produce *both* an increase and a decrease in perceived strength. As strange as this initially sounds, such behavior is possible with complex adaptive systems.[130] Relationships within the system, such as that between audit rates and perceived strength, might not easily reduce to linear cause and effect. For example, it is possible that an increase in audits from the current rate of about one percent to, say, two percent could increase the tax authority's perceived strength, but any increase in the audit rate beyond two percent will reduce the perceived strength index, thereby decreasing voluntary compliance. The model is limited in that it intentionally excludes the effects of more audits on the perceived strength index. Future

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128. However, if taxpayers cannot tell whether they are dealing with a weak or strong tax authority, increased audits might be necessary before taxpayers can begin to tell the difference. *See* Kotowski et al., *Audits as Signals*, *supra* note 4, at 194–201 (discussing in greater detail how strong and weak tax authorities use audits as signals).

129. *See supra* Figure 2 and accompanying discussion.

130. *See* North, *A Theoretical Formalism*, *supra* note 27, at 2 (noting that nonlinearity is typical in complex adaptive systems).

work should examine the relationship between expected audit probability and perceived tax authority strength more closely to develop this limitation.

Even if one accepts this limitation, there is still an alternative interpretation of the model's results: Voluntary compliance in the United States might be correlated with other globally-applicable incentives that have no relation to the tax authority's perceived enforcement strength. Because this is a computational model, the change in any globally-applicable variable will affect taxpayer behavior in the same manner. As a consequence, the globally-applicable variable denoted as "perceived tax authority strength" (*S*) can just as easily be labelled "globally-applicable social norms," "levels of agreement with government policies," "a citizen-level sense of patriotism," "a national sense of compliance as a moral duty" and a whole host of other globally-applicable incentives discussed previously under behaviorist theory.[131]

As a consequence, one cannot decidedly conclude that it is "perceived tax authority strength" that explains the observed levels of tax compliance in the United States, and such a definitive conclusion is not the purpose of this Article. Instead, this Article set out to better understand the general governing dynamics of a self-report or audit system. The results of this overly-simplistic model suggest that macro-level tax compliance depends more on a globally-applicable criterion (or bounded set of criteria) than on the local and discrete risk analyses of individual taxpayers concerned with the probability of getting caught underreporting. It is not that individual taxpayers fail to make such rational risk analyses as part of their compliance decisions. The model suggests that this, indeed, does happen. The somewhat unexpected result is that these individual risk calculi have little to no observable effect on system-wide tax compliance patterns. Instead, these patterns seem to depend more on common understandings and heuristics applicable to all taxpayers that surface as part of the individual's conscious compliance decision-making process.

An analogy might be helpful in explaining these results. An interstate highway is typically used by drivers bound by the simple expectation of complying with the traffic laws. For the most part, drivers comply with these rules.[132] Most avoid colliding with each other based on the invisible barriers created by nothing more than white paint, and most

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131. *See* discussion *supra* Part II.B.

132. *See generally* Martin Friedland, Michael Trebilcock & Kent Roach, *Regulating Traffic Safety*, *in* SECURING COMPLIANCE: SEVEN CASE STUDIES 165–324 (Martin L. Friedland ed., 1990); *see also* Herbert C. Kelman, *Compliance. Identification, and Internalization: Three Processes of Attitude Change*, 2 J. CONFLICT RESOL. 51, 52–53 (1958) (claiming that obeying traffic laws to avoid a ticket is an example of *voluntary compliance*, while obeying the same laws because one believes they are just and right is an example of internalizing the rule as an acceptable *behavioral norm*).

generally obey the maximum speed laws. At the same time, there are some drivers who are noncompliant for a number of reasons, almost all having to do with levels of risk, probability of detection, compliance thresholds, and the perceived strength of the highway patrol system (or other globally-applicable variable).

When a *compliant* driver passes a highway patrol car parked in the median, the driver immediately becomes hyperaware of the rules, but there is no observable change in the driver's compliance state: the driver was compliant before noticing the patrol car and remains compliant. When a *noncompliant* driver passes a highway patrol car, the noncompliant driver also becomes hyperaware of the rules and, in most cases, transitions from a noncompliant state to a compliant state. After some time passes and the noncompliant driver no longer sees any additional highway patrol vehicles, the driver most likely returns to the noncompliant state.[133] So, in the noncompliant driver example, there are observable changes to the compliance state: the driver begins noncompliant, changes to complaint when faced with an immediately-perceived higher probability of detection, and then transitions back to the noncompliant state once the immediately-perceived detection probability decreases.

This analogy is perhaps instructive for interpreting the tax compliance model's results. Generally, taxpayers comply with the rules just as most drivers do. Again, compliance appears to be the "natural state" for most taxpayers. This "natural state" of compliance is perhaps consistent with a variant of the behaviorist theory of social norms: taxpayers voluntarily comply not because they have internalized the tax laws as "just and right" (i.e., made them behavioral norms), but simply because individuals tend to comply with the promulgated rules of an authority. In other words, taxpayers might voluntarily comply simply because that is what the tax authority tells them to do.[134] Sufficient public acceptance of the *authority*—not the rule itself—could lead to widespread compliance with that rule.[135]

Although voluntary tax compliance might be the theoretical starting state, some taxpayers become noncompliant depending on factors such as levels of risk aversion, tax disdain, the perceived strength of the tax authority, and compliance thresholds. According to the model, when faced

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133. This might not even happen by conscious choice, but simply by the driver eventually returning to the state that is normal for him or her absent an immediately-perceived stimulus that makes the driver again hyperaware of the rules.

134. This is consistent with the Milgram experiments of the early 1960s on human obedience to authority. *See* Milgram, *Behavioral Study of Obedience*, *supra* note 86.

135. *Cf.* Harold Hongju Koh, *Why Do Nations Obey International Law?*, 106 YALE L.J. 2599, 2656 (1997) ("Social internalization occurs when a norm acquires so much public legitimacy that there is widespread general obedience to it.").

with an immediately-perceived increase in audit probability, noncompliant taxpayers become compliant, just as deterrence theory predicts. The difference between the model and deterrence theory is that once the immediately-perceived threat of detection diminishes, the deterrence "wears off" and noncompliance resumes, whereas deterrence theory predicts the transitioned state from noncompliant to compliant remains.[136] These changes in immediate perception of audit probability affect only the state of noncompliant taxpayers, since compliant taxpayers remain compliant. Additionally, since noncompliant taxpayers across the entire tax system are "turning on and off" at different times, the net effect of this immediately-perceived deterrence is nullified when observed at the macro level. In other words, they cancel each other out so that they are not observable at the system level.[137]

One can conclude from these results that there is no tax compliance puzzle to solve. Deterrence theory *and* behaviorist theory *and* perceived tax authority strength all accurately describe different dimensions of taxpayer behavior.[138] One only perceives a puzzle in the myopia of analyzing compliance as a result of just one factor. When all factors are seen as contributing something different to the complex adaptive system of U.S. tax compliance, one realizes the truth: there is no puzzle.

V.   CONCLUSION

A computational model based on very simple individual behavioral rules offers a novel and perhaps promising approach to understanding the complex system dynamics of tax compliance and audit enforcement in jurisdictions with self-report or audit strategies such as the United States. The model described here supports the proposition that globally-applicable factors—such as the perceived auditing strength of a tax authority—have a direct and nonlinear effect on the level of taxpayer compliance. The model also suggests that while the probability of audit influences individual

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136. *Cf.* Milgram, *Behavioral Study of Obedience*, *supra* note 86, at 377 (finding that compliance levels in the experiment strongly correlated to the proximity of an authority figure).

137. If the tax compliance model discussed here correctly identifies the governing dynamic of compliance state transitions nullifying each other to the point of being unobservable at the macro level, then under the effective theory principle there would be no utility to including changes in perceived audit probability in future models of system-level voluntary compliance. *Cf.* RANDALL, WARPED PASSAGES, *supra* note 121, at 28–29.

138. *Cf.* Phillips, *Reconsidering the Deterrence Paradigm*, *supra* note 48, at 103 ("[T]here is no reason that the 'deterrence' and 'behavioral' paradigms need be mutually exclusive.").

compliance decisions, these micro-level effects are not apparent in macro-level compliance patterns.

This model, while not complete enough to propose specific tax legislative and administrative policies, does provide insights into the governing dynamics of a self-report or audit tax structure. Extensions of this model that further develop the globally-applicable dynamics directly influencing tax compliance might bridge this gap so that tax policymakers have better insight into factors that encourage tax compliance at the system level. Future work confirming both the local effects of audits on individual tax compliance and the global effects of audits on the tax authority's perceived strength could clarify appropriation and budget needs in order to minimize audit enforcement costs without risking a reduction in overall voluntary tax compliance levels.