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de Geest, G.; Dari-Mattiacci, G.

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ARTICLES

The Rise of Carrots and the Decline of Sticks

Gerrit De Geest[†] & Giuseppe Dari-Mattiacci^{††}

There is a remarkable tendency in modern legal systems to increasingly use carrots. This trend is not limited to legal systems but can also be observed in, for instance, parenting styles, social control mechanisms, and even law schools' teaching methods. Yet, at first glance, sticks appear to be a more efficient means of inducing people to comply with legal rules or social norms because they are not meant to be applied (thus minimizing transaction costs and risks) and may cause fewer unintended distributional distortions. So how can we justify the widespread use of carrots?

This Article shows that carrots can be superior in two cases. The first is when the lawmaker faces specification problems, which means that she does not know what to expect from each individual citizen (for instance, she may not know which citizen should spend time composing songs or which part of the cargo of a sinking ship should be rescued). In those cases, sticks are likely to punish citizens who are unable to comply with the norm and likely to cause wasteful transaction costs, risks, and undesirable wealth changes.

The second is when the lawmaker needs to require significantly higher efforts from some citizens than from others. We use the term singling-out danger to refer to this problem. This is the case, for instance, when the lawmaker wants only some families to send a family member to the army, or only some families to sacrifice land for a highway project. In such cases, sticks would cause significant unintended distributional distortions (artificially impoverishing those from whom much is required), making carrots superior.

Overall, our results predict that in societies with more specialization and division of labor, carrots will be used more often. But they also predict that within each society, carrots will be used more often in situations that involve a higher degree of complexity. Applications include patents, regulatory takings, contract bonuses, the duty to rescue, finders, information disclosure to contract parties, the Endangered Species Act, incentives in the military, slavery, health policy, and parenting.

[†] Professor of Law, Washington University School of Law.

^{††} Professor of Law and Professor of Economics, University of Amsterdam; Becker Friedman Institute Visiting Fellow, The University of Chicago.

INTRODUCTION.....	343
I. PROBLEM AND LITERATURE.....	347
II. THEORETICAL ANALYSIS.....	354
A. Defining Carrots and Sticks.....	354
B. Framework of Our Analysis.....	356
C. Seven Fundamental Differences between Carrots and Sticks.....	360
1. Difference 1: A carrot is applied upon compliance; a stick upon violation.....	361
2. Difference 2: Carrots incentivize by effectively rewarding while sticks incentivize only by threatening.....	361
3. Difference 3: Carrots generate (ex post) transaction costs in case of compliance; sticks in case of violation.....	361
4. Difference 4: Under carrots, all nonmonitored citizens receive the same treatment as monitored violators; under sticks, all nonmonitored citizens receive the same treatment as monitored compliers.....	362
5. Difference 5: Carrots create risks for compliers; sticks create risks for violators.....	362
6. Difference 6: Only carrots have a built-in compensation mechanism.....	363
7. Difference 7: Individualized and general carrots have different distributional effects for compliers while individualized and general sticks have the same distributional effects for compliers.....	364
D. The Easy Case for Sticks: Homogeneous Society with a Fully Informed Benevolent Lawmaker.....	365
E. The Case for Carrots: Citizens Have Different Effort Costs.....	367
F. Another Case for Carrots: The Lawmaker Has No Information on the Citizens' Individual Effort Costs.....	369
III. NORMATIVE GUIDELINES FOR THE USE OF CARROTS AND STICKS.....	371
A. In Simple Settings, Sticks Are Superior.....	371
B. Carrots in the Case of Specification Problems: The Lawmaker Does Not Know What to Ask from Each Citizen.....	372
C. Carrots in the Case of Singling-Out Problems: The Lawmaker Needs to Ask for Substantially Higher Efforts from Some Citizens.....	372
IV. APPLICATIONS.....	373
A. Patents and Copyrights.....	373
B. Rescuers.....	373
C. Finders.....	377
D. Takings and Regulatory Takings.....	378
E. Endangered Species Act.....	380
F. Incentives to Acquire Information in Contracts.....	381
G. Contract Bonuses.....	383
H. Incentives in the Military.....	384
I. Slave Societies.....	386

J. Health Policy 387
 K. Parenting and Education 388
 CONCLUSION 389

INTRODUCTION

A legal system consists of norms that are legally enforced. But should enforcement happen through carrots such as positive sanctions, rewards, and bonuses, or through sticks like negative sanctions, penalties, damages, fines, and imprisonment? This is one of the most fundamental questions one can ask about a legal system. But remarkably, we know very little about the answer.¹

Legal systems traditionally rely more on sticks than on carrots. Tort law and criminal law consist almost solely of sticks.² Contracts are usually enforced through sticks (damages, specific performance under the threat of criminal sanctions for contempt of court, stipulated damages).³ Administrative agencies try to improve the behavior of citizens by threatening them with fines.⁴ Police officers—the archetype of law enforcement—have guns in their pockets, not dollars or candy.

Yet there is a remarkable tendency in modern legal systems to increasingly use carrots. Patent and copyright law—two relatively young legal fields—are the poster children of this evolution; they offer carrots to encourage citizens to invent or produce art.⁵ But the trend is much more general than this. Modern legal systems tend to avoid the stick-based command-and-control approach to change behavior and try to use subsidies and tax credits more often.⁶ Modern armies no longer recruit through a stick-based general conscription but instead use carrots to attract volunteers.⁷ Modern law enforcement authorities offer rewards

¹ See James Andreoni, William Harbaugh, and Lise Vesterlund, *The Carrot or the Stick: Rewards, Punishments, and Cooperation*, 93 Am Econ Rev 893, 893 n 1 (2003).

² See Giuseppe Dari-Mattiacci and Gerrit De Geest, *Carrots, Sticks, and the Multiplication Effect*, 26 J L, Econ, & Org 365, 367 (2010).

³ See Avery Wiener Katz, *The Option Element in Contracting*, 90 Va L Rev 2187, 2201–02 (2004).

⁴ See Gary S. Becker, *Crime and Punishment: An Economic Approach*, 76 J Polit Econ 169, 193–98 (1968).

⁵ Patents and copyrights offer a carrot in the form of an exclusive right, which allows the holder during a certain period to charge a supracompetitive price for the use of the invention or artistic creation. See Wendy J. Gordon, *Of Harms and Benefits: Torts, Restitution, and Intellectual Property*, 21 J Legal Stud 449, 449–50 (1992).

⁶ See Brian Galle, *The Tragedy of the Carrots: Economics and Politics in the Choice of Price Instruments*, 64 Stan L Rev 797, 828–30 (2012).

⁷ See generally William A. Fischel, *The Political Economy of Just Compensation: Lessons from the Military Draft for the Takings Issue*, 20 Harv J L & Pub Pol 23 (1996).

(in the form of money or sentence reduction) in exchange for information on crimes,⁸ which stands in contrast to the practice of some older legal systems that induced such cooperation through the threat of torture.⁹ Commercial and employment contracts increasingly use bonuses to encourage productive behavior.¹⁰

This trend to use carrots is not limited to legal systems. Modern books on parenting emphasize carrots (appraisal, encouragement) rather than sticks (physical punishment, humiliation, shouting).¹¹ Social control systems seem to have become less judgmental, less based on inducing feelings of guilt, and more based on emphasizing the positive, praising the good.¹²

Even law schools seem to be abandoning the stick-based aspects of the traditional Socratic method (public humiliations for students who could not answer the professor's questions¹³) and are trying to create a more positive learning environment.¹⁴

⁸ See Kneave Riggall, *Should Tax Informants Be Paid? The Law and Economics of a Government Monopsony*, 28 Va Tax Rev 237, 239–42 (2008).

⁹ See Beccaria, *On Crimes and Punishments and Other Writings* 39–45 (Cambridge 1995) (Richard Bellamy, ed) (Richard Davies, Virginia Cox, and Richard Bellamy, trans). Beccaria is credited with being one of the first to reflect on the utility of torture as an information-acquisition and deterrence device in economic terms. See A. Mitchell Polinsky and Steven Shavell, *Public Enforcement of Law*, in Boudewijn Bouckaert and Gerit De Geest, eds, 5 *Encyclopedia of Law and Economics* 307, 321 (Edward Elgar 2000).

¹⁰ See Edward P. Lazear, *Labor Economics and the Psychology of Organizations*, 5 J Econ Persp 89, 98 (Spring 1991).

¹¹ See, for example, Edward R. Christophersen and Susan L. Mortweet, *Parenting That Works: Building Skills That Last a Lifetime* 31–45, 65–66 (American Psychological Association 2003).

¹² See Allan V. Horwitz, *The Logic of Social Control* 1–5 (Plenum 1990).

¹³ See, for example, *The Paper Chase* (20th Century Fox 1973). See also Orin S. Kerr, *The Decline of the Socratic Method*, 78 Neb L Rev 113, 118–19 (1999) (“The most common complaint against the Socratic method is that it is cruel and psychologically abusive.”).

¹⁴ See Kevin K. Washburn, *Elena Kagan and the Miracle at Harvard*, 61 J Legal Educ 67, 70–72 (2011); Kerr, 78 Neb L Rev at 129–31 (cited in note 13). How can we explain this evolution toward a more positive approach within our framework? One explanation is that the questions asked of Harvard law students in *The Paper Chase* were all related to the facts of the case and the ruling of the court—relatively simple questions that every hardworking student should be able to answer. If professors are sure that all students are able to answer such questions, and if wrong answers result from a lack of effort, then sticks can make sense (because they will not have to be applied, since all rational students will prepare for class). But modern professors raise legal issues more frequently in context and ask more complex questions that may require some background knowledge of political or economic science, philosophy, or psychology. Moreover, the student population has become more international and culturally and sociologically diverse. As a result, professors may have more specification problems; that is, they feel less certain about whether individual students will be able to arrive at the expected answer. Under these circumstances, sticks would regularly punish the innocent. See Part III.B. Of course other factors may have played a role. Professors from previous generations may just have copied the stick-based approach that was common in families and busi-

How can we explain this evolution? Despite an emerging literature on this topic, all insights to this point have been limited to specific situations or aspects. In this Article, we derive a *general* proposition on the comparative benefits of carrots and sticks, identifying a heretofore unrecognized benefit of carrots.

Our starting point is that *in simple settings sticks are superior*. By “simple setting” we mean a situation in which citizens have more or less equal compliance costs and the lawmaker knows these costs and asks for equal efforts from all citizens. In these cases, sticks are superior because the lawmaker can easily set them high enough so that all citizens comply. When all citizens comply, sticks do not have to be applied, reducing transaction costs and preventing uncertainty regarding who will be punished. Moreover, the existing income distribution in society is not unintentionally changed because all citizens have equal compliance costs.

But complexity can make carrots superior for two reasons. The first is when the lawmaker faces *specification problems*, which means that she does not know what to expect from each individual citizen (for instance, she may not know which citizen should spend time composing songs). In those cases, sticks are likely to punish citizens who are unable to comply with the norm and likely to cause wasteful transaction costs, risks, and undesirable wealth changes.

The second is when the lawmaker needs to require significantly higher efforts from some citizens than from others. We use the term *singling-out danger* to refer to this problem. This is the case, for instance, when the lawmaker wants only some families to send a family member to the army or only some families to sacrifice land for a highway project. In such cases, sticks would cause significant unintended distributional distortions (artificially impoverishing those from whom much is required), making carrots superior.

These findings could be reframed in terms of complexity. Although complexity is a somewhat vague concept, it could serve as an overarching notion covering the fundamental causes of heterogeneity (the reason why citizens have different costs and need to do different things is the division of labor and specialization among them) and the lawmaker’s imperfect information (the reason why the lawmaker may have great difficulties determining which citizen should do exactly what is that all citi-

ness organizations at that time—and which may in turn have been associated with less complexity. See Part IV.K.

zens have different skills or that the citizens have superior information about situational characteristics).

Overall, our results predict that in societies with more specialization and division of labor, carrots will be used more often. But they also predict that within each society carrots will be used more often in situations that involve a higher degree of complexity.

While we do not deny that carrots and sticks have many psychological dimensions too,¹⁵ we develop our arguments using a narrowly defined rational choice framework, as is standard in economic analysis of law enforcement.¹⁶ More specifically, our framework considers transaction costs, risks, and distributional side effects. But while we use an economic framework, it would not be difficult to justify our results on fairness grounds instead. Our specification problem argument is summarized in the statement that sticks should not be used when they would punish the innocent. And our singling-out problem argument is encapsulated in the idea that sticks should not be used when the law requires a significantly higher burden from certain citizens than from others.

The Article proceeds as follows. In Part I we argue that, while the law traditionally focuses on sticks, there is a remarkable tendency to increasingly use carrots. We show that the general question of whether carrots are better than sticks has received very little attention in the literature, which focuses on particular characteristics of specific applications. In Part II we offer a theoretical analysis. We show that carrots and sticks can be objectively defined, explain the framework of our analysis, and derive seven fundamental differences between carrots and sticks. We show that sticks are superior in simple settings, when citizens have similar effort costs and the lawmaker knows these effort costs, and that carrots can be superior when these conditions are not fulfilled. In Part III we formulate normative guidelines for the use of carrots and sticks. We argue that sticks should be used in simple settings and carrots in the case of specification problems and singling-out problems. In Part IV we discuss eleven applications for these principles: patents and copyrights, rescuers, finders, takings and regulatory takings, the

¹⁵ See Lazear, 5 *J Econ Persp* at 89–90 (cited in note 10).

¹⁶ See A. Mitchell Polinsky and Steven Shavell, *The Economic Theory of Public Enforcement of Law*, 38 *J Econ Lit* 45, 47–49 (2000); Becker, 76 *J Polit Econ* at 176–79 (cited in note 4).

Endangered Species Act of 1973¹⁷ (ESA), incentives to acquire information in contracts, contract bonuses, incentives in the military, slavery societies, health policy, and parenting and education. In Part V we summarize and reflect on our findings.

I. PROBLEM AND LITERATURE

Incentives can be generated by either carrots (promises to reward, such as with prizes or bonuses) or sticks (threats to punish, such as with fines or damages). Carrots and sticks are *prima facie* equivalent because any behavioral change induced by promising compliers a \$100 reward can also be obtained by threatening violators with a \$100 punishment. Yet, while carrots and sticks seem to produce the same effects, they are not chosen at random; some general patterns can be observed across legal systems. Incentives for careful driving are generally created by holding negligent drivers liable under tort law rather than by rewarding careful drivers.¹⁸ Likewise, theft is discouraged by penalizing thieves and not by rewarding those who do not steal.¹⁹ Incentives to invent are created by rewarding successful inventors with patents or academic prizes rather than by punishing all others.²⁰

But while there are some patterns in how carrots and sticks are used across legal systems, there is also a remarkable trend toward the increased use of carrots in complex societies with a far-reaching division of labor and specialization.

This pattern remains largely unexplained, but it may be because the differences between carrots and sticks are still largely undertheorized.²¹ There are some contributions in the literature, but they remain fragmented, exploring narrowly defined subquestions. Among the topics considered in papers addressing specific applications of carrots and sticks are law enforcement

¹⁷ Pub L No 93-205, 87 Stat 884, codified as amended at 16 USC § 1531 et seq.

¹⁸ See Gordon, 21 *J Legal Stud* at 455 (cited in note 5).

¹⁹ See Becker, 76 *J Polit Econ* at 176–80 (cited in note 4).

²⁰ See Gordon, 21 *J Legal Stud* at 480–81 (cited in note 5).

²¹ Note that in the criminological literature, the terms “carrots” and “sticks” are often used in a different sense than in the present Article: working with carrots stands for improving the attractiveness of the alternatives to a criminal career, for instance by increasing education levels, reducing unemployment, or improving social cohesion. See, for example, Hope Corman and Naci Mocan, *Carrots, Sticks, and Broken Windows*, 48 *J L & Econ* 235, 237 (2005).

wages,²² the duty to rescue,²³ combating corruption,²⁴ and rewarding whistle-blowers.²⁵

However, some papers do discuss certain general aspects of carrots and sticks. For instance, there is some literature about

²² See, for example, Gary S. Becker and George J. Stigler, *Law Enforcement, Malfeasance, and Compensation of Enforcers*, 3 J Legal Stud 1, 13–16 (1974). Gary Becker and George Stigler argue that since the apprehension rate of corrupt officials is very low and dismissal is the normal sanction (harsher sanctions being very infrequent), law enforcement officials should be overpaid so that dismissal becomes more costly to them because they will lose a well-paying job. Id at 6–11. Note that this form of overpayment is in fact an *annullable carrot* in the sense further explained in notes 28 and 48. The idea of overpaying law enforcement officials is related to a more general principle known as efficiency wages, which we further discuss in note 37.

²³ See, for example, Saul Levmore, *Waiting for Rescue: An Essay on the Evolution and Incentive Structure of the Law of Affirmative Obligations*, 72 Va L Rev 879, 886–89 (1986). Professor Saul Levmore argues that the traditional approach of the common law to have no duty to rescue but also to virtually never reward rescuers creates balanced incentives. Id at 892. He also observes that when sticks are introduced, carrots are often introduced as well, and argues that this is necessary in order to balance long-term activity-level incentives. Id at 899. See also William M. Landes and Richard A. Posner, *Salvors, Finders, Good Samaritans, and Other Rescuers: An Economic Study of Law and Altruism*, 7 J Legal Stud 83, 91–92 & n 19, 119–24 (1978) (arguing that legal incentives could overcrowd social incentives to rescue and hence be detrimental, that carrots may induce people to invest too much in avoiding risky situations in order not to pay the rewards, and that sticks may induce potential rescuers to stay away from locations where there may be people who need to be rescued).

²⁴ See, for example, Robert Cooter and Nuno Garoupa, *The Virtuous Circle of Distrust: A Mechanism to Deter Bribes and Other Cooperative Crimes* *2–3 (Berkeley Program in Law and Economics, Working Paper Series, Nov 2000), online at <http://escholarship.org/uc/item/83c0k3wc> (visited Mar 3, 2013) (arguing that offering carrots to those who report crime induces mistrust between criminals and hence reduces the incidence of corruption). Our analysis is not restricted to cooperative crimes and is also valid if individuals do not interact with each other as they do in Professors Robert Cooter and Nuno Garoupa's framework. Moreover, the analysis of Professors Cooter and Garoupa is purely based on incentives and does not consider the other aspects that we bring to bear on the choice of carrots versus sticks. To make our point stronger, we start from the assumption that incentives are exactly the same under carrots as under sticks and focus on other factors (transaction costs, risks, and distribution).

²⁵ See, for example, Ben Depoorter and Jef De Mot, *Whistle Blowing: An Economic Analysis of the False Claims Act*, 14 S Ct Econ Rev 135, 137–40 (2006). The authors criticize the use of carrots for private whistle-blowers in fraud cases on account of two factors that make the private incentives to act diverge from social incentives. First, carrots make private parties act upon the prospect of a reward while the government looks at the broader picture of social costs and benefits of prosecuting fraudulent activities. The reward might be an imperfect proxy for the social value of the prosecution, resulting in too much or too little prosecution. Id at 154–55. Second, if there is competition among whistle-blowers and rewards are paid to the first in time, there will be a race to be the first, which results in premature prosecutions. Id at 158–61. The authors conclude that both the incentives to blow the whistle and the timing of whistle-blowing will typically be different from their theoretical optimal values. Id at 161–62. The authors do not compare carrots and sticks in a general setting as we do.

whether carrots can be rewritten as sticks and vice versa.²⁶ There is also some literature arguing that small sticks can be sufficient to generate large incentive effects.²⁷ Annullable carrots and sticks in general, which have very different characteristics than normal carrots and sticks and are rarely used in the real

²⁶ See, for example, Katz, 90 Va L Rev at 2228–29 (cited in note 3). Professor Avery Katz showed that most contracts can be seen as option contracts. For instance, a contract with a penalty clause for breach could be viewed as an option contract in which the promisor has two options: perform or pay a predetermined amount. The original contract can be seen as implementing a stick: damages are a penalty that is due if the promisor does not perform. In contrast, the option contract can be seen as implementing a carrot in which the reward corresponds to the amount that the promisor saves if he chooses the option of performance over the alternative option. *Id.* at 2219–24. Professor Katz concludes that characterizing a contract as a stick contract or a carrot contract depends on where the baseline is. If the baseline is performance (as in the original contract), then the payment of the penalty is a stick. If, instead, the baseline is no performance (as in the option contract), then saving an amount of money equal to the penalty is a carrot. *Id.* at 2228–29. In Part II, we explain how the ambiguity surrounding the definition of a regime as carrots or sticks can be overcome. See also Lazear, 5 J Econ Persp at 102 (cited in note 10). Professor Edward Lazear argued that, in the context of employment contracts, a bonus contract can easily be rewritten as a penalty contract by simply changing the baseline. *Id.* at 103–04. The choice between carrots and sticks may then be influenced by whether it is easier to set upper or lower limits to performance. In Professor Lazear’s framework, arriving on time at work, for instance, should be incentivized by sticks for late arrival because an upper limit is appropriate: arriving too early has no value. But salespersons should be incentivized by carrots because an upper limit (the maximum quantity that they may be able to sell) cannot be defined. *Id.* In our analysis, we take performance to be a discrete, binary variable, so that considerations on upper and lower limits do not apply.

²⁷ See, for example, Dari-Mattiacci and De Geest, 26 J L, Econ, & Org at 366–67 (cited in note 2) (arguing that a single stick can be used to incentivize many people at the same time when the law enforcer can prevent cooperation among citizens). The reason sticks have more powerful incentive effects than carrots is that sticks rely on threats, while carrots rely on actual rewards. If a threat is followed by compliance, the threatened sanction does not need to be applied and can be used to incentivize another individual. We called this the “multiplication effect” of sticks. *Id.* at 373. An extreme example would be a world dictator who has only a single bullet and uses it to threaten six billion citizens to work as his slaves. In contrast, carrots require the actual payment of the promised reward upon compliance and, hence, cannot be recycled. *Id.* at 367. If individuals cannot coordinate, the multiplication effect makes enforcement through sticks much more powerful than enforcement with carrots because one stick can be used to incentivize several individuals, while one carrot can be used to incentivize only one individual. If individuals can coordinate, the multiplication effect disappears. The intuitive reason is that individuals could agree to share the stick among them and hence reduce the incentive effect to a fraction of the original stick, so that for n coordinated individuals the enforcer needs n sticks (not just one). *Id.* at 373–75. Since in most law-enforcement situations individuals cannot coordinate, it seems plausible to conclude that enforcement is cheaper with sticks than with carrots. This observation calls for further analysis: If enforcement is in principle cheaper with sticks, what justifies the evolution toward a more widespread use of carrots? In this Article we set out to answer this question.

world, are discussed in a 2009 article we wrote with Professor Jacques Siegers.²⁸

Other scholars have explored the symmetry between the different legal treatments of positive and negative externalities in tort law and intellectual property, including Professors Saul Levmore,²⁹ Wendy Gordon,³⁰ and one of us.³¹ These papers,

²⁸ Gerrit De Geest, Giuseppe Dari-Mattiacci, and Jacques J. Siegers, *Annulable Bonuses and Penalties*, 29 *Intl Rev L & Econ* 349, 352–55 (2009) (arguing that annulable bonuses and penalties make sense only under rather exceptional conditions). Annulable sanctions (bonuses or penalties) are sanctions that are applied *unless* monitoring takes place. This stands in contrast to normal sanctions, which are applied *if* monitoring takes place. *Id.* at 351–53. To illustrate, a speed limit implies that if a motorist is photographed while speeding, he or she will be subjected to a fine. This is a normal sanction. The annulable variant of the same sanction is that the motorist must pay the fine unless she is photographed while not speeding. What is the difference between these two regimes? For monitored motorists (those who have been photographed), nothing changes: those speeding will pay a fine while those driving under the speed limit will not. Instead, for nonmonitored motorists (those who have not been photographed), the situation changes. With normal fines, they do not pay the fine, while with annulable fines, they do pay a fine. Since monitoring is probabilistic, not all motorists are photographed (monitored); actually, only a few are. Thus, applying an annulable sanction rather than a normal one has consequences for the many nonmonitored individuals and for optimal law enforcement policy. *Id.* at 352–54. This Article does not touch upon these issues and only examines normal sanctions, given that annulable sanctions are the exception. For a discussion of the difference between annulable carrots and sticks and normal carrots and sticks, see note 48.

²⁹ Saul Levmore, *Explaining Restitution*, 71 *Va L Rev* 65, 67 (1985) (comparing restitution with tort law). Professor Levmore notes that while the law of torts generally forces compensation for unbargained-for harm, the law of restitution is much more parsimonious in requiring compensation for unbargained-for benefit. *Id.* at 69–71 (“In short, the law may be seen as . . . sometimes allowing claims for nonbargained benefits when the valuation task is easy.”). The explanation offered by Professor Levmore focuses essentially on wealth dependency (which makes it difficult to assess the value of an unrequested benefit for the recipient, due to the fact that the monetary valuation of benefits could vary with wealth and preferences) and market encouragement (if unrequested benefits are not compensated for, those able to benefit others have a choice between doing it for free or negotiating with the recipient; this encourages the formation of markets and induces people to prefer voluntary transactions to unbargained-for transfers). *Id.* at 74–81. The point of this Article is different, as we do not ask why some forms of positive externalities are not compensated for but rather whether one should use carrots or sticks to induce people to behave according to a rule of conduct. In the framework of positive externalities, our question translates into asking whether (assuming that we want to induce the production of such externalities) we should reward benefactors or punish those who fail to benefit others.

³⁰ Gordon, 21 *J Legal Stud* at 449–52 (cited in note 5) (comparing intellectual property law, tort law, and restitution). Professor Gordon notes that

[f]rom an abstract perspective, there would seem to be little reason for harms and benefits to be treated differently. Decades of cost-benefit analyses suggest that the two categories are interchangeable: reducing by one dollar damage that would otherwise occur is equivalent to providing a dollar’s worth of new goods or services. The labels are themselves variable. One can verbally transform most benefit questions into “harms” and vice versa by juggling the baseline from which effects are measured.

however, only indirectly reflect on the general differences between carrots and sticks.

The most extensive literature dealing with a specific context is the economic literature on the use of taxes versus subsidies to control pollution.³² This literature largely focuses on the long-run activity-level effects of carrots and sticks. Subsidizing pollution-reducing measures by firms, for instance, injects money into the industry and may attract more polluters in the long run. One of the general conclusions of this literature, therefore, is that carrots should be used for positive externalities and sticks for negative externalities.³³ In a recent paper, independently

Id at 451. Professor Gordon's analysis focused on whether the traditional arguments offered for the granting of compensation in benefit cases extend to the domain of intellectual property. Id at 460–71. The analysis proposed in this Article is broader in scope and relies on novel discriminants between carrots and sticks.

³¹ Giuseppe Dari-Mattiacci, *Negative Liability*, 38 J Legal Stud 21, 22–24 (2009) (comparing restitution and tort law). Negative liability is the mirror image of positive tort liability. Under positive tort liability, those causing harm to others are obliged to pay compensation to the victim; in contrast, under negative liability, those who receive an unsolicited benefit are obliged to pay compensation to the benefactor. In principle, these two regimes are perfectly symmetric, as are the problems they address (negative versus positive externalities). See id. However, there are relevant asymmetries due to information gathering during trial, incentives for victims and benefactors to behave optimally, and the decoupling of care incentives and activity-level incentives. These factors explain why negative liability is rarely used in the real world and sheds light on the design of a number of existing negative-liability rules. Id at 26–30. Negative and positive liability are special examples of carrots and sticks and, in particular, they are analyzed under the assumption that one instrument (the carrot or the stick) must be used to achieve two goals at the same time (incentivize the injurer and the victim or the benefactor and the beneficiary; provide incentives for care and incentives for activity level). Id at 33–38. Moreover, the analysis does not touch upon transaction costs, risks, and distributional issues. Id at 35. In contrast, in the present Article, we focus on cases in which one instrument is used for only one goal and proceed with an analysis of transaction costs, risks, and distribution of resources.

³² See, for example, A.C. Pigou, *The Economics of Welfare* 192–96 (Macmillan 4th ed 1932) (discussing the state's power to mitigate negative externalities by applying "bounties and taxes"). Arthur Pigou spurred an enormous literature that generally reflects on the methods for internalizing negative externalities. For research that relates to Pigou that more directly addresses the point of an analytical symmetry between different methods of internalization, see Ronald H. Coase, *The Problem of Social Cost*, 3 J L & Econ 1, 2 (1960). See also note 44.

³³ See, for example, Donald Wittman, *Liability for Harm or Restitution for Benefit?*, 13 J Legal Stud 57, 61–62 (1984). Professor Donald Wittman was also the first to point out that transaction costs play a role in the choice between carrots and sticks. For instance, theft should be penalized, rather than nontheft subsidized, because theft occurs less frequently than its alternative, and therefore sticks involve lower transaction costs. Id at 65. Professor Wittman attributed the dominance of sticks to the fact that efficient behavior tends to become "normal" behavior (theft is less frequently occurring than non-theft because theft is inefficient—and hence, sticks are used for thieves rather than carrots for nonthieves). Id at 60 n 11.

from us, Professor Brian Galle³⁴ revives the association between carrots and positive externalities and sticks and negative externalities³⁵ and argues that modern societies use carrots excessively due to political reasons.³⁶

The distinction between carrots and sticks has also received some attention in other fields of economics, such as (1) labor economics (for example, the efficiency-wages literature, which analyzes the characteristics of a special type of annullable bonuses,³⁷ or the work of Professor Edward Lazear,³⁸ who argued

³⁴ Galle, 64 *Stan L Rev* at 801–03 (cited in note 6). Professor Galle analyzes the effects of carrots and sticks on government revenues (payments to or from the government), distribution (but, contrary to us, he does not examine the distributional effects of different costs of efforts and only focuses on the payments made by or to the government), repeated games (that is, the activity-level incentives that are central in the pollution-tax-versus-subsidy literature), and mitigation. *Id.* at 814–27. Our analysis goes further and considers risk, transaction costs, and distributional distortions (which, in our analysis, also include the different costs of effort). Professor Galle’s analysis of mitigation is based on the implicit assumption that the policymaker uses one instrument (the carrot or the stick) to solve two problems (for instance, incentivizing an injurer and a victim). One of us has explained why this may be a more serious problem with carrots than with sticks; in this Article, we consider situations in which one instrument is used to achieve one goal. See Dari-Mattiacci, 38 *J Legal Stud* at 41–42 (cited in note 31).

³⁵ Galle, 64 *Stan L Rev* at 800 (cited in note 6). But as we will show, this association is not at all obvious. The military draft is a very clear example of a positive externality (national defense) accompanied by sticks (penalties for not serving in the army). We discuss this issue in Part IV.H.

³⁶ Galle, 64 *Stan L Rev* at 840–45 (cited in note 6). Professor Galle’s predictions on the use of carrots versus sticks in society are static in nature: political incentives induce policy makers to make excessive use of carrots. Our analysis, instead, accounts for social and economic changes, as we show that the use of carrots versus sticks is related to some characteristics (complexity) of the behavior that needs to be incentivized. Therefore, we are able to explain not only the present use of carrots but also the historical trend toward the present situation.

³⁷ See, for example, Carl Shapiro and Joseph E. Stiglitz, *Equilibrium Unemployment as a Worker Discipline Device*, 74 *Am Econ Rev* 433, 437–38 (1984). Professors Carl Shapiro and Joseph Stiglitz show that overpayment of workers can be an effective incentive device in that overpayment increases the cost of labor and hence creates unemployment. Unemployment in turn makes the sanction of dismissal more severe for workers and, hence, improves their incentives to work in situations where the monitoring level is low. *Id.* Such an overpayment is called an efficiency wage and is a form of annullable carrot, as explained in notes 28 and 48. Overpayments are advocated by the authors in scenarios in which sticks cannot be applied. Therefore, the authors do not offer guidance for the choice of carrots versus sticks more generally when both are available. See Shapiro and Stiglitz, 74 *Am Econ Rev* at 433, 443 (cited in note 37). For other commentary on efficiency wages, see George A. Akerlof, *Labor Contracts as Partial Gift Exchange*, 97 *Q J Econ* 543, 543–44 (1982); George A. Akerlof, *Gift Exchange and Efficiency-Wage Theory: Four Views*, 74 *Am Econ Rev Papers & Proceedings* 79, 80–82 (1984) (arguing that efficiency wages can also be explained with a gift-reciprocity argument: workers who are overpaid receive a gift and are likely to return the gift to the employer in the form of more effort even if there is no monitoring at all). This argument relates more to the behavioral literature on carrots versus sticks than to our framework. See note 40.

that carrots should be used in employment contracts when only minimum performance can be defined and sticks when only the maximum performance can be defined), and (2) institutional economics.³⁹

The different reactions of human beings (and animals) to negative and positive sanctions are also widely studied in psychology and behavioral economics. Prospect theory, for instance, suggests that negative incentives are more effective than positive incentives because of loss aversion.⁴⁰ While we do not deny the importance of psychological aspects, we examine the properties of carrots and sticks within a narrowly defined, rational choice framework, in which their apparent equivalence is more poignant.⁴¹ Hence, this Article will not address psychological aspects, although we will briefly comment on the general tendency among psychologists to favor carrots over sticks in Part IV.K.⁴²

Overall, there is a lack of normative guidelines on the use of carrots and sticks in general, and a lack of explanations of more general patterns.⁴³ How can we explain that such a fundamental dimension of norm systems has remained so undertheorized? Several elements have played a role. One is the difficulty in objectively defining carrots and sticks, and somewhat related, the

³⁸ Lazear, 5 *J Econ Persp* at 102 (cited in note 10).

³⁹ See, for example, Robert William Fogel and Stanley L. Engerman, *Time on the Cross: The Economics of American Negro Slavery* 3–11 (Little, Brown 1974) (initiating a debate on the conditions of slaves and the viability of slavery as a means of production); Stefano Fenoaltea, *Slavery and Supervision in Comparative Perspective: A Model*, 44 *J Econ Hist* 635, 637–43 (1984). See also note 160 and accompanying text.

⁴⁰ See, for example, Daniel Kahneman and Amos Tversky, *Prospect Theory: An Analysis of Decision under Risk*, 47 *Econometrica* 263, 263–69 (1979) (arguing that the incentive effect of carrots and sticks is also a function of psychological factors and that these factors make the result deviate from what would be predicted by traditional economic theory); Amos Tversky and Daniel Kahneman, *The Framing of Decisions and the Psychology of Choice*, 211 *Science* 453, 458 (1981); Andreoni, Harbaugh, and Vesterlund, 93 *Am Econ Rev* at 899–901 (cited in note 1) (presenting experimental results on the joint use of carrots and sticks as compared to using carrots or sticks alone).

⁴¹ Behavioral economics and psychology tend to give carrots a larger role than traditional rational choice framework since they make a stronger point concerning the advantages of carrots over sticks.

⁴² For a description of this tendency, see Alfie Kohn, *Punished by Rewards: The Trouble with Gold Stars, Incentive Plans, A's, Praise, and Other Bribes* 3–4 (Houghton Mifflin 1993).

⁴³ The analytical symmetry between carrots and sticks is explicitly discussed in Nobel Laureate Gary Becker's seminal paper on the economics of criminal law. See Becker, 76 *J Polit Econ* at 191–93 (cited in note 4). But Becker came no further than suggesting that the more frequent use of sticks in legal systems may be due to historical coincidences or difficulties in measuring benefits. *Id.* at 208. On the other hand, Professor Galle concludes that the trend to use more carrots is inefficient and due to distorted political incentives. Galle, 64 *Stan L Rev* at 840–45 (cited in note 6) (discussing the distorting effects of interest groups and a federal system).

false idea that the difference between carrots and sticks is only one of framing—much like the difference between a half-full and a half-empty glass. If the difference between carrots and sticks is only a perceived one, there is indeed no need to look any further for real differences. Note that this framing idea is popular not only in the psychology literature but also in the economics literature. Indeed, the economic concept of “opportunity cost” suggests at first sight that a stick is analytically the same as an unapplied carrot and vice versa. Also, economists usually focus on marginal incentives, and the marginal incentives of carrots and sticks are, in principle, the same.⁴⁴

Another reason economists have paid so little attention to the difference between carrots and sticks is that distributional side effects play a crucial role in the understanding of their differences, as we will later show.⁴⁵ But economists tend to ignore such effects (partly because they believe that the best way to redistribute income is through the tax system⁴⁶), and this may have led them to overlook one of the main explanatory variables in the context of carrots and sticks.

II. THEORETICAL ANALYSIS

A. Defining Carrots and Sticks

While there is some confusion regarding what carrots and sticks are, defining these terms is surprisingly easy. Carrots and sticks are both transfers of wealth that induce the citizen to comply with a rule. A *carrot* is a payment *to* the citizen (by the lawmaker)⁴⁷ that is made *if* the citizen has been monitored and found complying. A *stick* is a payment *by* the citizen (to the lawmaker) that is made *if* the citizen has been monitored and found violating.⁴⁸

⁴⁴ The economic idea that carrots and sticks are equivalent with respect to marginal incentives is implicit in Ronald Coase’s work, although this idea is not presented in terms of a choice between carrots and sticks. Coase shows that the same result can be obtained either by having actual polluters pay damages or by paying potential polluters not to pollute. Coase, 3 J L & Econ at 6 (cited in note 32).

⁴⁵ See Part II.B.

⁴⁶ See, for example, Louis Kaplow and Steven Shavell, *Why the Legal System Is Less Efficient Than the Income Tax in Redistributing Income*, 23 J Legal Stud 667, 667–69 (1994).

⁴⁷ “Lawmaker” is broadly defined in this Article. See Part II.B.

⁴⁸ An *annullable carrot*, in contrast, is a payment that is made *unless* the citizen has been monitored and found violating. Similarly, an *annullable stick* is a payment *by* the citizen (to the lawmaker) that is made *unless* the citizen has been monitored and found complying. In essence, an annullable carrot is a threat to take back while an an-

But can carrots and sticks indeed be objectively defined or are they just the same phenomenon seen from a different angle, similar to the difference between a half-full and a half-empty glass? Some authors have made the point that the distinction is only a matter of framing because carrots can be rewritten as algebraically identical to sticks and vice versa.⁴⁹ To illustrate, consider a construction contract with a price of \$100 and a penalty for late performance of \$9 (applied with probability $p = 1$). This contract can be rewritten as one with a price of \$91 and a bonus for timely performance of \$9. In both cases the builder receives \$100 if he finishes on time and \$91 if he finishes late. *Prima facie*, these two regimes seem equivalent.

However, this argument holds only if monitoring is nonprobabilistic—that is, if it occurs with a probability equal to 1. If the probability of monitoring is less than 1, the payoffs under carrots and sticks are no longer algebraically identical.⁵⁰ To illustrate, in the previous construction contract example, suppose that the citizens can only be monitored in 10 percent of the cases. The penalty contract with a base price of \$100 now needs a penalty with a magnitude of \$90 (because it is applied to only 10 percent of violators); the bonus contract with a base

nullable stick is a promise to give back. The difference between the normal form and these annullable variants consists in what happens in the case of no monitoring. In the absence of monitoring, normal carrots and sticks are not paid, while annullable carrots and sticks are paid. This implies that when all citizens are monitored (probability $p = 1$), the difference between the normal and the annullable variant disappears. See De Geest, Dari-Mattiacci, and Siegers, 29 *Intl Rev L & Econ* at 349–51 (cited in note 28). Annullable carrots and sticks are relatively rare. See *id.* at 358. A real-life example of an annullable carrot is an efficiency-wage contract, which pays supra-market wage premiums to all employees in order to give them an incentive not to shirk. See, for example, Becker and Stigler, 3 *J Legal Stud* at 6–11 (cited in note 22) (arguing that increased wages for enforcers will improve efficiency of fighting corruption); Shapiro and Stiglitz, 74 *Am Econ Rev* at 435–38 (cited in note 37) (modeling the efficiency wage at which a worker will be sufficiently dissuaded from shirking). Efficiency wages are annullable carrots because all employees receive the overpayment unless they have been found shirking; employees who have not been monitored (which may include some who have shirked) receive the bonus as well. Outside of contractual relationships, it is difficult to find examples of annullable carrots and sticks. An implicit example of an annullable stick is a penalty for which the burden of proof has been reversed, and the innocent needs some luck to prove his innocence. See also De Geest, Dari-Mattiacci, and Siegers, 29 *Intl Rev L & Econ* at 358–59 (cited in note 28).

⁴⁹ See, for example, Lazear, 5 *J Econ Persp* at 101–05 (cited in note 10) (arguing that restrictions on penalty schemes in employment contracts can be circumvented by rewriting them as bonus schemes); Robert Cooter and Thomas Ulen, *Law and Economics* 252–53 (Pearson 4th ed 2004); Katz, 90 *Va L Rev* at 2200–01 (cited in note 3) (arguing that the law's refusal to enforce penalty clauses may be evaded in similar ways).

⁵⁰ Another condition is that it is possible to pay precompensation, which may be difficult if the parties are not in a contractual relationship. See De Geest, Dari-Mattiacci, and Siegers, 29 *Intl Rev L & Econ* at 352–53 (cited in note 28).

price of \$91 now needs a bonus of \$90 (because it is paid to only 10 percent of the compliers). This means that compliers will receive \$100 under a penalty regime while under a bonus regime, they will receive either \$91 (the base price, in case of no monitoring) or \$181 (the base price plus the \$90 bonus, in case of monitoring). Under a penalty regime, violators will receive either \$100 (the base price, in case of no monitoring) or \$10 (the base price minus the \$90 sanction, in case of monitoring), while they will always receive \$91 under a bonus regime. While the payoffs are equal in expected terms,⁵¹ they are different in real terms, and therefore the risk allocation is different (the penalty contract is risky for breachers while the bonus contract is risky for performers).⁵²

B. Framework of Our Analysis

Our analysis of carrots and sticks is based on a traditional rational choice framework, which is commonly used in economic analysis of law. It is important to repeat that we do not consider psychological or behavioral effects. This means on the one hand that our conclusions do not depend on the occurrence of such effects. But it does mean that our results may need to be qualified when such effects do occur.

The framework we have in mind is very basic. A *lawmaker* exercises some authority (deriving from nature, the law, or the use of force) over a population of individuals (the *citizens*) on whom she enforces a *norm* (or rule). Complying with this norm requires some effort from each citizen, but this effort cost may be different (that is, the lawmaker may require more from some citizens than from others or may require the same but compliance may be more costly for some citizens than for others). To enforce the norm, the lawmaker has a simple choice: she can use either sticks or carrots (but not both).

Note that we are using the term “lawmaker” in the broadest possible sense. It can refer to an international, federal, state, or local public authority, to a democratic institution or dictatorship, or even to a parent, employer, or slave owner who sets the “rules” for her children, employees, or slaves. (Note that in

⁵¹ To calculate the expected value, one adds the payoffs from each possible outcome discounted by its probability. So, for example, if a violator has a 10 percent chance of earning \$10 and a 90 percent chance of earning \$100, the expected value is: $(10) \cdot (0.1) + (100) \cdot (0.9) = \91 .

⁵² See Gordon, 21 J Legal Stud at 452 (cited in note 5). See also text accompanying notes 75–76.

terms of principal-agent theory, which is now standard in economic analysis of law enforcement,⁵³ the lawmaker is the principal, and the citizen is the agent.)

Although it is not our intention to develop a formal model,⁵⁴ it is important to make our underlying assumptions explicit. This will make it easier for the reader not only to understand our arguments but also to discover possible shortcomings of our analysis. Most of our assumptions are standard in the economic analysis of law enforcement. For instance, we assume that both the lawmaker and his citizens are rational, wealth-maximizing parties;⁵⁵ we assume that the citizens are fully informed about the legal rule and that each citizen has what is called a “discrete choice,” which means that she either has to fully comply with the rule or fully violate it. We also assume that the lawmaker is not opportunistic⁵⁶ (she monitors the citizen with a given probability and applies the penalty or pays the reward as announced *ex ante*; note that even a nonbenevolent lawmaker might find it advantageous not to behave opportunistically as opportunistic behavior might affect the credibility of threats and promises in the future).

Further, we also assume that the citizens are risk averse⁵⁷ because we want to consider the risk properties of carrots and sticks.⁵⁸ We assume that the lawmaker is benevolent,⁵⁹ that is, her purpose is to do what benefits the general welfare and to achieve rule compliance with the smallest transaction, risk, and distributional distortion costs (although we will also briefly consider the case of nonbenevolent lawmakers).

Three other simplifying assumptions may be less “innocent” and may deserve some attention in future research. First, we assume that carrots are financed through the general tax sys-

⁵³ See, for example, Kishore Gawande and Alok K. Bohara, *Agency Problems in Law Enforcement: Theory and Application to the U.S. Coast Guard*, 51 *Mgmt Sci* 1593, 1605–08 (2005).

⁵⁴ A formal model is available with the authors.

⁵⁵ See Gary S. Becker, *Nobel Lecture: The Economic Way of Looking at Behavior*, 101 *J Polit Econ* 385, 385–86 (1993).

⁵⁶ See Kenneth H. Wathne and Jan B. Heide, *Opportunism in Interfirm Relationships: Forms, Outcomes, and Solutions*, 64 *J Mktg* 36, 37–40 (2000).

⁵⁷ See, for example, Becker, 76 *J Polit Econ* at 178 (cited in note 4).

⁵⁸ For simplicity, we assume that the lawmaker herself is risk neutral. The lawmaker’s risk aversion will generally reinforce our results with respect to the risk costs of carrots and sticks. For instance, if the citizen is not sure whether she will receive a carrot, given less-than-full enforcement, the lawmaker may not be sure whether she will have to pay carrots as well.

⁵⁹ See generally Peter T. Leeson, *How Much Benevolence Is Benevolent Enough?*, 126 *Pub Choice* 357 (2006).

tem and that increasing taxes to finance carrots does not increase the transaction costs of the tax system, does not generate any risk, and does not have any effect on the existing distribution of resources (the latter, for instance, because they are distributed equally among all members of society). Similarly, we assume that the sticks paid by citizens go to the general tax system as well and do not have any economic or distributional effects.⁶⁰ Second, we assume throughout this Article that all citizens derive the same benefits from the rule (for instance, all enjoy a clean beach equally).⁶¹ Third, we assume that it is not possible to pay entry fees or any other form of precompensation to the citizens or the lawmaker. This means, for instance, that the lawmaker cannot pay a fee *ex ante* to citizens who will be subject to a rule that is enforced by a stick. Nor can citizens who step into a carrot system be made to pay an entry fee to the lawmaker.⁶²

We consider transaction costs, risk costs, and the costs of distributional distortions. As for *transaction costs*, a distinction must be made between *monitoring costs*, which are incurred *ex ante* (before citizens are actually monitored), and *processing costs*, which occur *ex post* (after the citizens have been monitored). *Ex ante* (monitoring) costs increase with the probability of monitoring and are the same under the two regimes. Conversely, *ex post* (processing) costs are the costs of actually paying a carrot or collecting a stick. These include not only payment

⁶⁰ These assumptions are not just made to simplify the model; relaxing them can significantly change the results. See, for example, note 62. See also Part II.B (discussing our comments and suggestions for future research). We make these assumptions, first, because they often correspond to the empirical reality (fines usually go to the treasury and many rewards and prizes are financed through the general tax system) and, second, because we want to study carrots and sticks in their “purest” forms, in which their fundamental differences are most pronounced. See Galle, 64 *Stan L Rev* at 802 (cited in note 6).

⁶¹ Heterogeneity with respect to benefits may be an argument in favor of carrots to the extent that a higher contribution can be asked from those who benefit most in order to finance the carrots. Sticks may artificially change the distribution of wealth by not obliging those who benefit to pay for this advantage and, *a fortiori*, by not requiring those who benefit more to pay accordingly.

⁶² The assumption of no entry fees is related to another implicit assumption: That the “participation constraint” of the citizen is satisfied. This is a technical way to say in essence that the citizen cannot leave the country, or the slave cannot run away. But the fact that we are making this assumption may have implications for the applicability of our analysis to contractual settings. It implies that some of the results may change when we consider, for instance, the relationship between an employer and an employee—unless we consider contracts that are signed without being read, or contracts that give authority to the employer to set the internal rules *ex post*, after the employee has made significant relation-specific investments. See De Geest, Dari-Mattiacci, and Siegers, 29 *Intl Rev L & Econ* at 352–53 (cited in note 28).

costs in a strict sense (for example, the cost of wiring an amount of money to a bank account) but also the costs of collecting evidence ex post (for instance, taking a photo of a speeding car or searching for the address of a driver caught speeding), determining the magnitude of the carrot or the stick (if the magnitude depends on the severity of the offense), and informing the citizen that a carrot or a stick will be applied. Processing costs increase when more citizens actually receive a carrot or pay a stick. These are the monitored compliers under carrots and the monitored violators under sticks. To clarify, the cost of installing a speed-monitoring camera near a highway (an ex ante monitoring cost) is the same whether the camera is intended to detect those who drive too fast or those who do not. Instead, the cost of taking actual photographs (an ex post processing cost) depends on whether the camera takes pictures only of speeding cars or of all those cars that drive under the speed limit.

Risk costs: Since citizens are usually risk averse, monitoring levels lower than 100 percent impose a risk-bearing cost on society.⁶³ Assuming that citizens have similar risk preferences, good proxies for the risk costs borne by society are the number of citizens subject to risk (the compliers under carrots and the violators under sticks) and the magnitude of the sanctions used.⁶⁴

Distributional distortion costs: These costs are rarely considered in economic analysis of law. Yet we will show that they need to be considered if we want to fully understand the different uses of carrots and sticks. To see why, it is important to bear in mind that the purpose of a penalty or reward is to incentivize citizens to comply with a rule. The purpose of a penalty or reward is not to change the distribution of wealth in society. However, under some conditions the effect of a penalty or reward may be that some citizens become poorer or wealthier than others.

To illustrate the latter, consider first a stick regime that requires all one thousand beach visitors to throw their litter into one of the beach's trash cans. This corresponds to an effort cost of \$2, but every visitor receives an in-kind compensation of \$3 that consists of enjoying a cleaner beach, if there are enough vis-

⁶³ See id at 357.

⁶⁴ That is, we look at *how many* people a rule exposes to risk and *how big* these risks are.

itors. Each visitor is in a typical free-rider situation: he could litter and yet enjoy a relatively clean beach if all other visitors cleaned up after themselves.⁶⁵ In this case, the stick-enforced duty to keep the beach clean does not change the distribution among the beach visitors. But now change the example and suppose that the most efficient way to keep the beach clean is to require one visitor to clean full-time (an effort of \$1,000) while all others do nothing. If the full-time worker were incentivized through a stick, he would be substantially impoverished by the rule. But the goal of the duty to keep the beach clean was to keep the beach clean, not to change the existing wealth distribution. The distributional distortion can be prevented by using a carrot system instead, incentivizing the worker through a carrot of \$1,000 (financed through the general tax system).⁶⁶

Why should we be concerned with the distributional side effects of carrots and sticks? Such distributional distortions are socially costly for three reasons. First, if the existing distribution of wealth in society were optimal, carrots and sticks might directly reduce social welfare by altering what was already optimal. Second, distributional distortions might alter ex ante activity-level incentives.⁶⁷ (And in this respect our analysis of distributional distortions also captures some of the long-run effects of carrots and sticks.) Third, in a dynamic society in which legal rules often change, distributional distortions also create risk since future rules may impoverish some citizens and enrich others in unpredictable ways.⁶⁸

C. Seven Fundamental Differences between Carrots and Sticks

From the definition of carrots and sticks, we can derive some fundamental differences between the two concepts. We do

⁶⁵ Each visitor bears the full costs of his effort in keeping the beach clean but enjoys only a portion of the benefits created by his effort since these benefits are shared with other visitors. In economics parlance, this is a situation characterized by positive externalities. Economic theory predicts that effort (in keeping the beach clean) will be under-supplied, unless the lawmaker intervenes. See V.V. Chari and Larry E. Jones, *A Reconsideration of the Problem of Social Cost: Free Riders and Monopolists*, 16 *Econ Theory* 1, 1–5 (2000).

⁶⁶ At first sight, it may appear as if the \$1,000 made the worker \$1,000 richer; yet, this is only so in a narrow bookkeeping sense, and not in a real economic sense, because the worker had to exert an effort cost that she valued at \$1,000. So in this very example, the worker was indifferent to receiving the \$1,000 job.

⁶⁷ See Wittman, 13 *J Legal Stud* at 68 (cited in note 33).

⁶⁸ For an application of this point in a different context, see Steven Shavell, *Specific Performance versus Damages for Breach of Contract: An Economic Analysis*, 84 *Tex L Rev* 831, 832–33 (2006).

this for two reasons. First, we want to attain a more general and fundamental understanding of their differences than does the previous literature. Second, we will use these differences as building blocks for our argument in the rest of this Article.

1. Difference 1: A carrot is applied upon compliance; a stick upon violation.

This follows from the direction of the transfer (to or from the citizen) under carrots and sticks and their common purpose (incentivizing the citizen to comply). Doing otherwise—that is, applying a carrot upon violation or a stick upon compliance—would create incentives to violate the rule, which is not the lawmaker’s aim. Note that while carrots and sticks seem to be each other’s mirror images, this symmetry is not perfect since compliance is the “normal” state—that is, the state that the lawmaker tries to reach. To what extent the lawmaker will succeed in obtaining compliance will depend on her information about the citizens’ effort costs as discussed below.⁶⁹

2. Difference 2: Carrots incentivize by effectively rewarding while sticks incentivize only by threatening.

This follows immediately from the previous difference: when the goal (compliance) is obtained, the stick is not applied. A corollary is that a *carrot* is used up upon *compliance* while a *stick* is used up upon *violation*. When a reward has been paid to a complying citizen, the same amount of money cannot be used again to incentivize the citizen to comply with another rule (in other words, there is exhaustion of the lawmaker’s budget). In contrast, when a threat is not executed, the same threat can generally be repeated.⁷⁰

3. Difference 3: Carrots generate (ex post) transaction costs in case of compliance; sticks in case of violation.

The transaction costs we consider here are *ex post processing costs*, that is, the costs of transferring money when pay-

⁶⁹ See Part II.F.

⁷⁰ See Dari-Mattiacci and De Geest, 26 J L, Econ, & Org at 366 (cited in note 2):

This peculiar characteristic of sticks is grounded in the fact that if the agent complies, the threat to punish does not need to be carried out and hence can be used again to incentivize the same or another agent. In contrast, a reward has to be paid to a complying agent and hence it is consumed at every use and cannot be recycled.

ing a carrot or collecting a stick. Difference 3 follows directly from Difference 1: in the case of sticks, these costs occur when the citizen is found shirking; in the case of carrots, the costs accrue when the citizen is found complying.⁷¹ As a result, carrots are more expensive in terms of transaction costs when the majority follows the rules.⁷² In contrast, there is no difference between carrots and sticks with respect to *ex ante monitoring costs*, since these costs are made *ex ante*, irrespective of whether the monitored individual is a complier or a violator and, hence, irrespective of whether enforcement is based on carrots or sticks. Moreover, monitoring will in principle be set at the same level under carrots and sticks.⁷³

4. Difference 4: Under carrots, all nonmonitored citizens receive the same treatment as monitored violators; under sticks, all nonmonitored citizens receive the same treatment as monitored compliers.

If monitoring occurs with a probability less than 1, some citizens will not be monitored and hence will forego the carrot or avoid the stick irrespective of their behavior. Under carrots, nonmonitored citizens and monitored violators do not receive a carrot while monitored compliers do receive a carrot. Under sticks, nonmonitored citizens and monitored compliers pay no stick while monitored violators do pay a stick. This characteristic could also serve as the basis for a test to determine whether a regime is a normal carrot or normal stick regime.⁷⁴

5. Difference 5: Carrots create risks for compliers; sticks create risks for violators.

This difference (which follows directly from the previous one) shows that carrots have an undesirable property: they create risks for the “good” citizens (the compliers) while sticks create risks for the “bad” citizens (the violators). In the basic

⁷¹ Note that a reversal of the burden of proof may affect some of these differences with respect to procedural costs. This will not be further examined in this Article.

⁷² See Wittman, 13 *J Legal Stud* at 65 n 25 (cited in note 33).

⁷³ Monitoring levels may differ when the stick cannot be set as high as the carrot because of the citizens’ wealth constraints (or those of the lawmaker) or when carrots need to be set higher because money has a decreasing marginal utility for the citizen.

⁷⁴ Such a test based on the treatment of nonmonitored citizens would not allow distinguishing between normal carrots and annulable sticks or between normal sticks and annulable carrots (this would also require an analysis of the distributional effects). See notes 28, 48 and accompanying text.

framework of Part II.B (in which there is full compliance), sticks create no risks at all.⁷⁵ Instead, carrots create risks for all citizens because, when there is full compliance, all citizens receive a probabilistic reward.⁷⁶

6. Difference 6: Only carrots have a built-in compensation mechanism.

Carrots do two things: they give citizens an incentive to incur some effort cost and they fully compensate citizens for this effort cost. The reason is that, in order to make a citizen exert effort, the carrot must be at least as large as the cost of the effort. Since carrots are applied upon compliance, the citizen is compensated for his effort.

However, this does not hold for sticks. Here, the complying citizen is made worse off (she exerts effort and receives no direct compensation for it), unless she receives sufficient indirect compensation in the form of benefits from the compliance of other citizens. Consider again the duty to keep the beach clean example. If all one thousand beach visitors must each spend \$2 to clean the beach but they all receive a benefit of \$3 in the value of a cleaner beach, nobody is worse off, resulting in a win-win situation. But if the rule states that the work must be done by a single citizen who has to work full-time and incur a cost of \$1,000 in order to avoid a stick, this citizen is made worse off by the rule.⁷⁷

Enforcement with sticks can make citizens worse off while enforcement with carrots cannot. In a sense, labor becomes free for the lawmaker with sticks while labor must be purchased

⁷⁵ We do not consider the risks for the lawmaker (who may have to finance the carrots or may receive the fines paid by violators) in this Article. The conclusions will generally point in the same direction because more risk for the citizen means more risk for the lawmaker. Risk may not be an issue for some lawmakers who are risk neutral (for example, a state or some large corporations). See Joshua Graff Zivin, Richard E. Just, and David Zilberman, *Risk Aversion, Liability Rules, and Safety*, 25 *Intl Rev L & Econ* 604, 608 (2005).

⁷⁶ There are subtle differences here between carrots and sticks in that carrots give complying citizens an incentive to increase the probability of monitoring. For instance, an inventor has an incentive to apply for a patent so that her good behavior is discovered by the legal system. Nonetheless, even carrots that are not meant to be probabilistic are often de facto probabilistic. For instance, an inventor may need some luck to find the right party to commercialize his invention, and a composer of a great song may need some luck to find the right singer to perform it. So, even if the good behavior leads with certainty to the legal carrot, it leads only in a probabilistic way to the financial carrot that the legal system intends to create. See also notes 82, 85 and accompanying text.

⁷⁷ See text accompanying note 66.

with carrots. Carrots are therefore “harmless”; their built-in compensation mechanism serves also as a *built-in exploitation protection* and a *built-in labor waste protection*. Legal systems may forbid using sticks for a reason that is analogous to the reason why they forbid takings without compensation: such restrictions improve the incentives to choose optimal rules.⁷⁸

Another way to interpret this result is as follows. When the lawmaker uses carrots, she can use them only to introduce a rule. When the lawmaker gets a stick, she can use it to introduce a rule but also to steal. Carrots and sticks can be used in productive ways, but only sticks can be abused.⁷⁹

This has important implications when the lawmaker delegates the decision to a lawmaker at a lower level (for example, a legal institution at a more decentralized level, or more broadly a parent who can set the rules for her children, or an employer who can set the rules for her employees).⁸⁰ When there is a danger that the right to use sticks will be abused, sticks may be forbidden or heavily regulated.

7. Difference 7: Individualized and general carrots have different distributional effects for compliers while individualized and general sticks have the same distributional effects for compliers.

Sticks are not applied upon compliance. Therefore, their magnitude has no effect on these citizens' wealth. Carrots, in contrast, are applied upon compliance, and therefore their magnitude matters. To illustrate, consider a group of citizens whose

⁷⁸ See Abraham Bell and Gideon Parchomovsky, *The Hidden Function of Takings Compensation*, 96 Va L Rev 1673, 1675 (2010).

⁷⁹ Could we say that a rule with a carrot is an *invitation* to act while a rule with a stick is an *order* to act? This popular belief seems to have been shared by Jeremy Bentham, who argued that sticks have a “coercive” influence while carrots have only an “alluring” influence. See H.L.A. Hart, *Bentham on Legal Powers*, 81 Yale L J 799, 805 (1972). Similarly, in his distinction between (softer and continuous) “prices” and (harder and noncontinuous) “sanctions,” Professor Cooter mentioned a carrot (subsidies) only as a “price.” Robert Cooter, *Prices and Sanctions*, 84 Colum L Rev 1523, 1532–37 (1984). Carrots may be discontinuous, too, and may remove any option to violate by being sufficiently high (like when a bid is so high that it “cannot be resisted”). See *id.* at 1531. Is it more respectful to incentivize human beings with carrots than with sticks? Is compliance under carrots more “voluntary” than compliance under sticks? This viewpoint is incorrect in the sense that both carrots and sticks create some pressure on individuals. However, the viewpoint is correct to the extent that carrots have a built-in participation constraint: The citizen who chooses to violate remains at his status quo position. Carrots allow violating citizens to preserve the status quo.

⁸⁰ See Michael C. Jensen and William H. Meckling, *Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure*, 3 J Fin Econ 305, 308–10 (1976).

effort costs are uniformly distributed between \$1 and \$10. A general stick has to be equal for all citizens—its expected value must be \$10 in this example because it must be at least as high as the highest effort cost of a citizen. Individualized sticks, on the other hand, can be set at different levels for different individuals—for instance, for a citizen with an effort cost of \$1, the stick's expected value can be \$1. The distributional effects of general and individualized sticks are the same when all citizens comply because sticks are not applied and hence their magnitude makes no difference. A citizen with an effort cost of \$1 will be impoverished by \$1 while a citizen with an effort cost of \$10 will be impoverished by \$10—the impoverishment of complying citizens always equals their effort cost and is not related to the magnitude of the sticks (as long as the sticks are high enough to induce compliance).⁸¹

The situation is different for carrots. Since carrots are paid upon compliance, their magnitude does matter. Individualized carrots may even completely prevent the distributional changes among citizens when they are set equal to the individual effort costs. Note further that a general carrot (for instance, \$10 for all citizens) has similar distributional effects *within* the group of citizens as sticks: the citizens with the higher effort costs benefit less than those with the lower effort costs.

D. The Easy Case for Sticks: Homogeneous Society with a Fully Informed Benevolent Lawmaker

We start by analyzing the simple case in which all citizens are identical with respect to the required effort cost (note that we also assume throughout this Article that citizens derive benefits from rule compliance by all others). Furthermore, we assume that the lawmaker is fully informed about the effort costs of her citizens.

Because the lawmaker is fully informed, she is able to set the values of the expected carrots and sticks at a level high enough that all citizens comply. From Difference 1, we know that sticks will never be applied because a threat is sufficient to induce compliance (Difference 2). By contrast, carrots will have to be paid to all citizens (with the probability announced ex

⁸¹ For simplicity we assume in this illustration that citizens do not benefit from the rule compliance of others. Relaxing this assumption would not change the distributional differences within the group of citizens (though it may change the distributional distortions compared to outsiders).

ante), since they will all comply. This simple fact leads to the following consequences:

Transaction costs: Carrots generate at least the same (ex ante) monitoring costs as sticks. Moreover, sticks will generate no (ex post) processing costs (Difference 3) because no citizen violates the rule. Instead, carrots will generate enormous processing costs, since all citizens comply and those who are monitored need to be rewarded. In sum, carrots generate more transaction costs than sticks.

Risk: Sticks generate no risk (Difference 5), even if monitoring occurs with a probability less than 1 because all citizens comply, and those who are monitored are never punished and hence are treated in the same way as those who are not monitored (Difference 4). Instead, under carrots, all complying citizens (that is, all individuals) are subject to the risk of either being monitored and rewarded or not being monitored but bearing the effort cost anyway.⁸²

Distributional distortion costs: Sticks are also neutral with respect to distribution: all individuals bear the same effort cost and no one is punished. This means that everyone is equally better off (at least if we assume that all citizens receive the same benefit from others' compliance with the rule).⁸³ Thus, sticks treat each individual in the same way.

In contrast, carrots make all monitored citizens richer (they receive a carrot and a share in the benefit) than all nonmonitored citizens (who only receive a share in the benefit). Thus, carrots create some distributional distortion while sticks do not distort. We will call this effect the *lottery effect of carrots* because compliers are forced to participate in a

⁸² Note that if the monitoring probability is equal to 100 percent there is no difference between carrots and sticks with respect to risk because in this case all complying citizens receive a carrot, and therefore carrots no longer generate risks for compliers.

⁸³ This is an assumption that we make for simplicity; if benefits are clearly unequal, this creates an argument in favor of carrots, which allow the legal system to charge a higher carrot tax from high-value users. The assumption of equal benefits is plausible in many circumstances though; for instance, citizens benefit more or less equally from a crime-free or litter-free environment. See Charles J. Ten Brink, *Gayborhoods: Intersections of Land Use Regulation, Sexual Minorities, and the Creative Class*, 28 Ga St U L Rev 789, 799–800 (2012). Note also that the benefit received by each citizen must be greater than the effort she makes. This is because the lawmaker is benevolent and hence the total effort cost must be less than the collective benefit.

virtual lottery. The winners—those who are lucky enough to be monitored—are overcompensated; the losers—those who have exerted effort but who are not monitored—are undercompensated. To illustrate, suppose that each citizen makes an effort of \$2 and has a 10 percent chance of being monitored and receiving a carrot of \$30. Those who are lucky enough to be monitored—that is, those who win the virtual carrot lottery—become \$28 richer in the end. The others become \$2 poorer.⁸⁴

E. The Case for Carrots: Citizens Have Different Effort Costs

Here we consider the case in which the lawmaker is fully informed but the costs of each citizen's effort vary. For instance, the lawmaker may want all citizens to give up some land for a new highway project, but some landowners must only give up 10 square feet while others must sacrifice a 100-acre farm. Or the lawmaker may want all boats that are in the vicinity of a sinking ship to help rescue its cargo, but some boats can do so more easily than others (because they have better equipment or greater storage capacity).

Transaction costs: The lawmaker can set the sticks or carrots high enough so that all citizens will comply. Since they all comply, sticks do not have to be applied, thus generating no transaction costs (in the sense of ex post processing costs). Carrots, however, must be paid to the citizens (or at least to some of them, if monitoring is probabilistic). Thus, sticks still generate fewer transaction costs than carrots.

Risk: Sticks generate no risk because all citizens comply and therefore face no risk of punishment. Under carrots, all (complying) citizens bear some risk—at least if they are paid probabilistically.⁸⁵ Thus, carrots generate more risk than sticks.

⁸⁴ The outcome becomes more complicated when we also consider the fact that nonmonitored citizens may receive a benefit from compliance by the others but at the same time must also pay their portion of the taxes to finance the carrots. But it is clear that there still may be cases in which carrots make nonmonitored citizens worse off.

⁸⁵ Even carrots that are not meant to be paid probabilistically can in fact be probabilistic. One reason is that some citizens may not be able to come up with sufficient evidence of their acts. Another is that carrots may have winner-take-all properties. For instance, an inventor may not receive a patent if someone else applies for the same patent one day earlier.

Distributional distortion costs: Both sticks and carrots may distort existing distributions of wealth. Sticks may impoverish citizens with large effort costs relative to citizens with small (or even zero) effort costs. Meanwhile, carrots may both enrich monitored citizens, whose effort is more than compensated by the carrot while also potentially impoverishing nonmonitored citizens, whose effort is not directly compensated by the carrot. In fact, the efforts of nonmonitored citizens could be larger than their share in the collective benefit (after deduction of the carrot tax they paid). Moreover, general carrots (which pay the same amount to all complying citizens, irrespective of their effort costs) may also overcompensate in expected terms, by paying the same amount to all citizens irrespective of their effort costs. Therefore, citizens with small effort costs may be enriched relative to citizens with high effort costs. *Carrots may distort by overpaying; sticks by underpaying.* As a result, *general carrots* will distort more than *general sticks* in some cases and less in other cases.

To illustrate with a numerical example, suppose that ninety citizens have an effort cost of \$100 while the other ten citizens have an effort cost of \$10. Both a general carrot and a general stick will need to be set at \$100 in order to induce all citizens to comply. The general carrot will overpay ten citizens by \$90 each, bringing the total amount of overpayment at \$900. The general stick will underpay those ten citizens by \$10 each, but it will also underpay the other ninety by \$100 each. This brings the total underpayment to \$9,100. Therefore, sticks distort the existing distribution more. But the opposite can hold true in other examples, if there are more citizens with relatively low effort costs (for instance when ninety citizens have an effort cost of \$10, and ten have an effort cost of \$100).

Yet, the advantage of carrots is that their amounts can be individualized. *Individualized carrots* can, in theory, remove the unequal effort effect by rewarding each citizen according to the cost of his effort. This cannot be accomplished by using individualized sticks (Difference 7). The reason is simple: sticks are applied to violators (Difference 1) and therefore, by individualizing sticks, it is possible to create differences among violators but not among compliers (because they exert effort but the stick is not applied). Additionally, with carrots, the distortion between the group of citizens and a group of outsiders can be corrected by fi-

nancing carrots through taxes applied principally to outsiders.⁸⁶ Using sticks, however, outsiders free ride on the efforts of the citizens, who are obliged to work for free. With carrots, this free-rider effect may be reduced when the outsiders pay their part of the taxes, which are needed to finance the carrots for the citizens.

In sum, if different efforts are asked from individual citizens, but the lawmaker is fully informed about these effort costs, sticks generate fewer transaction and risk costs than carrots but may in some cases generate greater distributional distortion costs than carrots. But overall, this means that sticks are no longer intrinsically superior. If the distributional distortions are significant (so that some individuals are really “singled out”), carrots are superior.

F. Another Case for Carrots: The Lawmaker Has No Information on the Citizens’ Individual Effort Costs

If the lawmaker does not know the individual effort costs of citizens, she also may not know which citizens are able to comply with a norm at reasonable costs. As a result, a stick regime may sanction citizens who are simply *unable to comply*. For instance, if the legal system used a stick system to create incentives for citizens to compose songs, those who lacked musical talent might be punished.⁸⁷ The greater the proportion of citizens who are unable to comply, the greater the transaction costs, risk costs, and distributional side effects generated by sticks.

To illustrate, suppose that one hundred citizens out of a province with a population of one million have valuable information about a criminal organization. The provincial government, however, does not know who these one hundred people are. Suppose that all one hundred potential compliers have identical effort costs of \$1 million (including protection costs). Incentives can be created either by offering a \$1 million reward to those who divulge the information or by giving all one million citizens of the province a \$1 million fine, except for those who offer the information. While fines create identical incentives, they generate higher transaction costs and distort the existing distri-

⁸⁶ For example, the Nobel Peace Prize is funded by “gifts, awards, and bequests.” *History of Organization* (Nobel Prize), online at http://www.nobelprize.org/nobel_prizes/peace/laureates/1904/international-law-history.html (visited Mar 3, 2013).

⁸⁷ See Part III.B and Part IV.A.

bution by impoverishing the one million citizens of that province compared to the rest of the country.⁸⁸ To the extent that fines are probabilistic, they also create risk.

The opposite is also possible—that some citizens are *unable to violate* the rule because they lack either the technical skills (for example, hacking) or the opportunity to do so (for example, corruption and insider trading). While inability to comply weakens the case for sticks, inability to violate weakens the case for carrots because carrots may reward citizens without merit. Paying a carrot for abstaining from hacking to someone who is not a computer expert does not improve her incentives while it increases transaction costs, creates risk (if rewarding is done in a probabilistic way), and creates distributional distortions (by artificially enriching some citizens who did not incur any effort cost). The higher the proportion of citizens who are unable to violate, the greater these transaction costs, risk costs, and distributional distortions associated with carrots will be.

Transaction costs: Let's assume that the lawmaker makes the carrot or stick large enough so that all citizens who can comply with the rule at reasonable costs will comply—in other words, all who are able to comply do so and all who are unable to comply violate. Sticks will be applied more often than carrots if there are more violators than compliers. To put it differently, sticks lose their intrinsic transaction costs advantage if the majority of the citizens are unable to comply with the rule.⁸⁹

Risk: By the same token, sticks begin to generate more risks than carrots if there are more violators than compliers. For instance, under sticks, all those who are unable to compose a song would live in fear that they might be singled out for monitoring and receive a penalty.

Distributional distortion costs: Distortions must derive from the fact that some individuals have larger effort costs than others or from the fact that some citizens are monitored

⁸⁸ Note that in this example, not only are the citizens who possess no information impoverished by \$1 million but so are those one hundred who possess the information because the latter have an effort cost of \$1 million. The distortion is substantially larger than a stick that would only target the one hundred, though. Moreover, carrots do not distort in this example because they are only paid to the one hundred who offer the information and who receive a carrot that corresponds to this effort cost.

⁸⁹ See Wittman, 13 *J Legal Stud* at 65–66 (cited in note 33).

while others are not.⁹⁰ With respect to the latter, sticks now generate a lottery effect as well because some individuals who are unable to comply will be punished. The lottery effect of carrots will also increase to the extent that the rule is applied to citizens who are unable to violate. Note that neither the lottery-effect distortions nor the distortions due to heterogeneity can be corrected by individualizing the carrot or the stick when the lawmaker does not know the individuals' effort costs (which is the case we are analyzing in this Section).

In sum, the choice between carrots and sticks should depend on several factors, including the degree of heterogeneity of the citizens and the seriousness of the risk that is created by the probabilistic nature of enforcement. But overall, carrots will tend to be preferable to sticks when there are few citizens who are able to comply with a norm.

III. NORMATIVE GUIDELINES FOR THE USE OF CARROTS AND STICKS

A. In Simple Settings, Sticks Are Superior

How should these results be interpreted? A first normative guideline is that *in simple settings, sticks are superior* because they are not meant to be applied, thus minimizing transaction costs and risks. In addition, sticks cause fewer distributional distortions when the citizens are sufficiently homogenous with respect to effort costs. This simple result explains why legal systems usually rely on sticks (as is clearly the case with criminal law and tort law) and why carrots (such as copyrights and patents) are the exception.

But sticks may lose some of their intrinsic comparative advantages when citizens are *heterogeneous* with respect to effort costs (because sticks may, in those cases, seriously impoverish some citizens). Moreover, heterogeneity in effort costs will often be accompanied by the lawmaker's incomplete information about individual effort costs, so that the lawmaker may have difficulties in determining what level of effort to demand from whom. In those cases, sticks may punish citizens who are unable to comply with the rule at reasonable costs; because sticks are ap-

⁹⁰ We do not consider distributional side effects that are caused by different benefits. Heterogeneous benefits generally make the case for carrots stronger.

plied in those cases, they generate transaction costs and risk costs.

B. Carrots in the Case of Specification Problems: The Lawmaker Does Not Know What to Ask from Each Citizen

Heterogeneity can be translated into two more specific conditions under which carrots are more likely optimal (and more likely to be used). First, it is more probable that carrots will be used when there are specification problems, when it is not clear who should do exactly what. Who should invent, compose, rescue, search for lost property, or discover valuable old paintings? Which employee should generate suggestions for improving the production process? And what exactly should be invented, composed, or rescued? What sport or how much exercise is optimal for an individual? If any of these is unclear, then the legal system may use carrots.

Why are carrots increasingly used in the case of specification problems? In essence, this is because a sticks regime would have to be overbroad (both in terms of the citizens from whom it requires an effort and the tasks it requires from the citizens). For instance, if incentives to compose songs were to be created through sticks, many individuals who are unable to compose would be sanctioned (since the legal system does not know who is able to compose), and those who are able would still be sanctioned if they composed fewer great songs than Paul McCartney or even Mozart (since the legal system does not know how many great songs a talented composer is able to compose). Moreover, most great composers would have to be sanctioned for not composing new types of music (since the legal system does not know which composers are able to create truly novel types of music).

C. Carrots in the Case of Singling-Out Problems: The Lawmaker Needs to Ask for Substantially Higher Efforts from Some Citizens

The second instance in which carrots are more likely to be optimal is when there is a singling-out danger, which is the case when rules are less general and more individualized (when high efforts are required from some individuals but not others). This explains why those who work full-time for the government receive a carrot in the form of a wage and those whose property is taken for a highway project receive compensation. But note that the magnitude of the individual effort cost itself is not sufficient for the singling-out danger; unequal treatment of individuals (or

families) is also required. For instance, if the law requires all males to serve in the army, the law requires large effort costs, but because all families contribute more or less equally, there are no significant distributional distortions.

IV. APPLICATIONS

In the following sections we apply these results to a variety of cases. We will show that in each of these cases the use of carrots can be explained by specification problems or singling-out problems.

A. Patents and Copyrights

Patents and copyrights are the most obvious examples of carrots created by the law. Successful inventors and composers receive a carrot in the form of the profits associated with the ownership of exclusive rights.⁹¹

The use of patents and copyrights is consistent with the results of our analysis. First, specification problems are enormous for these types of activities. Who in our society is in the best position to invent or compose? What should be invented or which songs should be composed? What exactly should individuals do to invent or compose more productively?

Second, stick regimes may lead to singling-out problems. Why do we not use a stick regime to oblige individuals who have proven that they can compose efficiently (such as Paul McCartney) to compose more songs (using the fact that after the first successful composition an important part of the specification problem is solved)? This method would single out an individual to exert a significant effort without compensation, and the singling-out effect would lead to many distortions, both directly (distorting the existing distribution) and indirectly (for instance in the form of activity-level distortions, that is, the decisions to become a composer in the first place).

B. Rescuers

The incentives to rescue are largely created through carrots—both nonmonetary (nonlegal carrots such as medals) and monetary (as in admiralty law for the rescue of cargo).⁹² Never-

⁹¹ See US Const Art I, § 8, cl 8; Troy Paredes, Comment, *Copyright Misuse and Tying: Will Courts Stop Misusing Misuse?*, 9 High Tech L J 271, 273 (1994).

⁹² See Levmore, 72 Va L Rev at 896, 909 (cited in note 23).

theless, many foreign legal systems (and a few American states) use sticks (that is, a duty to rescue supported by a sanction for failure to rescue) for simple forms of rescue.⁹³

Such a duty to rescue is never imposed for complex, risky, or costly forms of rescue; indeed, it only concerns simple forms of rescue, in which it is clear what should be done and who should do it (that is, *no specification costs*). Examples include throwing a rope to a drowning swimmer, calling a doctor or an emergency service, or informing the police of an ongoing criminal activity.⁹⁴ Moreover, there is only such a duty when the effort costs (including safety risks for the rescuer) are relatively small and homogeneous across the population, so that there is *no singling-out problem* (that is, there are no significant distributional distortions). This is clearly so in civil law countries (which have a tradition of duties to rescue),⁹⁵ but it holds as well for the few American states that have recently introduced statutory duties to rescue.⁹⁶

While there is no general duty to rescue under the common law,⁹⁷ courts have imposed a duty to rescue in an increasing number of situations in which a “special relationship” exists be-

⁹³ See, for example, French Penal Code § 223-6(2); notes 95 and 96.

⁹⁴ See Levmore, 72 Va L Rev at 883 (cited in note 23).

⁹⁵ The German Criminal Code provides a criminal sanction for one who does not help someone in need if it “can be expected of him under the circumstances, particularly if it is possible without substantial danger to himself and without violation of other important duties.” German Crim Code § 323(c), as translated in *The German Criminal Code: A Modern English Translation* 200 (Hart 2008) (Michael Bohlander, trans). The French Penal Code provides a criminal sanction for any person who abstains from “rendering assistance to a person in peril when he or she could have rendered that assistance without risk to himself.” French Penal Code § 223-6(2), as translated in *The French Penal Code of 1994 as Amended as of January 1, 1999* 120 (Rothman 1999) (Edward A. Tomlinson, trans). The statute does not apply to property—which makes sense because rescuing a person is a no-brainer while for property there are usually specification problems as to who should rescue what.

⁹⁶ In Vermont, Hawaii, Minnesota, Rhode Island, and Wisconsin, there is a statutory duty to rescue when such rescue is riskless. 12 Vt Stat Ann § 519(a):

A person who knows that another is exposed to grave physical harm shall, to the extent that the same can be rendered without danger or peril to himself or without interference with important duties owed to others, give reasonable assistance to the exposed person unless that assistance or care is being provided by others.

Hawaii Rev Stat § 663-1.6; Minn Stat Ann § 604A.01; RI Gen Laws § 11-56-1; Wis Stat § 940.34(2)(a). In Massachusetts there is a statutory duty to report a crime when reporting creates no danger. Mass Ann Laws ch 268, § 40. Washington requires reporting certain violent offenses and certain offenses against children. Wash Rev Code Ann § 9.69.100. Ohio requires reporting felonies. Ohio Rev Code Ann § 2921.22. Florida requires reporting sexual battery. Fla Stat Ann § 794.027. In California, there is a duty to report certain crimes against minors. Cal Penal Code § 152.3.

⁹⁷ See *Jackson v City of Joliet*, 715 F2d 1200, 1202 (7th Cir 1983).

tween potential rescuer and victim. Some of these special relationships are contractual relationships⁹⁸—for example, the duty of railroad companies to take care of ill passengers—but others cannot be explained as implied contract terms—for example, the duty of an innkeeper to protect strangers from injury by a guest.⁹⁹ Professor Levmore observes that all these cases contain three elements: “First, there is a single nonrescuer. Second, this nonrescuer could with little effort have prevented a serious loss. Third, this nonrescuer had no reason to think that someone else would save the day.”¹⁰⁰ Professor Levmore’s first and third points are related to what we have modeled as complete information: both the lawmaker (the government or the court) and the citizen (the rescuer) can easily identify the optimal rescuer (that is, *no specification problems*).¹⁰¹ Professor Levmore’s second point relates to the fact that there are no significant distributional distortions (that is, *no singling-out problem*).

Instead, risky, costly, and complex rescue activities are either provided by paid special services (for example, firefighters or alpine rescue teams) or rewarded with other types of carrots (prizes, or restitution for the costs incurred, or nonlegal carrots such as esteem). For instance, under admiralty law, a relatively generous carrot is awarded to rescuers for successfully salvaging

⁹⁸ See Christopher T. Wonnell, *Unjust Enrichment and Quasi-Contracts*, in Gerrit De Geest, ed, 6 *Encyclopedia of Law and Economics: Contract Law and Economics* 454, 459 (Edward Elgar 2d ed 2011); Landes and Posner, 7 *J Legal Stud* at 125 (cited in note 23). See also W. Page Keeton, et al, *Prosser and Keeton on the Law of Torts* § 56 at 376–77 (West 5th ed 1984) (describing the duties of innkeepers toward their guests, of employers toward their employees, and of schools toward their students).

⁹⁹ See Levmore, 72 *Va L Rev* at 899 (cited in note 23). Similar duties include the duty of hospitals to help unconscious patients in emergency situations, the duty of prison officers to protect prisoners against violence from other inmates, the duty of psychologists to warn strangers of their patient’s criminal plans, the duty of parole boards to protect strangers from the release of dangerous prisoners, the duty of landlords to help trapped trespassers, the duty of voluntary rescuers to continue their rescue efforts, the duty of drivers who hit another car to stop and rescue the other car’s occupants (under “hit-and-run driver” statutes), and the duty under admiralty law of a vessel involved in a collision to assist the other vessel. See id at 899–900. See also Richard L. Hasen, *Rescue*, in Peter Newman, ed, *The New Palgrave Dictionary of Economics and the Law* 327, 327–29 (Stockton 1998).

¹⁰⁰ Levmore, 72 *Va L Rev* at 936–37 (cited in note 23).

¹⁰¹ Id at 937. See also Wonnell, *Unjust Enrichment and Quasi-Contracts* at 458–59 (cited in note 98):

The incentive problem with mandatory rescue as opposed to restitutionary regimes is essentially a problem of governmental knowledge. To impose an efficient duty to help, one would need to know about the previous choices available to potential rescuers and what effect the prospect of liability might have on those choices.

property from a sinking ship.¹⁰² This is again in line with our results because here there are serious specification problems as to who should rescue—of all the ships that are in the area, which one is in the best position to rescue? And as to what should be rescued—if it is not possible to save all goods, which ones should be saved? The latter may depend not only on the value of the goods but also on the risks involved and on the space available on the rescuing ship. (To what extent is it worthwhile and justified to add load to the rescuing ship?) However, when it is possible to save a life without incurring risk, admiralty law imposes a duty to “render assistance to every person who is found at sea in danger of being lost.”¹⁰³ In this case, there are *no specification problems*—it is clear who should be saved and who the closest rescuer is—and only minor distributional distortions, since the costs of pulling a person out of the water are minimal and the necessary equipment is usually on board the ship.

These features of the law of rescue have been explained with reference to the omission-commission distinction in American tort law.¹⁰⁴ This distinction, however, is not only hard to define (negligence, for instance, can be viewed as an absence of taking precautions),¹⁰⁵ but it also does not fully explain the law. (For instance, it does not explain very well in which cases courts find a “special relationship”;¹⁰⁶ moreover, there is even criminal liability for some omissions, such as tax evasion or military desertion.)¹⁰⁷ What may be the real concern here is not the fact that there are many potential rescuers but that it is hard to specify who among them should rescue; in other words, there are *specification problems*.¹⁰⁸

¹⁰² See Wonnell, *Unjust Enrichment and Quasi-Contracts* at 457–58 (cited in note 98), citing Ross A. Albert, *Restitutionary Recovery for Rescuers of Human Life*, 74 Cal L Rev 85, 111–15 (1986).

¹⁰³ Salvage Act of 1912 § 2, Pub L No 62-249, ch 268, 37 Stat 242, 242. See also Grant Gilmore and Charles L. Black Jr., *The Law of Admiralty* § 8-1 at 532–34 (Foundation 2d ed 1975).

¹⁰⁴ See Levmore, 72 Va L Rev at 936 (cited in note 23).

¹⁰⁵ See *id.*

¹⁰⁶ See notes 98–99 and accompanying text.

¹⁰⁷ See Levmore, 72 Va L Rev at 934 (cited in note 23).

¹⁰⁸ One explanation that has been offered for the absence of a general duty to rescue is that legal sanctions may crowd out more effective moral rewards. See Landes and Posner, 7 J Legal Stud at 97–98 (cited in note 23). This explanation, however, has two shortcomings. First, it fails to explain why there is a duty to rescue under admiralty law, in most civil law countries, and in some common law states. Second, it could be used as an argument against legal rules in general; *prima facie* it is indeed not clear why the argument should only be made in the context of rescue operations. See Hasen, *Rescue* at 327–28 (cited in note 99). See also Bruno S. Frey, *Not Just for the Money: An Economic*

C. Finders

Incentives to find lost, mislaid, or abandoned property are created by a variety of carrots. First, the finder can receive compensation for expenses incurred in taking care of the good (based on an implied bailment).¹⁰⁹ Second, the owner may offer an award (as in the archetypical case of the returned lost cat) either by advertising it beforehand or by deciding to pay one afterward. Third, the finder may receive ownership; abandoned property generally goes to the finder,¹¹⁰ and, under estray statutes, the finder may obtain ownership if the good remains unclaimed for a certain period.¹¹¹

There are no sticks related to a failure to find in the sense that nobody has a duty to find, and those who find an object may simply ignore the property they discovered—there is no duty to pick it up and return it to the owner. In contrast, the finder cannot simply keep the property without trying to find the owner (or without following the procedure of the estray statutes); incentives to do so are generated by sticks.¹¹² The reason is that finding in itself is an action plagued by enormous specification problems—information is clearly incomplete as to who the best finder is and imperfect as to what finding effort should be ex-

Theory of Personal Motivation 7–10 (Edward Elgar 1997). A second explanation offered by Professor William Landes and Judge Richard Posner is that sticks may cause activity-level distortions (inducing good swimmers to avoid beaches). See Landes and Posner, 7 *J Legal Stud* at 120 (cited in note 23). This argument is captured in our model by the more general notion of distributional distortions. See Part II.B.

¹⁰⁹ See Levmore, 72 *Va L Rev* at 903 (cited in note 23).

¹¹⁰ See *id.* at 904 (cited in note 23). There are some exceptions. For instance, under English law treasures go to the government. Under American admiralty law, the finder of an abandoned or derelict ship in principle gains title to the vessel, but, in some cases (historic abandoned shipwrecks “embedded” in submerged lands, shipwrecks in coral formations, and shipwrecks listed on the National Registry of Historic Places), the state can claim title and the salvor receives only a reward. See 67B *Am Jur 2d Salvage* §§ 3, 53 at 229–30, 277–79 (2010); Thomas J. Schoenbaum, 2 *Admiralty and Maritime Law* § 16-7 at 180–85 (West 4th ed 2004).

¹¹¹ See Levmore, 72 *Va L Rev* at 904 (cited in note 23). One of the reasons for having this procedure is to distinguish a good-faith finder from a thief.

¹¹² Estray statutes and sticks for finder-keepers who do not follow the procedure existed as early as the ancient Hittite laws. See *id.* at 922, quoting the Hittite laws:

§ 45. If anyone finds utensils, he shall return them to the owner and he shall reward him. But if he does not return them he is a thief.

...

§ 71. If anyone finds an ox or a horse or a mule, he shall bring it to the royal gate. But if he finds it in the country, it shall be brought before the elders and he may continue to harness it. But if its owner finds it and receives it as it was, he shall not hold him as a thief. If he does not bring it before the elders, he is a thief.

pending. Instead, the obligation to follow a certain procedure after the finding creates no specification problems here—it is clear what should be done and who should do it—and the costs are minimal.¹¹³

D. Takings and Regulatory Takings

Public authorities can use sticks or carrots to make citizens perform certain tasks. Sticks are used for numerous inexpensive tasks, such as the duty to vote or to count votes (which exists in many countries),¹¹⁴ the duty to remove snow from the sidewalk in front of one's house,¹¹⁵ the duty to stop at red traffic lights,¹¹⁶ or the duty to throw litter in trash bins (rather than on the beach).¹¹⁷ However, sticks are sometimes also used for tasks that require high effort costs from all citizens (or families) equally, such as the duty to serve in the army¹¹⁸ or on juries.¹¹⁹

Carrots are used for many other tasks, such as public procurements or compensating those who serve as full-time public officials.¹²⁰ Moreover, the transfer of property under eminent domain is essentially a carrot system. (Strictly speaking, it is a mixed system since refusal to deliver the property is sanctioned with sticks, but the purpose of compensation is to fully compensate the owner, and the only reason why the price is determined by a court and why a stick accompanies the carrot is that holdouts need to be prevented.)¹²¹

¹¹³ See Levmore, 72 Va L Rev at 906 (cited in note 23) (“It is difficult, as a law enforcement matter, to identify potential finders who simply ignore lost property (as opposed to misbehaving finders who convert the property for their own use).”).

¹¹⁴ See, for example, Stefan Krassa and Mattias K. Polborn, *Is Mandatory Voting Better Than Voluntary Voting?*, 66 Games & Econ Beh 275, 275–77 (2009) (providing the example of mandatory voting laws in Australia in its comparative analysis of mandatory versus voluntary voting).

¹¹⁵ See, for example, NYC Admin Code § 16-123.

¹¹⁶ See, for example, 7A Am Jur 2d Automobiles § 238 at 695–96 (2007).

¹¹⁷ See, for example, La Rev Stat Ann § 33:4881.

¹¹⁸ See Part IV.H.

¹¹⁹ To the extent that members of juries receive some compensation, it is usually strongly undercompensatory. In a broader sense, examples also include the prohibition of theft (which can be interpreted as a duty to give up easy opportunities to enrich oneself, and which therefore require each citizen to incur a high opportunity cost, though of course each citizen benefits from the others not stealing). See Jacob Nussim and Avraham D. Tabbach, *Deterrence and Avoidance*, 29 Intl Rev L & Econ 314, 320 (2009).

¹²⁰ See, for example, 63C Am Jur 2d Public Officers and Employees § 265 at 734–36 (2009) (providing general information regarding compensation for public officials); 48 CFR §§ 1.000–1.603.

¹²¹ Note that to solve the holdout problem, sticks are the appropriate solution: the distributional distortions are low and there is no incomplete or imperfect information problem.

The logic behind all this seems again to be as follows: carrots are used when there are specification problems—when it is not clear who should deliver a good or service (Who should deliver pencils? Who should serve in Afghanistan?)—or when sticks would lead to singling-out problems because the required effort is high and unequally distributed among the population (which is the case when property is taken for a highway project).

The singling-out problem is an important issue in case law and in the literature on regulatory takings. The Fifth Amendment states that takings of property in the public interest need to be compensated. Such compensation is nearly always paid in the case of the physical taking of property. But when zoning laws or other forms of regulation greatly reduce property values though formally leaving the title with the owner, compensation for regulatory takings may be claimed.¹²² Under Justice Oliver Wendell Holmes's "diminution of value" test in *Pennsylvania Coal Co v Mahon*,¹²³ compensation is due if a regulation "goes too far" in diminishing the value of the property to the owner.¹²⁴ Justice Holmes did not specify his criterion very well, but the emphasis is clearly on the excessiveness of the distributional distortions caused by sticks.¹²⁵

Singling out is also the central point of the well-known dissenting opinion of Justice William Rehnquist in *Penn Central Transportation Co v New York City*,¹²⁶ according to which there is no regulatory taking if the prohibition does not single out individuals but "applies over a broad cross section of land and thereby 'secure[s] an average reciprocity of advantage.'"¹²⁷ A similar position is taken in *Agins v City of Tiburon*,¹²⁸ where the Court held that a landowner subject to a zoning ordinance "will share with other owners the benefits and burdens of the city's exercise of its police power. In assessing the fairness of the zoning ordinances, these benefits must be considered along with any diminution in market value that the appellants might suffer."¹²⁹ Professor Richard Epstein reframed the point by

¹²² See, for example, *Armstrong v United States*, 364 US 40, 49 (1960).

¹²³ 260 US 393 (1922).

¹²⁴ *Id.* at 415 (reviewing a challenge to a Pennsylvania statute that prohibited coal companies from any mining that created a safety risk for the surface owners due to cave-ins).

¹²⁵ *Id.* at 416.

¹²⁶ 438 US 104 (1978).

¹²⁷ *Id.* at 147 (Rehnquist dissenting), quoting *Pennsylvania Coal*, 260 US at 415.

¹²⁸ 447 US 255 (1980).

¹²⁹ *Id.* at 262.

stating the benefits from the zoning restrictions on other owners may in some cases form sufficient in-kind compensation.¹³⁰ As Professor Epstein put it,

[T]he more similar the situations between neighbours, the more likely it is that the restrictions in question will work for the benefit of all. Each landowner knows that he will profit and lose to the same extent as his neighbours. . . . Conversely, restrictions that hit one party harder than the next are likely to work an implicit redistribution of wealth from one party to another.¹³¹

E. Endangered Species Act

The federal Endangered Species Act (ESA) contains prohibitions against the “taking” of endangered species. “Taking” in this context refers not only to killing but also to habitat modification.¹³² One of the protections with the largest economic impact is that of the red-cockaded woodpecker.¹³³ Woods that house red-cockaded woodpecker populations or that are located near them are subject to costly timber-harvest restrictions.¹³⁴ The Act has serious unintended consequences because landowners can avoid the regulatory burden by prematurely harvesting their forests, by planting mixed woods instead of homogenous pine woods, or by planting no pine trees at all.¹³⁵

¹³⁰ Richard A. Epstein, *Takings: Private Property and the Power of Eminent Domain* 195–215 (Harvard 1985). See also Richard A. Epstein, *Takings*, in Peter Newman, ed., *The New Palgrave Dictionary of Economics and the Law* 561, 567 (Stockton 1998).

¹³¹ Epstein, *Takings* at 567 (cited in note 130).

¹³² 50 CFR § 17.3.

¹³³ See Daowei Zhang and Warren A. Flick, *Sticks, Carrots, and Reforestation Investment*, 77 *Land Econ* 443, 445 (2001). This woodpecker lives in southern pine forests and feeds on insects on mature pine trees near its den. It prefers homogenous pine forest (rather than mixed forest) with few under-trees. It also needs mature pine trees (preferably those that have been infected with the red heart fungus) to chisel out its den cavity. See *id.* (detailing the unique characteristics of the red-cockaded woodpecker).

¹³⁴ See *id.* For instance, pine trees greater than ten inches in diameter cannot be cut without first assessing the potential effect on red-cockaded woodpeckers. Cavity trees may not be cut or damaged at all. See *id.*

¹³⁵ See Dean Lueck and Jeffrey A. Michael, *Preemptive Habitat Destruction under the Endangered Species Act*, 46 *J L & Econ* 27, 51–55 (2003) (finding that forest landowners in North Carolina who are closer to populations of endangered red-cockaded woodpeckers are more likely to prematurely harvest their forests and to choose shorter forest rotations); Zhang and Flick, 77 *Land Econ* at 445 (cited in note 133) (finding that the ESA reduced reforestation investments on sites close to known endangered species habitats); David A. Dana, *Natural Preservation and the Race to Develop*, 143 *U Pa L Rev* 655, 656 (1995) (showing how the threat of regulation creates a race to develop wilderness before the regulation is put into place). For a general discussion of the impact of

Our framework can help to better understand why the ESA has those undesirable side effects and why subsidies or tax credits would be better instruments, as suggested by some commentators.¹³⁶ The ESA is based on sticks. The problem with sticks here is their distributional distortions.¹³⁷ The law requires a significant effort from a small group of individuals (*singling-out problems*) and by using sticks it does not compensate them for their effort. As we have discussed, distributional distortions can lead to several types of economic costs, one of which is activity-level distortions.¹³⁸

If carrots (in the form of subsidies or tax incentives) were used instead,¹³⁹ then these distributional distortions could be avoided, as could the unintended activity-level distortions. For instance, studies have empirically shown that public financial-assistance programs have a positive impact on reforestation.¹⁴⁰

F. Incentives to Acquire Information in Contracts

Our analysis may also shed a new light on the question as to what extent potential contract parties have a duty to acquire and reveal information.¹⁴¹ The standard analysis of Professor Anthony Kronman holds that the least-cost information gatherer should produce and reveal information, except in situations in which information is costly to acquire and revealing it would destroy the incentives to produce it.¹⁴² Professor Steven Shavell added the insight that buyers have greater difficulties in benefiting from information because the good about which they have information is in the hands of the seller, who may easily free

regulations on investment, see, for example, Epstein, *Takings: Private Property* at 263–82 (cited in note 130).

¹³⁶ See, for example, Zhang and Flick, 77 *Land Econ* at 444 (cited in note 133).

¹³⁷ The problem with sticks in this example is not due to transaction costs. As a matter of fact, transaction costs are lower under a sticks regime because sticks do not have to be applied and effort costs do not have to be compensated.

¹³⁸ See Part II.B.

¹³⁹ See Zhang and Flick, 77 *Land Econ* at 444 (cited in note 133); Epstein, *Takings: Private Property* at 263–82 (cited in note 130).

¹⁴⁰ See Zhang and Flick, 77 *Land Econ* at 446–48 (cited in note 133).

¹⁴¹ Note that while our model may be unable to fully address contractual situations because we did not consider “participation constraints” (that is, compensation in the form of a higher or lower price or wage that may have to be promised in order to make someone assent to a carrots or sticks regime), it nevertheless applies to the actions of parties *before* a contract is signed.

¹⁴² Anthony T. Kronman, *Mistake, Disclosure, Information, and the Law of Contracts*, 7 *J Legal Stud* 1, 9 (1978).

ride on the buyer's efforts.¹⁴³ How can we reframe the analysis in terms of carrots and sticks?

Incentives to acquire information are largely created by sticks for sellers. For instance, sellers have a general duty to reveal latent defects (for example, that their homes have been infected by termites) if it can be inferred that they should have known about the defect.¹⁴⁴ This "should have known" criterion is partly a tool used to overcome evidence problems (in many cases, the party who should have known that there were termites did effectively know it) but partly also a mechanism to generate incentives to acquire this type of information. The use of sticks here is consistent with our framework because in most cases there are *no specification problems*: it is clear that of all citizens the owner of a good is in the best position to acquire information about that good.¹⁴⁵ Moreover, the "should have known" criterion means that there is only such a duty when there are no specification problems as to the "what" question either. Also, sellers are less often held liable for omissions (failure to inform) than for wrong commissions (giving wrong information).¹⁴⁶ This is in line with our analysis because there are more specification problems associated with the first (What information should be given?) than with the second (it is usually obvious that it is wrong to give wrong information).

But incentives to acquire information are also created by carrots. Buyers with "entrepreneurial" information (for example, that there is a mine below the surface of a farm or that a painting is to be attributed to an old master) have in principle no duty to reveal this information.¹⁴⁷ This absence of a duty to reveal information allows buyers to benefit from entrepreneurial information, and this creates a carrot to produce such information. Here, there are clearly specification problems: *ex ante* it is not obvious who in our society is best placed to discover a painting of an old master or a mine. The situation is analogous to inventions and works of music, literature, or art (Who should invent a new technique or compose a new song?), and so is the solution—

¹⁴³ Steven Shavell, *Acquisition and Disclosure of Information Prior to Sale*, 25 RAND J Econ 20, 33 (1994).

¹⁴⁴ See Kronman, 7 J Legal Stud at 23–24 (cited in note 142).

¹⁴⁵ The seller's duty to acquire and reveal information may have distributional effects (the seller having to bear information costs and even becoming impoverished when she discovers that her property is worth less), but societies usually do not consider these as "distortions" but as fair adjustments.

¹⁴⁶ See Levmore, 72 Va L Rev at 879 (cited in note 23).

¹⁴⁷ See Kronman, 7 J Legal Stud at 9–18 (cited in note 142).

though there are technical differences with respect to how carrots are created by the legal system (for example, granting intellectual property rights for inventions and music or allowing physical property to be acquired without being sued for misrepresentation for mines and old master paintings).

But sometimes the legal system uses carrots for sellers as well. For instance, the owner of shares of a corporation does not need to reveal why she sells them. Maybe she did research and discovered that the company is less promising than the market believes. But unlike in the termites cases, no stick is used to make her reveal that information.¹⁴⁸ Here, it is not clear who is the least-cost information gatherer. Can the owner do such research more efficiently than anyone else in society? That is not so clear—in other words, there are *specification problems*. So instead, the incentives are created indirectly by carrots (in contrast to direct carrots, such as patents), for instance by not requiring the seller to warrant the value, not holding the better informed buyer liable for misrepresentation, or by allowing techniques such as shorting.

Our carrots-versus-sticks framework complements Professor Kronman's "least-cost information gatherer" principle by directing the attention to whether we know who the least-cost information gatherer is.¹⁴⁹ Very often we do know (because the seller is naturally better placed to acquire most types of information on the goods she owns), and then sticks are used. But if we don't, then carrots are used.

G. Contract Bonuses

Should contract breachers be penalized or should nonbreachers receive a bonus?¹⁵⁰ Contract law treatises tend to mention only

¹⁴⁸ See *id.* at 26.

¹⁴⁹ *Id.* at 9, 32–33.

¹⁵⁰ Our results should be applied with caution in a contractual context for two reasons. First, we did not consider the possible effect of participation constraints and entry fees. Yet to the extent that contracts are incomplete and delegate authority to one of the parties, a situation occurs that may not be so different analytically from pure authority relationships such as parent-child or state-citizen. And to the extent that contracts are not read by the parties that sign them, the situation comes analytically closer to the non-contractual framework we have analyzed, though formally they remain contracts.

But second, the analytical difference between carrots and sticks may become vague when the probability of enforcement equals 1, which is often the case in contracts (in those cases, there is still a difference between carrots and sticks with respect to built-in compensation, but it may be analytically hard to distinguish between the compensation of the carrot and the normal price or wage for the service). Note, however, that even carrots or sticks that are intended to be nonprobabilistic may in fact be probabilistic when

sticks: damages, specific performance (under the threat of criminal sanctions for contempt of court), or stipulated damages.¹⁵¹ But in practice, there seems to be a tendency to increasingly use carrots as well. Corporate executives may receive bonuses for exceptional performances.¹⁵² Workers in the auto industry who propose ideas to improve production processes may receive a reward (we are unaware of any manufacturer that penalizes employees who do not come up with such ideas).¹⁵³ Salespersons with the best results may receive a free cruise to the Caribbean Sea. How can we explain the general emphasis of the law on sticks and the tendency of the market toward carrots?

In most contracts, there are no serious specification problems. Building contracts, for instance, specify in a very detailed way what the builder should do.¹⁵⁴ As a result, our analysis suggests that sticks are superior.¹⁵⁵ But employment contracts and relational contracts more generally are highly incomplete. In the examples above, specifying what CEOs should do to improve the profits of the company may be very hard. By the same token, it may be impossible to specify which worker should generate good ideas to improve production processes or what each salesperson should do to achieve record sales. Because of these specification problems, carrots become superior.

H. Incentives in the Military

Armies often require enormous effort costs from their soldiers, and it is therefore interesting to view whether such efforts are induced through carrots or sticks.

The decision to join the army can be based on either sticks or carrots. General conscription is a stick system. Adult men are obliged to contribute to a public good (safety) in the form of a

evidentiary problems make enforcement less than perfect. In those cases, the risk and transaction-costs analysis becomes relevant again. Note also that carrots may also involve more risks for the lawmaker who has to finance the carrots.

¹⁵¹ See, for example, Jeffrey Ferriell and Michael Navin, *Understanding Contracts* 1–2 (LexisNexis 2004).

¹⁵² We admit that some of these bonuses have little to do with real “carrots” but are rather ways to frame high wages in such a way that they become tax deductible or harder to criticize by shareholders and outsiders. See Lucian Bebchuk and Jesse Fried, *Pay without Performance: The Unfulfilled Promise of Executive Compensation* 124–27 (Harvard 2004).

¹⁵³ See Máire Kerrin and Nick Oliver, *Collective and Individual Improvement Activities: The Role of Reward Systems*, 31 *Personnel Rev* 320, 328–34 (2002).

¹⁵⁴ See *Elkins Manor Associates v Eleanor Concrete Works, Inc.*, 396 SE2d 463, 469 (W Va 1990).

¹⁵⁵ Moreover, because contract breach is typically verifiable by a court, there is no real danger of abuse of sticks by uncontrolled, nonbenevolent lawmakers.

service under the threat of a criminal sanction. A professional army is a carrot system: Volunteers are attracted to the army by a wage (a carrot, which is financed by taxes). If the army needs the entire population of young males, there are no specification problems (it is clear what all males should do), and *no singling-out problems* (all families affected in similar ways, so that existing wealth distributions are not distorted).¹⁵⁶ Therefore, our results suggest that sticks will be used.

If the army requires only a minority of the young male population and the same degree of specialization is needed, specification problems occur: Who should join the army? Moreover, a stick system would cause severe distributional distortions because the minority that would have to go to the army without compensation would be significantly impoverished. Therefore, our analysis suggests that carrots are superior.

Concerning the incentives to follow rules, military boot camps are notorious examples of stick-based enforcement systems. This is in line with our analysis because there are usually no specification problems. It is not only clear what the optimal rules are—such as the fact that equipment should be properly maintained, that orders from higher-ranked officers need to be executed, or that soldiers should greet and march in a standardized way, and that no soldier should ever desert—but also who should do it: everybody of a certain rank.

Still, armies use carrots as well—war heroes receive medals. Medals are usually not awarded to those with the most dangerous tasks (such as those who fought in the front line) but rather to soldiers who undertook more risks than they were explicitly asked to.¹⁵⁷ This indicates that the situation in which the heroic act took place had some uniqueness and unpredictability (that is, there were specification problems) because otherwise formal orders could have been formulated.

Another example of carrots in armies is promotion. Also here it is not *prima facie* clear which individuals are best suited for higher positions. By attaching carrots to the relatively scarce higher positions, individuals who believe they have the right capabilities are given an incentive to reveal their type and exert the right efforts. Of course, penalties for those who did not obtain a promotion would create the same incentives but because only a minority is promoted, carrots are superior.

¹⁵⁶ Exceptions often granted to the only sons of single mothers confirm this point.

¹⁵⁷ See, for example, 10 USC § 3741 (providing the criteria for awarding the Medal of Honor).

I. Slave Societies

A slave owner is the archetypical *nonbenevolent rulemaker*: he does not aim for what is good for the slave or for society but for what is good for himself. Moreover, legal systems that permit slavery usually only rarely monitor the reasonableness of the lawmaker's decisions.¹⁵⁸

Unsurprisingly, sticks are largely preferred to carrots in master-slave relationships. Carrots have a built-in compensation and exploitation-preventing mechanism (Difference 6), but sticks do not. Therefore, it should not surprise us that someone who wants to exploit somebody else will choose sticks.

But this picture is incomplete because there is a well-documented use of carrots in master-slave relationships. For example, in ancient Rome, those slaves who were assigned managerial or intellectual tasks were often rewarded with gifts, money, or the concession of freedom.¹⁵⁹ The use of carrots and the size of the rewards have been shown to depend on the task assigned: slave-workers (those carrying out physical tasks) were mostly subjected to sticks, slave-managers (those carrying out managerial tasks, such as the administration of a workshop) were given moderate carrots, and slave-entrepreneurs (those who were given assets to autonomously run a business in the interest of their master) received the largest carrots.¹⁶⁰

¹⁵⁸ See Fogel and Engerman, *Time on the Cross* at 128–29 (cited in note 39).

¹⁵⁹ See Fenoaltea, 44 *J Econ Hist* at 639, 657 (cited in note 39).

¹⁶⁰ See *id.* at 636:

Since slaves (and “wage slaves”) may be driven by pain incentives, they may find themselves locked into Pareto-stable gang labor in effort-intensive activities. Where the worker's productivity depends overwhelmingly on his brute effort and negligibly on his carefulness, that is to say, a shift to a system that eliminates the supervisor and lets the worker retain his marginal product would *not* yield a reduction in total labor costs, precisely because the attendant shift from pain incentives to ordinary rewards causes a reduction in the worker's effort and productivity. In care-intensive activities, in contrast, the substitution of care for effort does not reduce the worker's productivity; a shift from supervised gang work with pain incentives to self-supervised work with ordinary rewards will therefore be profitable, other things being equal, and the predictions of the simple model recalled above will hold good.

For more literature analyzing slavery from an economic perspective, see Daron Acemoglu and Alexander Wolitzky, *The Economics of Labor Coercion*, 79 *Econometrica* 555 (2011); Nils-Petter Lagerlöf, *Slavery and Other Property Rights*, 76 *Rev Econ Stud* 319 (2009); Michael Suk-Young Chwe, *Why Were Workers Whipped? Pain in a Principal-Agent Model*, 100 *Econ J* 1109 (1990); Yoram Barzel, *An Economic Analysis of Slavery*, 20 *J L & Econ* 87 (1977); Giorgio Canarella and John A. Tomaske, *The Optimal Utilization of Slaves*, 35 *J Econ Hist* 621 (1975); Ronald Findlay, *Slavery, Incentives, and Manumission: A Theoretical Model*, 83 *J Polit Econ* 923 (1975); T. Bergstrom, *On the Existence and Optimality of Competitive Equilibrium for a Slave Economy*, 38 *Rev Econ Stud*

Why would a slave owner ever use carrots? Because of altruism? Maybe. But the use of carrots can also be explained in terms of specification problems: managerial and entrepreneurial tasks tend to be more difficult to define *ex ante*. It is hard to specify what exactly a slave who runs a business should do to make it more successful. Moreover, managerial skills are more difficult to identify *ex ante* than physical strength and good health. Therefore, the slave owner may not know what skill level a slave is able to reach. As a result, with sticks, the master may actually at times punish his slaves even though they exerted their maximum effort. But why would a slave owner care about that? In some cases the reason was altruism. But even to a selfish, nonempathic master the application of sticks was costly because it could destroy the investment he made in the slave. Sticks consisted mostly of physical punishments or death and slaves were traded on a market that priced them depending on their abilities. Therefore, the master internalized at least part of the costs caused by the use of sticks.¹⁶¹ As a result, it was convenient, even for nonbenevolent masters, to use carrots whenever the complexity of the situation made stick-based command-and-control regimes vulnerable to severe errors.¹⁶²

J. Health Policy

Health policy provides some clear examples of the pattern of use of carrots and sticks. Some activities that are harmful for individuals are also the object of state intervention in light of the externalities that they impose on society. Three clear examples are driving, smoking, and eating. Each of these activities presents some risk for the individual: driving might result in an accident, smoking might result in cancer, and unhealthy eating habits might result in cardiovascular diseases and a host of other food-related illnesses.¹⁶³ Remarkably, these activities are subject to very different types of state intervention.

23 (1971); Evsey D. Domar, *The Causes of Slavery or Serfdom: A Hypothesis*, 30 *J Econ Hist* 18 (1970); Alfred H. Conrad and John R. Meyer, *The Economics of Slavery: And Other Studies in Econometric History* 82–84 (Aldine 1964).

¹⁶¹ See Fogel and Engerman, *Time on the Cross* at 55 (cited in note 39).

¹⁶² For an historical and economic analysis, see generally Giuseppe Dari-Mattiacci, *Slavery and Information*, 73 *J Econ Hist* (forthcoming 2013).

¹⁶³ See Surgeon General, *How Tobacco Smoke Causes Disease: The Biology and Behavioral Basis for Smoking-Attributable Disease* 1, 5 (Department of Health and Human Services 2010), online at <http://www.surgeongeneral.gov/library/reports/tobaccosmoke/executivesummary.pdf> (visited Mar 3, 2013); Nancy T. Artinian, et al, *Interventions to Promote Physical Activity and Dietary Lifestyle Changes for Cardiovascular Risk Factor Reduction in Adults: A Scientific Statement from the American Heart Association*, 122

Injuries from driving are prevented through the use of sticks, such as the obligation to wear safety belts or the use of speed limits.¹⁶⁴ This can be explained by the fact that the traffic rules are rather homogeneous (no incomplete information),¹⁶⁵ and compliance with traffic regulations is relatively easy to detect (no imperfect information) and imposes similar costs on all individuals (no distributional distortions). The problems caused by smoking are tackled by taxes on cigarettes and smoking bans, which are sticks, but smoking as such is not prohibited.¹⁶⁶ This can be explained by the fact that prohibiting smoking in public areas can be easily done without inducing specification problems or great distributional distortions with sticks while prohibiting smoking as such would require a ban on the sale of cigarettes and more pervasive controls—witness the costs of the war on drugs.

At the other extreme is the enforcement of healthy eating habits. In this case . . . carrots are the norm! Imposing sticks on unhealthy eating would impose enormous specification problems—as to who should eat what—ex post monitoring problems, and distributional distortions—due to the variety of tastes and needs. Instead, the state often sponsors plans to induce healthy habits by (directly or indirectly) subsidizing healthy activities, such as indoor or outdoor sports or bio-industry, thus working with carrots rather than sticks.¹⁶⁷

K. Parenting and Education

Carrots and sticks are also used outside the law, in education for instance. There is a general tendency among psychologists to be more favorable toward carrots than toward sticks.¹⁶⁸ This emphasis on positive incentives is often attributed to the

Circulation 406, 407 (2010); Eleni Petridou and Maria Moustaki, *Human Factors in the Causation of Road Traffic Crashes*, 16 *Eur J Epidemiology* 819, 820–23 (2000).

¹⁶⁴ See National Highway Traffic Safety Administration, *Traffic Safety Facts Research Note: The Increase in Lives Saved, Injuries Prevented, and Cost Savings if Seat Belt Use Rose to at Least 90 Percent in All States 1* (Department of Transportation May 2009), online at <http://www-nrd.nhtsa.dot.gov/Pubs/811140.pdf> (visited Mar 3, 2013).

¹⁶⁵ Differences in driving abilities are plausibly not so pronounced to justify subject-specific rules, although speed limits can be tailored to the type of vehicle.

¹⁶⁶ See A. Blake Brown, *Cigarette Taxes and Smoking Restrictions: Impacts and Policy Implications*, 77 *Am J Ag Econ* 946, 946 (1995).

¹⁶⁷ See, for example, Mi-Ae Jung and Joseph Wong, *Pathways to Bio-Industry Development: Institutional Changes in the Global Economy* *2–3 (Imperial College London Business School, Opening Up Innovation: Strategy, Organization and Technology Conference Paper, June 2010), online at <http://www2.druid.dk/conferences/viewpaper.php?id=501509&cf=43> (visited Mar 3, 2013).

¹⁶⁸ See, for example, Kohn, *Punished by Rewards* at 3 (cited in note 42).

influence of behaviorism, the most popular school of thought in American psychology.¹⁶⁹ The so-called Law of Effect states that when behavior is followed by a positive consequence (“positive reinforcement”), it will be repeated.¹⁷⁰ When behavior is followed by a negative consequence, it is not certain that the desired behavior will be chosen instead.

Our analysis suggests that the emphasis of contemporary psychologists on carrots may be more than a coincidental by-product of the popularity of behaviorism. Instead, it may be a feature of a more complex society, in which it is less clear what to expect from children. Consider children that were raised on a traditional farm in pre-industrial times. For parents it was clear that the children would become farmers, too.¹⁷¹ It was also clear what capabilities and attitudes good farming involved (exactly the same as the parents had). Since there were no specification problems, sticks were the optimal type of sanction. It is much less clear what makes a good doctor, attorney, merchant, or artist, and it is not immediately evident what talents a child possesses. Therefore, most modern parents are reluctant to use punishments when a child sings out of tune or even when he does not receive an A on a math test (because parents may not know for sure whether the child is able to do better—that is, there are specification problems—and using sticks would often result in punishing those who are simply unable to comply with the norm). So instead, parents will use carrots for good singing or math performances. But modern parents will still use sticks when it comes to enforcing traffic rules. For instance, they may punish a child who crossed the street without looking. In those cases there are no specification problems—it is obvious what should be expected from each child.

Overall, *in complex societies, parenting will increasingly be based on carrots*—at least, this is what our theoretical results suggest.

CONCLUSION

Whether legal systems should use carrots or sticks is an important and largely unexplored question. We have argued that

¹⁶⁹ See *id.* at xi.

¹⁷⁰ See Edward Lee Thorndike, *Educational Psychology* 114–41 (Columbia 2d ed 1910). See generally C.B. Ferster and B.F. Skinner, *Schedules of Reinforcement* (Appleton-Century-Crofts 1957).

¹⁷¹ See James A. Henretta, *Families and Farms: Mentalité in Pre-industrial America*, 35 *Wm & Mary Q* 3, 21–26 (1978).

there is an increasing tendency in modern legal systems to use carrots. To explain this trend and to develop normative guidelines for further use of carrots and sticks, we have analyzed their effects on transaction costs, risks, and the distribution of wealth.

We found that in simple settings, sticks are superior to carrots. Indeed, if the lawmaker is fully informed about the capabilities of the citizens, and all citizens are very similar, the lawmaker will expect the same from all citizens and will be certain that the sticks are costly enough so that all citizens comply. Because all will comply, the sticks are mere threats that do not have to be applied. Sticks incentivize by threatening while carrots incentivize by actually rewarding; in an ideal world, fines are never paid, but prizes are. As a result, sticks yield fewer transaction costs and less risk for complying citizens. Moreover, sticks generate fewer distributional distortions when the citizens are sufficiently homogenous with respect to effort costs.

However, if the lawmaker is not fully informed about the citizens' individual effort costs, possibly because citizens differ so much, sticks lose some of these intrinsic advantages because the lawmaker may demand compliance from citizens who are not able to comply at a reasonable cost. The more citizens violate the norm, the more often sticks must be applied, which generates transaction costs and risk and may distort the existing distribution of resources by impoverishing those who are unable to comply. This can be reframed in terms of specification problems: if the lawmaker has difficulties in specifying what to expect from each citizen—that is, if the lawmaker does not know which citizen is able to do what—then carrots may become superior. This may help to explain why copyrights are used for composers and why carrots play an important role in modern parenting.

But even when the lawmaker is completely informed about each citizen's effort cost, carrots can be superior when the demanded effort costs vary among citizens. Carrots have the advantage that they can correct this distributional effect by being individualized (that is, set higher for those with higher effort costs). Individualizing sticks, in contrast, does not correct distributional distortions because sticks are in principle not applied to compliers. This result can be reframed in terms of the singling-out danger: if the lawmaker needs to obtain substantially higher effort from some individuals than from others, carrots may become superior because they generate fewer side effects in terms

of unintended distributional distortions (which may in turn lead to other economic problems, such as activity-level distortions).

Overall, our analysis suggests that, as societies become more complex, and labor more specialized, carrots tend to be used more often.

Of course, a word of caution is warranted. “Carrots versus sticks” is a complex problem that remains understudied. While this Article attempts to draw a broad picture of the factors that bear on the use of carrots and sticks, we still assumed away a number of complications that could influence our theoretical results and normative guidelines. The main limitation of our analysis is that we used a *narrowly defined rational choice framework* and discarded psychological effects. But we have tried to show that much of the law can be explained without taking behavioral distortions into account. Other complications we did not consider are annulable carrots and sticks,¹⁷² entry fees to enter into a carrot or stick system, the distributional effects of the tax system that is needed to finance carrots, and the possibility of combining carrots with sticks.

Finally, we offer a short theoretical reflection on the fundamental question of why carrots and sticks are not just *mirror images*. Two fundamental factors are responsible for the asymmetry between carrots and sticks. The first is that the lawmaker wants compliance, not violation. Compliance is the desired and therefore “normal” state of the world. To illustrate, carrots generate transaction costs in case of compliance, sticks in case of violation; carrots create risks for compliers, sticks for violators. Both differences are symmetrical and in essence caused by the sign of the sanctions (that is, whether they are positive or negative). Yet if the lawmaker is fully informed about the effort costs, all citizens will be induced to comply, and sticks will become superior with respect to both transaction costs and risk costs. This difference is ultimately driven by the fact that the lawmaker wants compliance, not violation.

The second fundamental factor that is responsible for the asymmetry between carrots and sticks is the wealth effect: carrots make citizens wealthier than sticks. This explains many of the distributional differences but also why some problems are more severe under sticks than under carrots. One example of an asymmetrical difference that is driven by this wealth effect is

¹⁷² See De Geest, Dari-Mattiacci, and Siegers, 29 *Intl Rev L & Econ* at 352–57 (cited in note 28).

that carrots are less prone to abuse than sticks. Another example is that only individualized carrots produce different distributional effects from general carrots while individualized and general sticks have the same distributional effects; as a result, only (individualized) carrots can prevent some unintended distributional side effects.

These are just some examples of asymmetrical differences. They prove that carrots and sticks are not just mirror images of each other. Therefore, we should not be surprised that different societies use them differently.