Rules as data

Alessia Damonte

Department of Social and Political Sciences, Università degli Studi di Milano, Milan, Italy

Computational Models and Designs (CMD) Hub, Università degli Studi di Milano, Milan, Italy

Giulia Bazzan

Department of Public Law and Governance, Tilburg University, Tilburg, The Netherlands

Abstract

Rules lie at the core of many disciplines beneath regulatory studies. Such a broad interest inevitably comes with fragmented understandings and technical choices that hinder knowledge cumulation and learning. This introduction tackles these limitations through an encompassing analytical blueprint from measurement theory. First, it addresses ambiguities to establish formal rules as a distinct research object. Then, it builds on legal, institutional analytic, and computational linguistic frameworks to pinpoint their constituting elements. Last, it revises strategies for assigning meaningful numbers to objects and outlines how the contributions to this Special Issue foster different aspects of the blueprint.

Keywords: computational institutional analysis, concept analysis, measurement theories, methodology, rules.

1. Introduction

Hallmarks of regulation studies are the plurality of the theoretical lenses and disciplines engaging with its normative and positive issues. Maps of the field include inquiries into the values and purposes of regulation, the alternative shapes it can take across context, the mechanisms and limits of its cogency, the variety of its governance architectures and political economies, and the tensions among the criteria invoked to establish its success or failure. Beneath the variety of themes, however, regulation remains conceptually anchored to the making, enforcing, and monitoring of rules (e.g., Baldwin et al., 2010; Koop & Lodge, 2017; Levi-Faur, 2011).

Rules matter as the empirical ground for a bounty of research hypotheses on, for instance, agencies' design (e.g., Bazzan, 2021; Hanretty & Koop, 2012; Maggetti, 2007), governance modes and regimes (e.g., Black, 2008; Jochim & May, 2010; Levi-Faur, 2011; Mizrahi-Borohovich & Levi-Faur, 2020), paradigms and policy instruments (e.g., Atkinson & Schubert, 2021; Damonte, 2013; Franchino, 2019; Lascoumes & Le Galès, 2007; Rangone, 2015; Schaffrin et al., 2015), the structure and performance of democracy (e.g., Levi-Faur et al., 2018; Schlager et al., 2021; Scott, 2015), and phenomena such as institutional convergence and diffusion (e.g., Epstein & Martin, 2009; Gilardi, 2005; Jordana et al., 2011; La Porta et al., 2001), delegation and control (e.g., Bersch & Fukuyama, 2023; Epstein & O'Halloran, 1999; Gailmard & Patty, 2012; Koop, 2015), implementation and enforcement (e.g., May, 1993; May & Wood, 2003; Thomann, 2019), policy change (e.g., Hurka et al., 2016; Liefferink et al., 2009), or conflict and compliance (e.g., Chen, Heikkila, et al., 2022; North et al., 2009; Siddiki et al., 2018; Thomann & Zhelyazkova, 2017; van Rooij & Daniel Sokol, 2021).

The knowledge rules yield ultimately depends on how they are measured. Sound measurement is vital to solid conceptualizations, broader comparisons, and the reliable identification of problems and dilemmas (e.g., Coglianese, 2002; Short et al., 2021). Conversely, flawed measures can misrepresent a phenomenon, overestimate or underestimate its severity or diffusion, and ultimately undermine the validity of findings and

evaluations—with remarkable consequences when they are uncritically transferred from analysis to advocacy (e.g., Independent Evaluation Group, 2022; Saltelli, 2006; Voigt, 2012). Often, however, analyses confine measurement issues to methodological annexes with little discussion. Moreover, these issues seem to have increasingly lost priority as more researchers have turned to computational solutions to scale up the scope of their analyses—despite computer scientists warning that no technical advancement can guard researchers against the "Garbage In—Garbage Out" (GIGO) syndrome.

This Special Issue elaborates on the intent of reversing the focus and giving center stage to how to turn rules into sound research data. Zooming into innovations in frameworks, techniques, and applications is the particular concern of individual contributions. This introduction consolidates and elucidates the methodological foundations of measuring rules to bridge disciplines, improve researchers' awareness, and favor cumulation in turning rules into data.

Therefore, this introduction builds on a well-established social science understanding of measurement as assigning numerals to entities according to systematic criteria. It also justifies measurement with the intent of enhancing the reliability of human knowledge for more effective communication and action in the world (e.g., Mari, Wilson, and Maul, 2021; Narens, 2012). Along these lines, it understands measurement through the semantic triple in Figure 1.

In the original proposal, the triple has a chained structure: within a particular universe of reference, the usage of a sign, tag, or label as a shorthand for actual entities (dashed line *c* in Fig. 1) holds if it is assigned a meaning (solid line *a* in Fig. 1) that can identify the actualities of interest adequately (solid line *b* in Fig. 1). In the social sciences, concept analysis (e.g., Adcock & Collier, 2001; Gerring, 1999; Goertz, 2020; Sartori, 1984) relates the triple to a concept expressed in natural language within the boundaries of a particular discourse. Thus, the meaning provides the label with an intension—that is, a set of observable implications (line *a*, Fig. 1). In turn, the intension allows discriminating between the entities that display these observable implications from those that do not, and so provides the label with a real-world extension (line *b*, Fig. 1). Strictly speaking, measurement enters the picture to improve step *b*. By turning observable implications into criteria for assigning numerals to objects, states, or events, measurement promises greater accuracy in establishing whether or to what extent they fall under the label. The triple, however, encourages widening our view and encompasses the specification of the intension, too, to ensure valid measures. Indeed, clarifying the concept of interest by dispelling ambiguities and pinpointing its constituting elements improves the interpretation of construct and content validity tests. Moreover, a clearer concept lends higher credibility to the measure's capacity to discriminate between the entities that bear it from those that do not—therefore, to predictions or explanations of their behavior (e.g., Adcock & Collier, 2001).

This introduction adopts the whole triple as its blueprint. Each section has a methodological opening and a substantive part. The methodological opening delves into an element of the triple that the substantive part uses as a viewpoint to select and discuss issues in measuring rules. Thus, Section 2 assigns unambiguous meaning to the concept of "rules" that suit the social science discourse. Then, Section 3 unpacks the structure and analytical components of a rule's intension, while Section 4 delves into transitioning from the rules' intension to extension through measures and indexes. Last, Section 5 reconnects the contributions of the Special Issue to the major themes of this introduction.
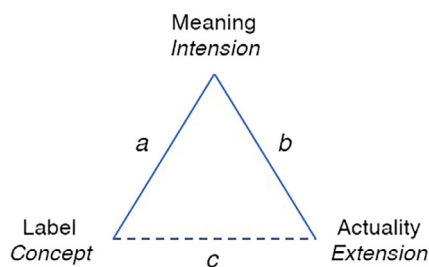

FIGURE 1 The semantic triple. *Source*: Elaboration of the references in the main text.

2. Label and meaning

A thorough procedure for elucidating the meaning of a term to move along line *a* in Figure 1 is the operation of explication as developed in linguistics and the philosophy of language (e.g., Brun, 2015; Cordes, 2017). The procedure performs the descriptive purpose of pinpointing which qualitative features define the term of interest or *explicandum*. Explication compels an analytic definition and can build on contrasting the term with its customary synonyms and homonyms in the discourse of reference. The contrast is carried out to uncover issues of vagueness, ambiguity, and biased intuition and so contribute to better establishing the boundaries of the term's content. When applied to the concept of rules, this first step entails a critical review of the meanings different communities have attached to it while responding to similar research questions.

Rules have long attracted researchers' attention as testable explanations for people's regular behaviors under recognizable circumstances. In a shared minimal definition, a rule is a human construct enabling and constraining people's agency. It boils down to a direction stating, "If X, do Y" and compels individuals in X-type situations to avoid courses of conduct that are not Y (Hodgson, 2006: 3; see also Schauer, 1991; Voigt, 2012). Thus, a rule can make agency predictable in a context and shape people's expectations, strategies, and coordination efforts. Hence, it qualifies as the fabric of institutions with other recognized constraints. However, the boundaries and relationships between these constraints often prove fuzzy across authors and streams of literature.

For instance, Hindriks and Guala (2015) maintain that rules thrive if they solve people's coordination problems. Their exemplary illustrations oppose long-lasting marriage rights and obligations to the long-forgotten French *ordonnance* forbidding women to wear trousers. In their view, the two illustrations convey that rules can emerge from below "by trial and error and spread spontaneously by imitation" or be "designed and implemented by an authority" from above through laws and decrees (p. 462). Rules are forgotten when nobody believes they will be strictly enforced. With a normative twist, their theory assumes people believe only useful rules will be enforced—and a rule is useful when it steers people toward optima in games with multiple equilibria. For instance, everybody knows it is better to drive on the same side of the road; a useful rule signals which hand the traffic keeps. In short, Hindriks and Guala's synthesis holds that emerging and imposed rules coincide and evolve following efficiency principles. The theory dismisses the possibility that authority strictly enforces welfare-inefficient rules instead, for long, and against some people's interests or codes of conduct.

Similarly, Bicchieri (2017) notes that rational theories assume people's behavior follows optimizing decisions, while daily behavior often stems from some automatic response to cues irrespective of monitoring and enforcement systems. In her approach, "rules of behavior" are the fabric of social norms with which people comply for emotional reasons. Individuals spontaneously internalize them under some constitutive human preference to conformity, plus a twofold belief about relevant people—that they, too, stick to the conduct and expect the same from others. Eventually, in this theory, rules of conduct coincide with "embedded scripts" that operate in people's minds as "prescriptive sequences of actions of varying levels of specificity that people automatically engage in (and are expected to engage in) while in particular situations" (p. 132). Therefore, the theory assumes all institutional constraints to align and collapse into a habit, insensitive to power issues and strategic intentions. Later developments (e.g., Bicchieri & Dimant, 2022) reinstate power as they link beliefs and expectations to knowledge of others' behavior, leaving room for nudging agents by circulating information.

Influential distinctions among different behavioral constraints are Elster's (1991). He posits "norms" and "habits" as nonoverlapping labels, albeit both in contrast with rational conduct. He observes that the rational theory of action embodies an outcome-oriented perspective building on conditional statements of the kind: "If you *want* X, do Y." Just the opposite, in his view, norms compel non-consequentialist behavior. Their instructions can take the shape of unconditional imperatives ("Do Y" or "Do not do Y"), appeals to imitation or legacy ("Do Y because others have done Y"), or reasons to adhere to some principle ("Do Y because it would be good that everyone did Y"). Norms are "personal" when they stem from a purely individual commitment—for instance, to reinforce some resolution. They are "social" when shared with others that praise or blame behavior. Expected social evaluation triggers emotions—from anxiety and guilt to pride—that compel the agent's compliance. Therefore, to Elster, compliance with social norms falls beyond rational calculation, cannot be easily reduced to self-interest, and may not enforce optima. However, norm-driven behavior differs from habit-driven behavior, for the

latter develops as an automatic response to clues by sheer repetition regardless of social pressures, and its viola-tion does not elicit deep feelings.

Elster also suggests a characterization of rules. For instance, it equates the "norms of retribution" to those "rules regulating revenge" and "ethical codes" that may heighten, moderate, or suppress the human impulse to return harm. In discussing "work norms," he recalls how in "the workplace, one often finds informal norms among the workers that regulate their work effort," such as the "'code of honor' that forbids them to train new workers who are hired to do the same job for lower wages." (p. 112). Hence, the rules that realize social norms are "informal" in contrast with the "formal" ones that realize "legal norms." In Elster's theory, legal norms stand apart as they are enforced by specialists with a professional self-interest in doing it—and their decisions can clash with some community's codes. Besides, the rules that realize legal norms make room for rational calculation in compliance. Agents can perceive the expected outcome of legal enforcement as the additional price to be paid for adopting a sanctioned conduct without attaching any special negative feeling to it—and the price can be paid with pride when their social circle highly regards that conduct. Elster's distinction echoes Hart (2012)'s contrast between "primary" and "secondary" rules of obligation. Primary rules are the codes of conduct that regulate and preserve small communities knit together by kinship and shared sentiments. All their members know which codes are in force, and social pressures ensure adherence. In complex, encompassing societies, such codes prove too limited in scope. Therefore, secondary rules are needed that recognize which primary rules are to be adopted for the whole society; rule-makers, courts, and enforcement agencies are given the responsibility for meeting this need. With its enforcement capacity, the legitimate authoritative system becomes crucial to leaven secondary rules.

A neater conceptualization of formal, secondary rules is of particular concern to Schauer (1991). He distin-guishes "descriptive" from "prescriptive" rules: the former captures a regularity about the world; the latter is for guiding, controlling, and changing strategic agents' behavior. Prescriptive rules can be "of thumb" or "manda-tory." Rules of thumb offer "recipes" for succeeding in some tasks; people searching for guidance freely abandon them if they prove faulty. Compliance with mandatory rules, instead, is not optional: their directions always come with a normative, "deontic" element and, in their most typical shape, read, "If X, *you must/can* (*not*) do Y." Albeit the actual force of mandatory rules depends on an effective sanctioning system, the deontic element implies that ineffective sanctions open opportunities for rational agents to exploit noncompliance but do not offer proper reasons for people to resist the prescription. Instead, individuals can rightly contravene mandatory rules when blind compliance with their letter would clash with their purpose or higher interests. Moreover, compliance is not due when rules are issued against established procedures or by some subject who lacks the required authority. Thus, formal rules stand apart from other sources of behavioral regularity as they are set through specific procedures to enact, amend, or revoke them and by specialized bodies with the authority to activate these procedures and inter-pret their result.

In short, as summarized in Table 1, research can reduce ambiguities by considering rules as "formal" con-structs and analytically separate from automatic "scripts" and rational "strategies," but also from the "informal"

TABLE 1 Alternative sources of behavioral regularities

Constraint	Script	Strategy	"Informal" rule	"Formal" rule
Realizing	Habit	Game	Social norm, code of conduct	Legal norm
Scope	Personal	Interaction	Group	Jurisdiction
General shape	When you meet X, respond Y	If you want X, do Y	Do Y as others expect you to do so	If X, you can/must (not) do Y, else incur Z
Triggered by	Situated cues	Expected payoffs	Gut feeling & anticipation	Justification & sanction
Enforced by	Repetition	Optima	Relevant others' reactions	Specialized bodies
Adherence	Automatic	Calculative	Emotional	Reasoned

Source: Elaboration of the literature in the main text.

prescriptions of codes and social norms—as each offers a qualitatively different account of a behavioral regularity.

Of course, the highest behavioral regularities can be expected when formal rules and informal prescriptions, strategies, and possibly scripts point in the same direction (e.g., Gunningham et al., 2004). However, establishing formal rules as an analytically independent phenomenon prevents assuming the political-legal, social, and psychological domains are aligned before evidence (e.g., Jordana et al., 2018; Koop & Lodge, 2017). In the rest of this work, we will refer to rules to indicate formal constructs only.

3. Intension

The raw observables for a label constitute the result of the explication process (i.e., the endpoint of line *a* in Fig. 1), dubbed *explicatum*. This construct may be formulated in a language different than the original term and require the introduction of the new syntax for it to substitute the original label. The new syntax might exclude more vagueness, ambiguity, or inconsistencies than the original formulation (e.g., Cordes, 2017). However, when serving measurement purposes, the added heuristic value of the *explicatum* is usually decided against the backdrop of an array of *desiderata*, such as its similarity to the original *explicandum*, simplicity or higher precision as a future classification criterion, and capacity to ease the identification of meaningful relationships. In concept analysis, the *explicatum* consists of a set of components—the concept's *intension*—allowing an observer to decide whether an actual entity is an instance of the concept. The relationship between a concept and its defining components has long been a matter of logic before methods and proceeds along either classic analytical or non-classical lines of reasoning (e.g., Gerring, 1999; Goertz, 2020).

The analytical ideal maintains that the good *explicatum* consists of a set of individually necessary and jointly sufficient constituent properties that confer a univocal meaning to the term (Fig. 2, dark area in left diagram). Such a structure turns the concept into a discrete class because its components can discriminate faultlessly between the entities to which the term applies and the others. Indeed, necessary and sufficient features construe tidy classification criteria and promise no error beyond measuring instrument issues. Hence, the usual tenet maintains that the classical approach offers an ideal ground for establishing a robust intension irrespective of contextual features. This understanding is contrasted with the idea of "family resemblance" (Fig. 2, dark areas in center diagram). Its structure applies to entities that entertain only partial similarities with each other. Thus, the label refers to a bundle of features such that each feature identifies some entities, but no feature is common to all. Another non-classical concept has a "radial" intension instead (Fig. 2, dark areas in right diagram). Again, instances of radial concepts branch into separate groups, but at least one property is common to all. Radial and resemblance concepts, then, differ from the classic ones for their uncertain boundaries and apply a label to actual entities that match some exemplary reference points such as an ideal type or a prototype (e.g., Goertz, 2020; Hampton, 2006; Kaplan, 2017).
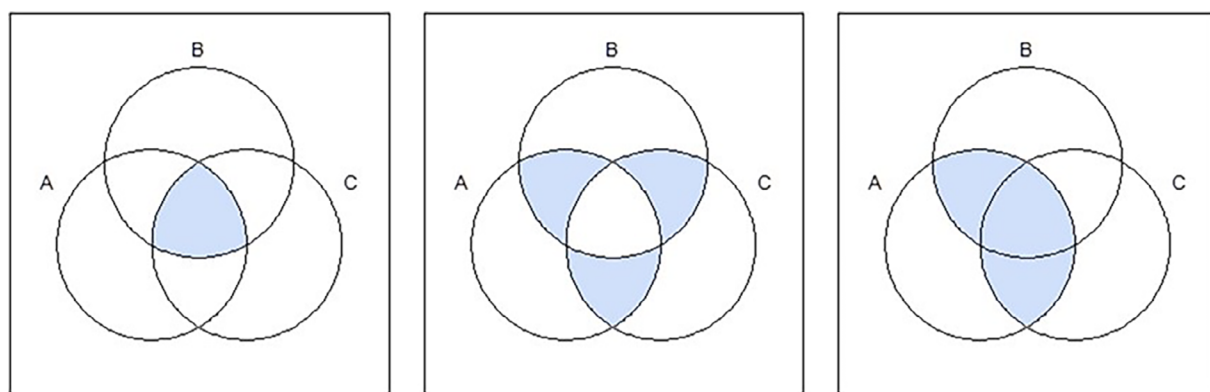

FIGURE 2 Classic, resemblance, and radial concepts' structure from three constituents. *Source*: elaboration from the literature in the main text.

3.1. Rules' components

Intension draws attention to the inner structure of rules. As established so far, a canonical rule takes the shape of a conditional statement, "If X, then you must/can (not) do Y, else incur Z."

Schauer (1991) considers that, in principle, any rule at least comprises two consistent halves—a factual predicate, "X," and a consequent, "do Y." The consequent specifies what should happen when the condition in the factual predicate obtains; the predicate includes the combination of "operative facts"—places and conditions—that "activate" the factual predicate in a situation. Often, parts of the operative facts are laid down in another kind of statement—dubbed "constitutive" (e.g., Schauer, 1991; Searle, 1969; von Wright, 1963)—ruling that "event or entity x counts as X in context C." Constitutive statements, therefore, establish and define institutional activities or states of the world, like voting and being a voter, while leaving the details of how to vote someone into office to the canonical if-then structures.

Albeit the "X" and "do Y" parts may be spread across different texts produced by different authorities, Schauer maintains the logical relationship between them is somehow causal as the antecedent lists the conditions that justify activating the consequent. Justifications are intrinsic to rules, providing the underlying theory that connects X to Y and operates at two levels. The lower level is specific: justifications connect the prescription to an actual goal that people's compliance is expected to realize in a particular situation. For instance, a speed limit on city roads connects compliance to preventing harm from urban drivers' overspeed. The higher level is general and pertains to the reason for having a rule in the first place. These justifications link the rule to broad social goals like predictability in coordination, prudence toward certain risks, or fair opportunities.

However, the factual predicate is also inevitably misspecified, for it might either encompass states of affairs that do not justify activating the consequent in the situation—for instance, when "doing Y" would harm higher interests—or exclude states that would justify it instead—such as when new technologies raise factual conditions that the rule did not envisage. The misspecification of the antecedent to its justification becomes inevitable as rules do not "micro-target" individuals but classes of individuals—that is, abstracted collectives across which risk propensity, opportunities, and coordination capacities can be unevenly distributed and change with time. Moreover, the specification is complicated by "unrules" (Walters et al., 2021) that lift or restrict a rule's scope through exemptions. Though often operating in the background, unrules modify the normative system through "carveouts" and "dispensations." Carveouts involve the deliberate exclusion of specific entities or activities from the scope of a provision and operate as defusing conditions. In contrast, dispensations entail reducing or modifying obligations under specific conditions, raising a new rule. Unrules might serve various purposes—reducing regulatory burdens, conserving government resources, or accommodating unique circumstances—but their introduction curbs the original justification.

In addition, the "causal" nature of the linkage between operative facts "X" and their consequent "do Y" in a rule is far from straightforward. Causality concerns relationships that can be verified or falsified between events that exist necessarily, possibly, or contingently in the world. Instead, rules establish that specific actions in certain jurisdictions are obligatory, permitted, or forbidden, hence creating "institutional" phenomena of concern to deontic logic (e.g., von Wright, 1963). Deontic logic maintains a problematic relationship with causality. Real people break the rules, so we cannot maintain that if Y is mandatory under X, Y-events will certainly occur under X-events. Conversely, observed violations might license conclusions about the social fit of a rule, the viability of its prescriptions, or the credibility of its enforcement but cannot invalidate it as they would if the rule were a causal statement—for the validity of a mandatory rule uniquely depends on its issuing procedure.

Moreover, deontics lay standard inferences open to paradoxes when rules acknowledge rule-breakers and establish "contrary-to-duty" codes of conduct to minimize harm in the situation (e.g., Chisholm, 1963). Examples assume a rule, such as "if you drive on this road, you cannot exceed 70 miles per hour," and a contrary-to-duty obligation, such as "if you cannot drive within speed limits, warn other road users." Standard logic assumes a single actual world and can conclude that drivers should use hazard lights while not exceeding speed limits. The paradox disappears when reasoning can recognize contrary-to-duty obligations only hold within the second-best worlds of violators—which can be many, depending on actual cases (e.g., Jones & Sergot, 1992).

Albeit deontics cannot determine behavior, they provide the agents in the field with focal points and reasons for acting that can exceed or clash with social norms (e.g., Sunstein, 1996). These reasons are conventionally associated with sanctions that make prescribed actions convenient to rational agents; however, sanctions can also

trigger emotional mechanisms (e.g., Mulder, 2018). In this regard, behavioral analyses contrast "rewards" for choosing a recommended course of action, conveying voluntariness, with "penalties" for violating prohibitions, conveying obligatoriness; "compensative" sanctions, justified by the principle of repairing damages, with "retributive" sanctions, punishing the violation of a principle; "light" penalties, signaling misdemeanor, with "severe" penalties, signaling a felony. Sophisticate approaches consider that penalties can erode social norms and undermine adherence (e.g., Reinders Folmer, 2021); improvements can follow from fine-tuning severity to the responses of the rule breaker after the violation is detected—for instance, by negotiating compensation when the response is cooperative and resorting to retribution otherwise (e.g., Braithwaite, 2002; May & Wood, 2003). Design theories emphasize the relevance of third-party monitoring and devices for eliciting information from the agents in the field to improve compliance before sanctions (e.g., Dari-Mattiacci & De Geest, 2017; Ostrom, 2005); organizational approaches highlight the capacity of enforcement (e.g., Feld & Voigt, 2003; Jordana et al., 2018). Thus, similar to constitutive statements, sanctions take their shape through bundles of further provisions that can expand the boundaries of a rule across texts. On the whole, sanctions lend credibility to the causal interpretation of rules but add to the complexity of their intension.

Sanctions' contribution to unintended behavioral effects has long driven attention to principles and standards as alternative guidance to behavior (e.g., Alexy, 2014). Rules are specific in their directives, conditions for action, and classes of addressees—which reduces ambiguity in interpretation but opens to misspecified applications. In contrast, principles and standards offer flexible content: instead of providing rigid instructions, they articulate overarching values or broad objectives and invite addressees to choose optimizing behaviors. In this, they value agents' latitude to adapt their compliance to the contingency of actual situations (e.g., Baldwin, 1990). However, the license to follow context-specific judgments comes at the addressees' costs of exercising discretion to align their actions with the broader prescription, leaving details to be reinstated through litigation. Besides, principles and standards may offer weaker reasons to resist pressures from clashing social norms in the field.

A systematization of the constituents of a rule for research has been advanced by Crawford and Ostrom (1995). Their original "Grammar of Institutions" breaks down rules into five elements, namely

- *Attributes*, specifying values and variables that identify the addressees—like age, education, or specific positions. The full details may lie in separate constitutive statements.
- *Deontic*, comprising modal verbs linked to deontic logic, such as "may" for permit, "must" for obligation, and "must not" for prohibition. It conveys the normative weight of the prescription.
- *Aim*, including the particular actions or outcomes to which the deontic component applies. In short, it renders the general consequent "Do Y."
- *Conditions*, encompassing factual variables that define when, where, how, and to what extent the consequent applies. Hence, Conditions render the activating compound "If X" for the agents identified by Attributes net of carveouts.
- *Or else*, representing the penalties or consequences that non-compliants will incur and, therefore, refines the strength of the deontic.

According to the original proposal, a rule is complete when all these elements are specified—albeit some missing components allow for conventional "default" completion of the statement. For instance, missing Attributes imply that the statement holds "for all;" missing Conditions entail that the statement applies "unconditionally." Instead, the missing Aim makes the rule void, while missing Or else and Deontic turn a rule into something else. Statements with undefined sanctions count as "norms" as principles; principles without deontic terms offer "strategies" instead—which recall Schauer's rules of thumb or recipes. Together, these considerations outline a rule's specific intension, as summarized in Table 2.

Along these lines, a formal rule corresponds to a radial concept. Its common core is complete when it includes a deontic, the prescription, and sanctions. Scope and specification depend on the activating conditions and the addressees' attributes, which may be unspoken. Further elements are carveouts and contrary-to-duty obligations for the breakers, which can prove irrelevant to define the existence of the rule in a text yet crucial to establish its effectiveness as a behavioral constraint.

TABLE 2 Rules, principles, and recipes by their intension

Structure		Component(s)	Rule	Principle	Recipe
If	X	Activating conditions	Required or default	Required or default	Required or default
Then	you	Constitutive statements	Required or default	Default	Default
	must/can (not)	Deontic	Required	Required	*Missing*
	do Y	Prescription	Required	Required	Required
Else	*do Y' &*	*Rule breakers' obligations*	Possible	*Missing*	Possible
	incur Z	Sanction	Required	*Missing*	*Missing*
Unless	X'	Defusing conditions	Possible	Possible	Possible

Source: Own elaboration of the literature in the main text.

3.2. Rules' retrieval

Researchers have traditionally identified rules by asking expert human coders to pinpoint meaningful chunks from relevant legal texts and develop conventions to solve disagreements in classification (e.g., Jordana et al., 2018; Schlager et al., 2021). However, such a "close reading" proves laborious and constrains the analysis within a limited scope. A broader scope has been pursued with surveys gathering responses from selected local experts about the presence or absence of specific provisions in legal texts. However, human responses come with interpretation biases that might prove hard to control (e.g., Kholodilin & Pfeiffer, 2021). The best of the two worlds is expected from "distant reading." First developed in computational linguistics, this family of techniques has attracted interest across the social sciences for its promise of reliable evidence for or before substantive theory (e.g., Gentzkow et al., 2019; Gilardi & Wüest, 2020; Grimmer et al., 2022; Livermore & Rockmore, 2019). Such a promise has been pursued along separate rationales: applying conventions from morphology, syntax, and semantics or discovering them as patterns in the corpus of interest.

Conventions in morphology assume "morphemes" as their building block. Morphemes are the minimal linguistic and grammatical units expressing basic concepts; as part of a word, they are dubbed "morphs." To wit, in English, "lace" is a "free morph" that can compose a monomorphic word; the suffix "-s" for plural nouns and the third person of a verb in the present tense, the suffix "-ed" for the past tense of a regular verb, or the prefix "un-" for antonym are all examples of "bounded morphs" that change the sense of a root/base/stem morph. Any language contains far fewer morphs than words, and morphological conventions govern the relationship between the two sets. These conventions can be specified and turned into mapping functions at the core of Finite State Transducers to turn specific strings of morphemes into a word. As an alternative, or in addition, these conventions and their evolution can be discovered as statistical relationships and patterns from large corpora after either stemming or lemmatization. Again, stemming implements some efficient yet coarse heuristics of chopping common affixes off to insulate the hopefully right base and create "bags of words." In contrast, lemmatization relies on less efficient yet more accurate knowledge from dictionaries providing tags for words' morphosyntactic features. The preference for either of these operations depends on the users' ultimate goal—for instance, information retrieval is usually deemed less demanding in accuracy than natural language understanding (e.g., Cahill, 2016).

Syntactic conventions pertain to sentences and assume that morphs contribute to composing "parts-of-speech" classes, often distinct in "open"—evolving "content words" carrying semantic information, such as nouns, verbs, adjectives, adverbs—and "closed"—more stable "function words" expressing relationships, such as adpositions, conjunctions, determiners, auxiliaries including modals, and pronouns. Sentences are units that organize the different parts-of-speech according to principles of order and contiguity. Contiguity principles define "phrases" of related words—for instance, a Noun Phrase (NP) can include a determiner, a noun, and its modifiers; a Verb Phrase (VP) can include a modal and a transitive verb. Order principles change with languages and establish that a "grammatical" sentence (S) can consist of a limited number of sequences depending on intransitive, transitive, and ditransitive verbs. The related structures provide the blueprint for as many Finite State Automata—algorithms that automatically execute defined sequences of operations, such as parsing raw text into parts-of-speech to evaluate their connections. In the map of syntactic structures as trees of part-of-speech nodes and dependency linkages, distance from the first Noun Phrase can decide the relevance of the others. However,

notation can impose restrictions on the complexity of representations compared with the original text. Once again, the admissible loss of information largely depends on the user's purpose (e.g., Kaplan, 2014).

Last, compositional conventions in semantics aim to capture how the meaning of a sentence can follow from its syntactic constituents (e.g., Blackburn & Bos, 2005; Lappin, 2021). They build on propositional and first-order predicate logic, often augmented to accommodate higher types, events, time intervals, modalities, and possible worlds. These conventions superimpose the logical forms of a meta-language to particular parts of an object language—in this case, the natural language of a text. The building blocks are the "model" of a "situation" and a "vocabulary" (also dubbed "signature" or "ontology") recording information against which models can be evaluated. Models render situations as abstract relations among entities. Vocabularies include a collection of "entities"—for instance, a list of proper names as individuals, predicates as properties, and verbs as relations gathered from the whole "domain"—and an "interpretation function" that assigns numerals to entities according to their semantic value—for instance, based on the number of relations required to make an entity meaningful, 0 can be assigned to individuals, 1 to properties, 2 to transitive verbs, 3 to ditransitive verbs. Any specific assignment in a model is an "interpretation" that renders which individuals take which properties and enter which relations in the chunk of interest. Properties and relationships can be combined through logical operators into "formulas" or "descriptions" of the situation. Formulas can be evaluated against the model, and this rationale extended with lambda calculus to cover higher-order structures. The semantic strategies that rely on parsing raw sentences, identifying their structure, and interpreting them compositionally are dubbed "deep" methods in contrast with "shallow" ones. Typical of distributional semantics (e.g., Boleda, 2020), shallow methods capture the meaning of a text statistically through the features of raw "surface" forms—such as, again, stemmed word-to-word or word-to-document countings, used alone or to weight co-occurrences.

Notably, "deep" and "shallow" dubbing might prove misleading, as the adjectives apply to both linguistic ontologies and learning architectures. "Shallow" architectures are simpler machine learning algorithms for natural language processing, such as random forests, while "deep" architectures are complex, like neural networks. In the social sciences, shallow architectures still attract higher interest than deep ones for their higher computational efficiency. However, in treating legal texts, shallow architectures can yield more accurate results with little or no efficiency loss when combined with deeper blueprints based on semantic or syntactic parsing. For them, applications report rates of 85% or higher of correct retrievals—similar to the 85% inter-coder agreement rate from human coding—against less than 50% for deep architectures with shallower blueprints (e.g., Chen, Lei, et al., 2022; Dragoni et al., 2018; Schlager et al., 2021).

4. From intension to extension

The semantic strategies for distant reading introduce the issue of choosing how to move from the intension of a concept to its extension (line *b* in Fig. 1)—albeit mainly as a trade-off between computational efficiency and accuracy in recognizing structures from words and parts-of-speech. Before computational considerations, measurement has long been debated across many disciplines, including philosophy, physics, psychology, and statistics. In such a debate, three theories emerge as influential—often dubbed "classical," "operational," and "representational" (e.g., Hand, 1996; Michell, 1986; Narens, 2012)—for their consequences on the strategies for assigning numerals to entities.

4.1. Measurement theories and their consequences

The classical theory, rooted in geometrical thinking, maintains that entities have constituting attributes and "quantitative" attributes vary by magnitude. Magnitudes of the same kind raise "how much" questions as they can be ordered and added; measurement responds to such questions by stipulating some conventional "unit" and calculating how many units each entity contains. Orderability and additionality can also be "discovered" by observing or inducing variations in the attribute. Unobservable attributes can be measured through their hypothesized observable manifestations, and the hypothesis stands until falsified. Hence, different theories can give an attribute different extensions.

The operational theory emphasizes the role of measurement operations in shaping knowledge. It restrains from assumptions about entities' nature and maintains that experiments and observations create the attribute as their procedures impose a logical construct onto reality to yield a number. Operational constructs are valid when their numbers correlate with similar ones. Notably, the operational is the only approach that draws attention to measurement error.

Measures in the representational theory render whole empirical systems as the relationships among the actual entities that carry the attribute. Actual entities constitute an empirical equivalence class when their comparison shows the attribute has the same value; otherwise, they belong to a different class that entertains a specific relationship with the first one—such as "greater" or "double." Classes and their relations form an "empirical relational system" that can be "mapped onto" a "numerical relational system" of numerals and algebraic relations faithfully. Therefore, representational theory requires that numbers remain "meaningful," preserving empirical information across transformations. For instance, in contrast with operational practices, the representational theory considers the average of ordinal scores meaningless, as the evaluation of greater and lesser does not license the assumption of equal distance between contiguous classes.

Measurement theories also invite a distinction between measures and indicators (e.g., Franceschini et al., 2019; Mari et al., 2017) based on the richness of the information they return. Empirical operations of "transduction"—where each entity interacts with a chosen instrument that returns a simple "reading," such as a tally—yield measures and provide the rawest information. Scaled readings—for instance, those assigning different weights to complete, partial, or void items—improve information and qualify as indicators. However, the richest information lies in evaluative indicators from "calibration functions." Calibration remaps scaled scores through a filter function that can either be intentionally neutral (as in the center diagram of Fig. 3) or assign penalties and rewards to high or low scores (as in the left and right diagrams of Fig. 3).

Social science concepts call for a further distinction between "reflective" and "formative" indicators (e.g., Coppedge et al., 2020). The former is based on measures of traces or manifestations of some latent construct. Thus, changing one reflective indicator for another does not affect the construct. Moreover, different reflective indicators of the same construct shall correlate as they share the same origin, and errors are evaluated at the level of individual measures. In comparison, formative indicators are observable parts of the construct of interest. Thus, indicators can be neither treated as interchangeable nor expected to correlate, for they capture different facets of the construct. A change of indicator implies the redefinition of the concept, and errors are evaluated at the level of the construct rather than individual components. The distinction between reflective and formative indicators affects how they aggregate to render the overall concept for entities' ranking, prediction, or explanation. Interchangeable, reflective indicators can be added to one another or averaged, for each contributes unconditionally to the overall index. In contrast, formative indicators aggregate by multiplication or taking the minimum, for these strategies render the intuition that each component provides a weight for the others and an
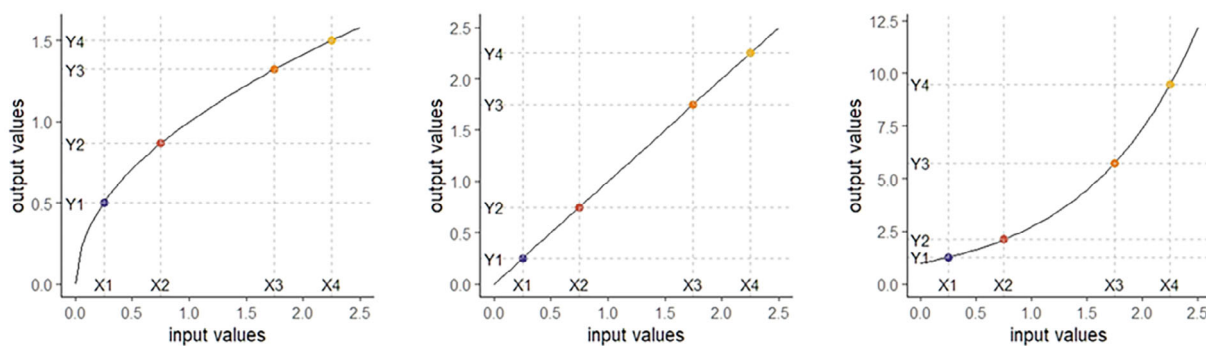

FIGURE 3 Examples of filter functions. *Keys*: The solid line plots illustrative filter functions: convex (left), linear (center), and concave (right). X1 to X4 are the raw inputs; Y1 to Y4 are the corresponding filtered outputs. Dashed vertical lines project inputs; dots indicate the projections intersecting the filter function; dashed horizontal lines identify the filtered output. Across diagrams, the distance between X1 and X2 is the same as between X3 and X4. Convex functions penalize high input values; conversely, concave functions reward them. *Source*: own elaboration of the literature in the main text.

entity's low score on any component should weaken its score on the overall index. However, the validity of overall indexes from reflective and formative indicators can still be evaluated on similar test benches, such as their capacity to discriminate between relevant and irrelevant entities, predict behavior or performance, and correlate with measures of cognate concepts (e.g., Adcock & Collier, 2001).

4.2. Attaching numbers to rules

The central issue in transforming rules into data is to code their content to render some theoretical concept of interest. As measurement theories warn, the content of rules seldom affords straightforwardly meaningful coding.

Even when the relevant information is already offered as a number, it can only gain meaning if reported to some relevant reference class. For instance, La Porta et al. (2004) use the tenure of the supreme courts' justices to capture the independence of the judiciary across political systems. Length in years is the measure for tenure that they rescaled into an indicator of independence with three possible values: "2 if tenure is life-long, 1 if tenure is more than six years but not life-long, and 0 if tenure is less than six years" (p. 450). Thus, rescaling depends on two thresholds ("six" and "life-long") that turn the ratio-scaled variable ("length of tenure") into an ordinal indicator to convey qualitative changes of interest in the underlying attribute ("justices' independence"). The choice of the thresholds follows two different rationales. "Life-long" gets the maximum value as it renders the positive response to whether the position of justice is permanent and takes the same meaning across systems. Instead, "six years" introduces a difference between non-permanent positions, but it does so through a fixed value that can fail to capture relevant information. To wit, if the target concept is the courts' independence from the elected politicians who appoint justices, the fixed threshold assigns a score of 1 to a case where the justice's tenure is 7 years regardless of the office term of the appointing politicians. However, if the politicians' term has the same length as the justices', the justice position remains strongly tied to the fortune of the appointing politicians, providing courts with incentives to prioritize politicians' preferences as in situations scored 0. Thus, using fixed raw values as thresholds risks creating heterogeneous groupings, which undermines the explanatory and predictive capacity of the indicator. A more faithful threshold for the independence of justices with non-permanent positions can be the length of the politicians' office term in each system—alone or times the maximum number of office terms for an incumbent. More refined indexes of independence take exit rules into account—for instance, those imposing retirement, assigning removal powers, or deciding a justice's disqualification—or budget and organization rules (e.g., Feld & Voigt, 2003; Hanretty & Koop, 2012, Koop & Hanretty, 2018). Similar choices ensure indicators are faithful to contexts—but often require quantifying raw legal text.

The usual and more agnostic quantification strategy of legal text assigns binary scores for the presence and absence of some meaningful chunks in a document or a corpus. Rules offer researchers two types of meaningful observation units for scores: components and whole constructs. Whole constructs encompass the if/then/else (/unless) structures that shape rights, obligations, immunities, or liberties for specific entities (e.g., de Oliveira et al., 2021). In shallow blueprints for distant reading, these units might be identified by "proxies"—for instance, modal verbs, assuming they capture the deontic side of rights, obligations, immunities, and liberties in the text; else, they are often collected as responses to surveys. Whole rules become relevant, for instance, to establish whether regulation takes simple or complex forms (e.g., McLaughlin & Sherouse, 2019), to classify legal systems by their distance from a performing benchmark (e.g., La Porta et al., 1998), or to define "families" of regimes by the kind of protection guaranteed to some deserving interest, such as creditors' in bankruptcy (e.g., Armour et al., 2016). Grouped into functional classes—such as "entry," "information," or "decision" rules—these constructs also allow comparing governance arrangements—for instance, to decide if the complexity of their purpose affects whether and how they signal credible commitment (Schlager et al., 2021) or find out whether legislatures retain or delegate authority to other bodies in particular sectors (Epstein & O'Halloran, 1999). Focus on components, instead, can yield a more fine-grained map of the diversity in the substantive content of some theory-relevant provision across time and contexts. For instance, in refining their measure of delegation, Epstein and O'Halloran (1999) considered 12 conditions that could make it void—limits to appointment or spending power; sunset clauses; legislature or executive power to approve or veto; reporting obligations or expert oversight; consultation or public hearing requirements; and additional procedures for rulemaking—plus two unrules—exemptions or compensations for special affected interests. In unpacking the accountability of regulatory agencies, Koop

(2015) identifies eight types of information—itemized budget and financial report, activity plan and performance report, regulatory decisions, minutes of the board, rules of procedures, and the register of interests—that agencies can be obligated to report to the parliament, the executive, expert bodies, or the public, raising a combinatorial typology of accountability. Conway and Nicoletti (2006) defined the variations in product market regulation through legal provisions establishing barriers to entry, public ownership, market structure, vertical integration, price controls, and constraints on business operation. These items raise the issue of how to aggregate the different scores.

Additive strategies are especially diffused when information is gathered through questions that pinpoint which information should be distilled from texts, as responses are often understood as manifestations of the underlying concept raising as many reflective indexes. Averaged tallies provide the most straightforward and neutral aggregation strategy: as an example, Feld and Voigt (2003) unpack the concept of *de jure* judicial independence into 12 indicators, each contributing one-twelfth to the overall score of a country case—rescaled as a percentage. Weights can also be assigned to reflect a logical structure. In the same work, for instance, the difficulty of amending the constitution was decided by how many branches of government have to agree (either "one," "two," or "three," weighting 0.25, 0.5, and 0.75 respectively) and whether their agreement be required more than once (weighting 0.25), so that only three branches having to agree more than once could score 1 to the question whether amendments are difficult. Nested aggregations, then, force components into relationships that might or might not capture the shape of the concept—and may survive correlational validity tests but fail to predict expected outcomes. Indeed, Feld and Voigt noted that parts of their *de facto* independence index correlated with economic growth positively, while others negatively, so that it was "no surprise that the index as an aggregate of those countervailing influences does not have any impact." (p. 510). Possible amendments might follow from questioning the nature of the theoretical structure: to wit, the number of branches required to amend the constitution and the times they need to agree might be considered as separate parts of a process rather than functionally equivalent manifestations of a latent structure, hence require a multiplicative instead of an additive aggregation. Moreover, as Feld and Voigt (2003) noted, the indexes might prove too rich in dimensions than actually needed for prediction or explanation, calling for strategies for dimensionality reduction such as Qualitative Comparative Analysis (e.g., Gelter & Siems, 2021), factor or principal component analyses (e.g., Kholodilin & Pfeiffer, 2021), or regression strategies (e.g., Jordana et al., 2018).

5. The special issue's contributions

This special issue advances the analysis of formal rules as a *sui generis* institutional constraint to human decisions. It addresses the challenge of rendering their content faithfully, even when it depends on the interplay of sparse provisions across jurisdictions or time windows. It considers consequential responses come, first, from analytic frameworks able to accommodate a range of substantive theoretical concerns and enhance exchanges across disciplines; second, from computer-assisted techniques that pinpoint rules' components and interactions within large corpora to expand the scope of analyses across jurisdictions and languages. This special issue advances the research agenda at the intersection of these two aspects, offering a platform for innovative contributions in this evolving field along three lines of reasoning:

- *Advances in frameworks*: The special issue opens with the latest developments in frameworks to guide fine-grained analysis of rules' design and enable researchers to gain new thorough insights on institutional phenomena.
- *The promise and perils of computational analysis*: In this part, contributions critically scrutinize the advantages and limits of distant reading complex legal documents to enhance human interpretation, with a particular focus on the depth of the blueprint.
- *Substantive applications*: The special issue culminates with studies applying frameworks and methodologies to address a spectrum of substantive questions. These applications reflect the broader implications of innovative theoretical and methodological advancements within the neo-institutionalist tradition, demonstrating the transformative potential of this kind of research.

Along the first line, Siddiki and Frantz (2023) explore the area of regulatory design, emphasizing the importance of the Institutional Grammar (IG) approach. This framework is used for classifying and analyzing rules within regulatory texts, focusing on syntax and semantics. The article introduces an improved version, Institutional Grammar 2.0, with a more robust coding system to handle diverse regulatory rules. The authors highlight the IG's interdisciplinary adaptability, integrating various theoretical and methodological perspectives across disciplines. The practical use of IG in regulation studies demonstrates its effectiveness for rule analysis. Siddiki and Frantz acknowledge the challenges and limitations of analyses from different disciplinary perspectives, stressing the importance of measurement validity and rigorous scrutiny in rule measurements. Their work enriches understanding of regulatory design and offers a valuable tool for institutional research.

Along the second line, Franchino et al. (2023) delve into measuring executive constraints in European legal provisions. They compare two approaches from existing literature to assess legislative intent: variations in the types of constraints versus frequency of constraints. The authors argue for the superiority of the frequency measure over the toolbox perspective in understanding how mandates aim to limit executive implementation. The article introduces supervised machine learning based on syntactic structures, showcasing its effectiveness in improving measurement accuracy in legislative constraint studies. Overall, this article makes a substantial contribution to the field by bridging the gap between theoretical perspectives on executive constraints and the practical challenges of measurement. It showcases the potential of computational methods to offer more reliable, accurate, and nuanced insights into legislative intent and bureaucratic control within the European Union context.

Egger et al. (2023) highlight the integration of Natural Language Processing (NLP) in legal text analysis, focusing on COVID-19 containment measures. Combining social sciences and NLP expertise, their study showcases how NLP can adapt to legal languages across contexts. A key outcome is a supervised classification model that identifies exceptional measures in legal documents. Their research is marked by its interdisciplinary approach and the development of a comprehensive taxonomy with eight classes and 83 subclasses of events. They draw five crucial lessons from their work, offering deep insights into NLP's application in social sciences and the potential and limitations of computational analysis in legal texts. Overall, the contribution enhances our understanding of NLP's capabilities in analyzing legal language and provides an exemplary illustration of computational techniques in legal studies and governance analysis.

Hurka et al. (2023) conduct an in-depth exploration of changes in policies, laws, and regulations, emphasizing the use of computational methods to extract policy substance from legislative texts. Their work highlights automated NLP's efficiency in assessing legal documents' structural characteristics. Focusing on the relationship between substantive changes and legal text structures, they explore the effectiveness of computational tools in quantifying policy tools within the structure of legal documents, offering new insights into the complexities of legal texts. This research aligns with the growing trend of applying computational approaches to legal document analysis, illustrating how computational analysis bridges the gap between policy substance and legal structures, illuminating new avenues through the evolving landscape of legal corpora.

As we move to substantive applications along the third line, Ruffing et al. (2023) investigate the formal independence of EU agencies using a rules-as-data approach for longitudinal research. They analyze 206 regulations and amendments from 1975 to 2022, creating a comprehensive dataset that covers all 39 EU agencies. This extensive analysis reveals a pattern of gradual reforms in agency independence over nearly five decades, providing insights into the historical development of this independence. The study highlights a generally high and stable level of formal independence across these agencies while identifying significant variations in autonomy and control, influencing EU agency independence. The dataset comprises reflective indicators, as changes in regulations and amendments over time are treated as measures of traces reflecting the historical development of EU agency independence. Their research significantly contributes to our understanding of governance processes and institutional relationships within the EU, demonstrating the effectiveness of applying rules as data in governance studies.

On a similar line, Kosti (2023) delves into the concept of regulatory discretion within the context of delegation. The study fills a research gap regarding the within-case variation of regulatory discretion in mandates across broad periods. It advances a thorough conceptualization of regulatory discretion along three essential dimensions—delegation, content, and procedure—to identify specific legal provisions that delegate and constrain regulatory powers. Remarkably, the analysis relies on NLP techniques to extract information from UK mandates

passed between 1900 and 2020, offering valuable insights into the phenomenon's evolution that highlights the changing balance between constraints and flexibility. This study employs formative indicators, as the analysis conceptualizes regulatory discretion along multiple dimensions, acknowledging that changes in legal provisions redefine the very nature of the construct over time. Kosti's contribution provides a rich empirical foundation for future dynamic delegation models.

Gordon Pfeffer (2023) innovatively relies on rules to classify judicial systems based on how they deal with law violators. Her work challenges conventional measures of state punitiveness based on incarceration rates by introducing the "P-Index." This novel gauge extracts indicators from the legal codes of 26 countries to advance a more nuanced view of state responses to crime. This global scope provides a comprehensive understanding of punitiveness across diverse legal and political contexts. Her methodology offers a deeper insight into the complexities of legal systems and opens up new avenues for analyzing punitive judicial systems from a broader political and economic perspective. Her work utilizes reflective indicators, extracting nuances from legal codes to classify judicial systems, where changes in indicators reshape the understanding of state responses to crime without altering the core construct of the "P-Index." Pfeffer's contribution significantly enhances empirical analysis in legal studies, offering a comprehensive lens for examining punitive judicial systems.

Collectively, these contributions showcase the relevance of formal rules as evidence of institutional phenomena and computational methods as instruments for capturing rules' content and turning it into predictors, causal factors, or outcomes. Such a shift can enhance understanding and knowledge cumulation across disciplines and promises to improve evidence for better policy evaluation, legal formulation, and effective governance design.

Acknowledgments

Data availability statement

Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.

References

Adcock, R., & Collier, D. (2001). Measurement validity: A shared standard for qualitative and quantitative research. *American Political Science Review*, 95, 529–546. https://doi.org/10.1017/s0003055401003100

Alexy, R. (2014). Formal principles: Some replies to critics. *International Journal of Constitutional Law*, 12, 511–524. https://doi.org/10.1093/icon/mou051

Armour, J., Deakin, S., & Siems, M. (2016). *CBR Leximetric Datasets*. Apollo - University of Cambridge Repository. https://doi.org/10.17863/CAM.506

Atkinson, C., & Schubert, N. (2021). Augmenting MSME participation in trade with policy digitalisation efforts: Chile's contribution to 'An Internet of Rules'. *Trade Law & Development*, 13, 80–111.

Baldwin, R. (1990). Why rules don't work. *The Modern Law Review*, 53, 321–337.

Baldwin, R., Cave, M., & Lodge, M. (2010). Introduction: Regulation – The field and the developing agenda. In *The Oxford handbook of regulation* (pp. 2–16). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199560219.003.0001

Bazzan, G. (2021). *Effective governance designs of food safety regulation in the EU: Do rules make the difference?* Palgrave Macmillan. https://doi.org/10.1007/978-3-030-82793-9

Bersch, K., & Fukuyama, F. (2023). Defining bureaucratic autonomy. *Annual Review of Political Science*, 26, 213–232. https://doi.org/10.1146/annurev-polisci-051921-102914

Bicchieri, C. (2017). *Norms in the wild*. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780190622046.001.0001

Bicchieri, C., & Dimant, E. (2022). Nudging with care: The risks and benefits of social information. *Public Choice*, 191, 443–464. https://doi.org/10.1007/s11127-019-00684-6

Black, J. (2008). Constructing and contesting legitimacy and accountability in polycentric regulatory regimes. *Regulation & Governance*, 2, 137–164. https://doi.org/10.1111/j.1748-5991.2008.00034.x

Blackburn, P., & Bos, J. (2005). *Representation and inference for natural language*. CSLI Publications. https://press.uchicago.edu/ucp/books/book/distributed/R/bo3685980.html

Boleda, G. (2020). Distributional semantics and linguistic theory. *Annual Review of Linguistics*, 6, 213–234. https://doi.org/10.1146/annurev-linguistics-011619-030303

Braithwaite, J. (2002). *Restorative Justice & Responsive Regulation*. Oxford University Press. https://global.oup.com/academic/product/restorative-justice-and-responsive-regulation-9780195158397

Brun, G. (2015). Explication as a method of conceptual re-engineering. *Erkenntnis*, 81, 1211–1241. https://doi.org/10.1007/s10670-015-9791-5

Cahill, L. (2016). Computational morphology. In *The Cambridge handbook of morphology* (pp. 820–846). Cambridge University Press. https://doi.org/10.1017/9781139814720.029

Chen, C., Heikkila, T., Weible, C. M., Yordy, J., Yi, H., Berardo, R., & Kagan, J. (2022). Policy composition and adoption duration: Capturing conflict in the legislative process. *Policy Studies Journal*, 50, 407–431. https://doi.org/10.1111/psj.12457

Chen, H., Lei, W., Chen, J., Wei, L., & Ding, J. (2022). A comparative study of automated legal text classification using random forests and deep learning. *Information Processing & Management*, 59, 102798. https://doi.org/10.1016/j.ipm.2021.102798

Chisholm, R. M. (1963). Contrary-to-duty imperatives and deontic logic. *Analysis*, 24, 33–36. https://doi.org/10.2307/3327064

Coglianese, C. (2002). Empirical analysis and administrative law. *University of Illinois Law Review*, 2002, 1111–1137. https://doi.org/10.2139/ssrn.327520

Conway, P., & Nicoletti, G. (2006). Product market regulation in the non-manufacturing sectors of OECD countries: Measurement and highlights. *OECD Economics Department Working Papers No. 530*. https://doi.org/10.1787/362886816127

Coppedge, M., John, G., Adam, G., Knutsen, C. H., Lindberg, S. I., Pernstein, D., Seim, B., Skaanig, S.-E., & Teorell, J. (2020). Dimensions and components of democracy. In *Varieties of democracy: Measuring two centuries of political change* (pp. 90–129). Cambridge University Press. https://doi.org/10.1017/9781108347860.005

Cordes, M. (2017). The constituents of an explication. *Synthese*, 197, 983–1010. https://doi.org/10.1007/s11229-017-1615-5

Crawford, S. E. S., & Ostrom, E. (1995). A grammar of institutions. *American Political Science Review*, 89, 582–600. https://doi.org/10.2307/2082975

Damonte, A. (2013). Policy tools for green growth in the EU15: A qualitative comparative analysis. *Environmental Politics*, 23, 18–40. https://doi.org/10.1080/09644016.2013.817759

Dari-Mattiacci, G., & De Geest, G. (2017). Carrots vs. Sticks. In *Oxford handbook of law and economics* (Vol. 1, pp. 439–465). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199684267.013.41

de Oliveira, L., Alberto, J., Griffo, C., Almeida, J. P. A., Guizzardi, G., & Aranha, M. I. (2021). Casting the light of the theory of opposition onto Hohfeld's fundamental legal concepts. *Legal Theory*, 27, 2–35. https://doi.org/10.1017/S1352325221000070

Dragoni, M., Villata, S., Rizzi, W., & Governatori, G. (2018). Combining natural language processing approaches for rule extraction from legal documents. In *AI approaches to the complexity of legal systems* (pp. 287–300). Springer. https://doi.org/10.1007/978-3-030-00178-0_19

Egger, C., Caselli, T., Tziafas, G., de Saint Phalle, E., & de Vries, W. (2023). Extracting and classifying exceptional COVID-19 measures from multilingual legal texts: The merits and limitations of automated approaches. *Regulation & Governance*. https://doi.org/10.1111/rego.12557

Elster, J. (1991). Rationality and social norms. *European Journal of Sociology*, 32, 109–129. https://doi.org/10.1017/S0003975600006172

Epstein, D., & O'Halloran, S. (1999). *Delegating powers. A transaction-cost politics approach to policy making under separate powers*. Cambridge University Press. https://doi.org/10.1017/CBO9780511609312

Epstein, L., & Martin, A. D. (2009). *An introduction to empirical legal research*. Oxford University Press. https://books.google.it/books?id=fPo5BAAAQBAJ

Feld, L. P., & Voigt, S. (2003). Economic growth and judicial independence: Cross-country evidence using a new set of indicators. *European Journal of Political Economy*, 19, 497–527. https://doi.org/10.1016/S0176-2680(03)00017-X

Franceschini, F., Galetto, M., & Maisano, D. (2019). Properties of indicators. In *Designing performance measurement systems* (pp. 85–131). Springer. https://doi.org/10.1007/978-3-030-01192-5_4

Franchino, F. (2019). In search of the ideational foundations of EU fiscal governance. *Journal of European Integration*, 42, 179–194. https://doi.org/10.1080/07036337.2019.1657858

Franchino, F., Migliorati, M., Pagano, G., & Vignoli, V. (2023). Concepts and measures of bureaucratic constraints in European Union Laws from hand-coding to machine-learning. *Regulation & Governance*. https://doi.org/10.1111/rego.12543

Gailmard, S., & Patty, J. W. (2012). Formal models of bureaucracy. *Annual Review of Political Science*, 15, 353–377. https://doi.org/10.1146/annurev-polisci-031710-103314

Gelter, M., & Siems, M. (2021). Letting companies choose between board models: An empirical analysis of country variations. *University of Pennsylvania Journal of International Law*, 43(1), 137–186.

Gentzkow, M., Kelly, B., & Taddy, M. (2019). Text as data. *Journal of Economic Literature*, 57, 535–574. https://doi.org/10.1257/jel.20181020

Gerring, J. (1999). What makes a concept good? A criterial framework for understanding concept formation in the social sciences. *Polity*, 31, 357–393. https://doi.org/10.2307/3235246

Gilardi, F. (2005). The institutional foundations of regulatory capitalism: The diffusion of independent regulatory agencies in Western Europe. *The Annals of the American Academy of Political and Social Science*, 598, 84–101. https://doi.org/10.1177/0002716204271833

Gilardi, F., & Wüest, B. (2020). Using text-as-data methods in comparative policy analysis. In *Handbook of research methods and applications in comparative policy analysis* (pp. 203–217). Edwar Elgar. https://doi.org/10.4337/9781788111195.00019

Goertz, G. (2020). *Social science concepts and measurement*. Princeton University Press. https://books.google.it/books?id=Ub_kDwAAQBAJ

Gordon Pfeffer, E. (2023). Conceptualizing and measuring Punitiveness in contemporary advanced democracies. *Regulation & Governance*. https://doi.org/10.1111/rego.12533

Grimmer, J., Roberts, M. E., & Stewart, B. M. (2022). *Text as data*. Princeton University Press. https://press.princeton.edu/books/paperback/9780691207551/text-as-data

Gunningham, N., Kagan, R. A., & Thornton, D. (2004). Social license and environmental protection: Why businesses go beyond compliance. *Law & Social Inquiry*, 29, 307–341. http://www.jstor.org/stable/4092687

Hampton, J. A. (2006). Concepts as prototypes. *Psychology of Learning and Motivation*, 46, 79–113. https://doi.org/10.1016/s0079-7421(06)46003-5

Hand, D. J. (1996). Statistics and the theory of measurement. *Journal of the Royal Statistical Society. Series A*, 159, 445–492. https://doi.org/10.2307/2983326

Hanretty, C., & Koop, C. (2012). Measuring the formal independence of regulatory agencies. *Journal of European Public Policy*, 19, 198–216. https://doi.org/10.1080/13501763.2011.607357

Hart, H. L. A. (2012). *The concept of law* (3rd ed.). Oxford University Press. https://doi.org/10.1093/he/9780199644704.001.0001

Hindriks, F., & Guala, F. (2015). Institutions rules, and equilibria: A unified theory. *Journal of Institutional Economics*, 11, 459–480. https://doi.org/10.1017/s1744137414000496

Hodgson, G. M. (2006). What are institutions? *Journal of Economic Issues*, 40, 1–25. https://doi.org/10.1080/00213624.2006.11506879

Hurka, S., Adam, C., & Knill, C. (2016). Is morality policy different? Testing sectoral and institutional explanations of policy change. *Policy Studies Journal*, 45, 688–712. https://doi.org/10.1111/psj.12153

Hurka, S., Knill, C., & Steinebach, Y. (2023). Rules as policy data? Measuring and linking policy substance and legislative context. *Regulation & Governance*. https://doi.org/10.1111/rego.12528

Independent Evaluation Group. (2022). *The development effectiveness of the use of doing business indicators fiscal years 2010-20—An independent evaluation*. World Bank. https://doi.org/10.1596/37143

Jochim, A. E., & May, P. J. (2010). Beyond subsystems: Policy regimes and governance. *Policy Studies Journal*, 38, 303–327. https://doi.org/10.1111/j.1541-0072.2010.00363.x

Jones, A. J. I., & Sergot, M. (1992). Deontic logic in the representation of law: Towards a methodology. *Artificial Intelligence and Law*, 1, 45–64. https://doi.org/10.1007/BF00118478

Jordana, J., Fernández-i-Marín, X., & Bianculli, A. C. (2018). Agency proliferation and the globalization of the regulatory state. *Regulation & Governance*, 12, 524–540. https://doi.org/10.1111/rego.12189

Jordana, J., Levi-Faur, D., & Marín, X. F. I. (2011). The global diffusion of regulatory agencies. *Comparative Political Studies*, 44, 1343–1369. https://doi.org/10.1177/0010414011407466

Kaplan, A. (2017). *The conduct of inquiry*. Routledge. https://doi.org/10.4324/9781315131467

Kaplan, R. M. (2014). Syntax. In *The Oxford handbook of computational linguistics* (2nd ed., pp. 74–93). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199573691.013.31

Kholodilin, K. A., & Pfeiffer, L. (2021). Measuring unmeasurable: How to Map Laws to Numbers Using Leximetrics. DIW Berlin Discussion Paper No. 1933 https://doi.org/10.2139/ssrn.3810489

Koop, C. (2015). Assessing the mandatory accountability of regulatory agencies. In *Accountability and regulatory governance* (pp. 78–104). Palgrave Macmillan. https://doi.org/10.1057/9781137349583_4

Koop, C., & Hanretty, C. (2018). Political independence, accountability, and the quality of regulatory decision-making. *Comparative Political Studies*, 51, 38–75. https://doi.org/10.1177/0010414017695329

Koop, C., & Lodge, M. (2017). What is regulation? An interdisciplinary concept analysis. *Regulation & Governance*, 11, 95–108. https://doi.org/10.1111/rego.12094

Kosti, N. (2023). Conceptualization and measurement of regulatory discretion: Text analysis of 120 years of British legislation. *Regulation & Governance*. https://doi.org/10.1111/rego.12516

La Porta, R., de Silanes, F. L., Shleifer, A., & Vishny, R. W. (1998). Law and finance. *Journal of Political Economy*, 106, 1113–1155. https://doi.org/10.1086/250042

La Porta, R., de Silanes, F. L., Shleifer, A., & Vishny, R. W. (2001). Law and finance. In J. Schwalbach (Ed.), *Corporate Governance. Essays in Honor of Horst Albach* (pp. 26-68). Springer. https://doi.org/10.1007/978-3-642-59499-1_3

La Porta, R., López-de-Silanes, F., Pop-Eleches, C., & Shleifer, A. (2004). Judicial checks and balances. *Journal of Political Economy*, 112, 445–470. https://doi.org/10.1086/381480

Lappin, S. (2021). *Deep learning and linguistic representation*. CRC Press https://www.routledge.com/Deep-Learning-and-Linguistic-Representation/Lappin/p/book/9780367648749

Lascoumes, P., & Le Galès, P. (2007). Introduction: Understanding public policy through its instruments? From the nature of instruments to the sociology of public policy instrumentation. *Governance*, 20, 1–21. https://doi.org/10.1111/j.1468-0491.2007.00342.x

Levi-Faur, D. (2011). Regulation and regulatory governance. In *Handbook on the politics of regulation* (pp. 3–21). Edward Elgar Publishing. https://doi.org/10.4337/9780857936110.00010

Levi-Faur, D., Kosti, N., & van Waarden, F. (2018). Democratic empowerment in the European Union: An introduction. In *Democratic empowerment in the European Union* (pp. 1–14). Edward Elgar Publishing. https://doi.org/10.4337/9781788113564.00008

Liefferink, D., Arts, B., Kamstra, J., & Ooijevaar, J. (2009). Leaders and laggards in environmental policy: A quantitative analysis of domestic policy outputs. *Journal of European Public Policy*, 16, 677–700. https://doi.org/10.1080/13501760902983283

Livermore, M. A., & Rockmore, D. N. (2019). Distant reading the law. In *Law as data* (pp. 3–19). The Santa Fe Institute Press. https://doi.org/10.37911/9781947864085.01

Maggetti, M. (2007). De facto independence after delegation: A fuzzy-set analysis. *Regulation & Governance*, 1, 271–294. https://doi.org/10.1111/j.1748-5991.2007.00023.x

Mari, L., Maul, A., Irribarra, D. T., & Wilson, M. (2017). Quantities, quantification, and the necessary and sufficient conditions for measurement. *Measurement*, 100, 115–121. https://doi.org/10.1016/j.measurement.2016.12.050

Mari, L., Wilson, M., & Maul, A. (2021). *Measurement across the Sciences*. Springer. https://link.springer.com/book/10.1007/978-3-030-65558-7

May, P. J. (1993). Mandate design and implementation: Enhancing implementation efforts and shaping regulatory styles. *Journal of Policy Analysis and Management*, 12, 634–663. https://doi.org/10.2307/3325344

May, P. J., & Wood, R. S. (2003). At the regulatory front lines: Inspectors' enforcement styles and regulatory compliance. *Journal of Public Administration Research and Theory*, 13, 117–139. https://doi.org/10.1093/jpart/mug014

McLaughlin, P. A., & Sherouse, O. (2019). RegData 2.2: a panel dataset on US federal regulations. *Public Choice*, 180, 43–55. https://doi.org/10.1007/s11127-018-0600-y

Michell, J. (1986). Measurement scales and statistics: A clash of paradigms. *Psychological Bulletin*, 100, 398–407. https://doi.org/10.1037/0033-2909.100.3.398

Mizrahi-Borohovich, I., & Levi-Faur, D. (2020). Varieties of consumer credit data regimes: A regulatory governance approach. *Governance*, 33, 109–134. https://doi.org/10.1111/gove.12473

Mulder, L. B. (2018). When sanctions convey moral norms. *European Journal of Law and Economics*, 46, 331–342. https://doi.org/10.1007/s10657-016-9532-5

Narens, L. (2012). *Theories of meaningfulness*. Taylor & Francis. https://doi.org/10.4324/9781410604156

North, D. C., Wallis, J. J., & Weingast, B. R. (2009). *Violence and social orders*. Cambridge University Press. https://doi.org/10.1017/CBO9780511575839

Ostrom, E. (2005). *Understanding institutional diversity*. Princeton University Press https://press.princeton.edu/books/paperback/9780691122380/understanding-institutional-diversity

Rangone, N. (2015). New frontiers for competition advocacy and the potential role of competition impact assessment. In *Competition law as regulation* (pp. 118–150). Edward Elgar. https://doi.org/10.4337/9781783472598.00013

Reinders Folmer, C. P. (2021). Crowding-out effects of laws, policies and incentives on compliant behaviour. In *The Cambridge handbook of compliance* (pp. 326–340). Cambridge University Press. https://doi.org/10.1017/9781108759458.023

Ruffing, E., Weinrich, M., Rittberger, B., & Wonka, A. (2023). The European administrative space over time mapping the formal independence of EU agencies. *Regulation & Governance*. https://doi.org/10.1111/rego.12556

Saltelli, A. (2006). Composite indicators between analysis and advocacy. *Social Indicators Research*, 81, 65–77. https://doi.org/10.1007/s11205-006-0024-9

Sartori, G. (1984). *Social science concepts: A systematic analysis*. SAGE https://books.google.it/books?id=AC18AAAAIAAJ

Schaffrin, A., Sewerin, S., & Seubert, S. (2015). Toward a comparative measure of climate policy output. *Policy Studies Journal*, 43, 257–282. https://doi.org/10.1111/psj.12095

Schauer, F. F. (1991). *Playing by the rules*. Clarendon Press https://books.google.it/books?id=CNXhBQAAQBAJ

Schlager, E. C., Bakkensen, L. A., Olivier, T., & Hanlon, J. (2021). Institutional design for a complex commons. *Public Administration*, 99, 263–289. https://doi.org/10.1111/padm.12715

Scott, C. (2015). Regulatory capitalism, accountability and democracy. In *Accountability and regulatory governance* (pp. 189–208). Palgrave. https://doi.org/10.1057/9781137349583_9

Searle, J. R. (1969). *Speech acts: An essay in the philosophy of language*. Cambridge University Press. https://doi.org/10.1017/CBO9781139173438

Short, J., Levi-Faur, D., Simpson, S. S., Thomann, E., & van Rooij, B. (2021). Editors introduction: Has Regulation & Governance made a difference? *Regulation & Governance*, 15(S1), S3–S7. https://doi.org/10.1111/rego.12446

Siddiki, S., & Frantz, C. K. (2023). Understanding regulation using the Institutional Grammar 2.0. *Regulation & Governance*. https://doi.org/10.1111/rego.12546

Siddiki, S., Heikkila, T., & Espinosa, S. (2018). Building a framework for contextualizing compliance. In *Contextualizing compliance in the public sector* (pp. 1–21). Routledge. https://doi.org/10.4324/9781315148144

Sunstein, C. R. (1996). On the expressive function of law. *University of Pennsylvania Law Review*, 144, 2021–2053. https://doi.org/10.2307/3312647

Thomann, E. (2019). *Customized implementation of European Union food safety policy*. Palgrave MacMillan. https://doi.org/10.1007/978-3-319-92684-1

Thomann, E., & Zhelyazkova, A. (2017). Moving beyond (non-)compliance: The customization of European Union Policies in 27 countries. *Journal of European Public Policy*, 24, 1269–1288. https://doi.org/10.1080/13501763.2017.1314536

van Rooij, B., & Daniel Sokol, D. (2021). Introduction: Compliance as the interaction between rules and behavior. In *The Cambridge handbook of compliance* (pp. 1–10). Cambridge University Press. https://doi.org/10.1017/9781108759458.001

Voigt, S. (2012). How (not) to measure institutions. *Journal of Institutional Economics*, 9, 1–26. https://doi.org/10.1017/s1744137412000148

von Wright, G. H. (1963). *Norm and action: A logical enquiry*. Routledge & Kegan Paul. https://archive.org/details/normactionlogica0000wrig

Walters, D., Coglianese, C., & Scheffler, G. (2021). Unrules. *Stanford Law Review*, 73, 885–967. https://heinonline.org/HOL/P?h=hein.journals/stflr73&i=920