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Rules as policy data? Measuring and linking policy substance and legislative context

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Abstract

There is growing scholarly interest in analyzing changes in policies, laws, and regulations. Some concepts depart from the goal of identifying changes in policy substance. Other contributions have concentrated on the structural characteristics of laws and regulations containing these substantive changes. Extracting measures of policy substance from legislative texts is a challenging and time-consuming endeavor as it requires the manual assessment and coding of legal acts. The assessment of the structural characteristics of laws and regulations, by contrast, can be done applying automated natural language processing. An important critical question is, thus, whether we can combine these approaches and simplify the information extraction by inferring changes in the policy substance from the legislative context in which these changes are embedded. Examining more than 100 legal acts in the area of EU environmental and climate policy, we find that the measures capturing policy substance and the structural characteristics of legal acts context are not systematically linked. In other words: changes in the structural features of legal acts cannot be used as an approximation for changes in policy substance. We conclude by sketching out a research agenda when (and when not) to use the different concepts and related measurements.

Keywords: policy accumulation, policy change, policy complexity, political science data.

1. Introduction

Over the last decade, there has been a growing scholarly interest in analyzing the changes in policies, laws, and regulations. Scholars from various disciplines, such as public policy, public administration, regulatory studies, economics, or law, have developed analytical concepts to capture changes in policy-making both across countries and policy sectors (e.g., Adam et al., 2019; Baumgartner et al., 2019; Benish & Levi-Faur, 2020; Gratton et al., 2021; Hurka et al., 2022; Kaufmann & van Witteloostuijn, 2018). The common objective of these studies is to capture patterns of change at the aggregate level of policy sectors and countries rather than offering detailed assessments of changes in individual policies (Hinterleitner et al., 2024). Despite this common focus, scholars rely on quite different concepts to identify and measure changes in policies and rules.

Some of these concepts aim at capturing changes in policy substance, that is, changes in the number and calibration of the policy targets addressed and the instruments applied (e.g., Howlett & Cashore, 2009; Schaffrin et al., 2015). This substance-driven perspective has been employed in various theoretical and empirical contexts. For example, scholars studied policy designs comparatively to assess their relative effectiveness (e.g., Fernández-i-Marín et al., 2021) or analyzed why policy design choices vary across time and space (e.g., May, 1991). Other concepts, by contrast, tend to concentrate on the structural characteristics of laws and regulations, such as the length, complexity, or readability of legal acts (Gratton et al., 2021; Hurka et al., 2022; Katz & Bommarito II, 2014). Among other things, this line of inquiry investigated how the transaction costs entailed by individual

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laws affect processes of policy formulation and decision-making (Hurka, 2023; Hurka & Haag, 2020), how the complexity of regulation affects judicial efficacy and labor productivity (de Lucio & Mora-Sanguinetti, 2022) and how readability and cross-referencing affect the perceived complexity of laws (Senninger, 2020).

Both approaches have different advantages and disadvantages. While the substance-focused approach gets to the “core of the matter,” it involves “massive data collection (...) [and] coding by trained coders according to a predefined manual” (Knill et al., 2012, p. 432). The structure-focused approach, by contrast, might be more “superficial” due to the focus on laws’ structural features but can be more easily performed in a large-N setting through the rule-based parsing of legislative texts and automated natural language processing (Hurka et al., 2022, p. 1519). So, can we combine the strengths of both approaches while avoiding their weaknesses? In other words, can structural features of laws (i.e., legislative context) serve as valid proxies for the policy substance contained in those laws?

Addressing this question is of crucial importance for the interpretation and comparability of existing research findings. A particular challenge in this regard is the fact that we sometimes find studies that rely on structural aspects to make arguments about substantive policy changes (Beaulieu-Guay et al., 2023; Zubek et al., 2021). For instance, Jakobsen and Mortensen (2015) assume that a higher word count of laws ultimately implies that more rules govern society. A further example is the Comparative Agendas Project (Baumgartner et al., 2019) which measures the number of legal changes in different policy sectors in order to capture dynamics in agenda-setting and, relatedly, degrees of policy change. Yet, we still lack systematic assessments of whether such conceptual assumptions are justified.

In this study, we hence examine whether and, if so, to what extent the concepts measuring (i) policy substance and those assessing (ii) the structural characteristics of legal acts are congruent or complement each other.

To address this question, we examine more than 100 legal acts in the area of EU environmental and climate policy. We find that the various measures capturing policy substance and the structural characteristics of legal acts context are not systematically related and capture different empirical phenomena. The strongest connection can be found between measures indicating changes in policy intensity, that is, stricter or more encompassing policies, and the number of articles of legal acts. Still, the association is relatively weak ($R = 0.3$). While all measures thus provide practical ways to study policy change patterns, their usefulness and appropriateness ultimately depend on what scholars are interested in. Consequently, scholars must carefully match the indicators used to the research question they address.

The remainder of this paper is structured as follows: In the following section, we briefly present the state-of-the-art with regard to the systematic study of changes in policy stocks and legislative context (Section 2). Based on this assessment, Section 3 introduces the respective indicators we develop and apply in order to analyze potential linkages between the policy substance and legislative context measurements. After introducing our database in Section 4, we analyze the empirical relationship between different measures of policy substance and legislative context in Section 5. Section 6 discusses the research implication of these findings. Section 7 concludes.

2. Conceptual approaches on policy accumulation and the complexity of legislation

While a focus on individual policy developments has long dominated the study of public policies and policy change (see e.g., Kingdon, 2003; Sabatier & Weible, 2007), this focus has been increasingly complemented by attempts to capture developments at the aggregate level, taking account of the change patterns in the policies and rules in different policy sectors and countries. We can distinguish two analytical points of departure in this regard: approaches focusing on changes in policy substance and approaches addressing changes in the legislative context, such as the length, complexity, or readability of legal acts.

2.1. Policy accumulation and the growth of policy substance

In recent years, there has been a growing body of studies concentrating on aggregate patterns of policy change, moving beyond the mere assessment of changes in individual policies. While varying concepts have been developed in the literature to capture aggregate developments in sectoral policy stocks, the overall finding is that—regardless of the countries or sectors under investigation—there is a constant growth in policy substance over time.

Adam et al. (2019), for instance, find that modern governments “tend to pile up policies like squirrels pile up acorns, constantly adding new elements to existing policy portfolios and thereby augmenting the size of their ‘policy collection’” (p. 29). This “policy collection” is typically composed of two dimensions: policy targets and policy instruments. While policy targets are all of the issues addressed by the government, policy instruments are the means that governments have at their disposal to address policy targets. Policy instruments include informational tools, economic incentives (subsidies, grants, etc.), and hierarchical forms of governing (obligatory standards, prescriptions, etc.) (see also Fernández-i-Marín et al., 2021).

Policy accumulation is closely related to the concept of policy layering which suggests that policy change typically takes place via the constant addition of new elements to existing policy structures rather than the substitution of old elements by new ones (Hacker, 2004; Schickler, 2001; Van der Heijden, 2011). Policy accumulation also resonates with research on the development of sectoral policy mixes. Policy scholars have observed that policy-makers often mix and match tools to reach particular goals (Howlett & Rayner, 2013). These mixes have become more multifarious over time, that is, policy-makers pursue a greater number of goals and employ an increasing range of instruments to achieve a broader set of targets. Similar observations have been made in the literature on rule growth that found that “rules breed rules” (Kaufmann & van Witteloostuijn, 2018) and that international policies produce “cascading” effects in the national context (see also Jennings et al., 2005; March et al., 2000).

2.2. Changes in the legislative context and the increasing complexity of legal acts

Complementing the aggregate perspective on the dynamic evolution of entire policy areas, recent years have seen an increased interest in how the legal systems in which this evolution takes place have developed over time. Employing network analysis, those studies have uncovered a massive increase with regard to the size and interconnectedness of laws in various political systems, like the European Union (Fjelstul, 2019; Koniaris et al., 2018), the United States and Germany (Coupette et al., 2021; Katz et al., 2020). Accordingly, not only the number of laws has gone up substantially over time, but those laws have also become longer and much more interdependent.

Yet, those changes in the legal system do not necessarily tell us much about the complexity of certain pieces of legislation. Addressing this deficit, several studies have proposed measures to gauge the complexity of laws. In empirical terms, many of those analyses focused on the complexity of tax codes (e.g., Hoppe et al., 2021; Kaplow, 1998; Krause, 2000), whereas other studies aimed at the development of a more general perspective on the question of what aspects of a law drive its (perceived) complexity. For example, focusing on the US code, Katz and Bommarito II (2014) argued that the complexity of a law is equivalent to the costs that accrue for end users who try to obtain information from the law, that is, a process of knowledge acquisition. They argue that those costs result from three main aspects of a law: its structure, its language, and its interdependence. While structural features essentially result from the size and the depth of the law’s hierarchical design (e.g., titles, articles, paragraphs, subparagraphs, points, and indents), linguistic features reflect how the law is formulated (e.g., the terminology it employs or the difficulty of its syntax). Interdependence, in turn, can affect the costs of information acquisition by requiring the end user to consult external legislation to fully understand the meaning of a legal provision (i.e., through external cross-referencing) or by requiring the end user to switch back and forth between individual legal provisions within the law itself (i.e., through internal cross-referencing). With slight adaptations, this model of policy complexity has also been used in other empirical contexts (e.g., de Lucio & Mora-Sanguinetti, 2022; Hurka et al., 2022; Walzl & Matthes, 2014). Most recently, Senninger (2020) used a quasi-experimental approach to demonstrate that a piece of legislation’s perceived complexity is closely linked to its textual sophistication and its connections to other laws.

Building on this conceptual groundwork, research has uncovered various causes and consequences of the complexity of laws. For example, the complexity of legislation varies systematically across policy domains (Hurka et al., 2022; Katz & Bommarito II, 2014), and it is affected by the political and institutional costs of policy formulation decision-makers are confronted with (Hurka, 2023). Complexity also affects the need for delegation (Franchino, 2004; Senninger, 2020) and it prolongs the duration of legislative negotiations (Hurka & Haag, 2020). The extent to which the complexity of a law affects the quality of its implementation is not yet fully clear

(Treib, 2014, p. 26 f.). In any case, existing research clearly demonstrates that understanding the complexity of laws is not only an academic exercise, but that this complexity has crucial effects in the real world and needs to be better understood.

In this section, we introduced two lines of research that are clearly related, but that hardly talk to each other: a literature on policy growth and accumulation, which focuses on policy developments and changes in policy substance, and a literature on the complexity of laws which essentially focuses on the legislative context (length, readability, or interdependence of legal acts) in which those changes are embedded. The central insight of the strands of literature is that policies have not only become more, but also embedded in longer and increasingly complex legal acts.

But what do those approaches methodically have in common and where do they differ? In order to better understand the conceptual and empirical relationship between the changes in policy substance and changes in the legislative context, we need to assess whether changes in policy substance and changes in legislative contexts are effectively interchangeable or whether they are rather complementary aspects that need to be evaluated separately. To accomplish this, we first need to disentangle the various concepts and measurement strategies that have been employed in the literature.

3. Disentangling policy substance and legislative context

Based on the above discussion of different approaches to study aggregate changes in policy substance and legislative context, this section introduces the respective indicators we develop and apply to analyze potential linkages between the policy substance and legislative context measurements. For policy substance, we rely on a complementary assessment of policy density and intensity. For legislative context, we combine measures of size, technicality, formulation, embeddedness, and interdependence.

3.1. Measuring changes in policy substance

Measuring changes in policy substance at the level of policy outputs requires a detailed and multidimensional assessment of political decisions and their changes over time. Policy outputs can, for instance, refer to basic principles or paradigms of political programs, the chosen policy instruments, or the concrete settings of these instruments (Hall, 1993). Moreover, any measurement has to explicitly consider that policy change can go in two directions, that is, policy expansion and dismantling (Jordan et al., 2013). For example, the introduction of environmental taxes can be interpreted as expansion, while their abolishment would imply dismantling. Moreover, expansion and dismantling activities can differ across the dimensions under study. For instance, it is possible that states introduce a variety of new policy instruments, while, at the same time, lowering the regulatory levels of existing instruments, for example, the strictness of emission standards. In social policy, this “twin-track” strategy has been described as “giving less by doing more” (Jensen et al., 2014). So how can we capture changes in policy substance in both its direction and its complexity on the basis of policy outputs?

In the following, we rely on a measurement concept developed by Knill et al. (2012) that draws a systematic distinction between the changes in policy density and policy intensity. In essence, the dimension of policy density measures the breadth of governmental intervention in a given policy area and provides information on the number of policy targets and instruments in place. In a complementary vein, policy intensity relates to changes in the stringency or generosity of the policy instruments applied.

3.1.1. Policy density

The dimension of policy density indicates the degree of penetration and internal differentiation of a policy field. It explores the number of policy targets or instruments used within a given policy field, and how this number changes over time. Policy targets are all issues addressed by the government. Depending on the policy area, these targets can imply different aspects in practice. A policy target in climate policy is, for instance, the CO₂ emissions from road traffic or aviation activities. In social policy, in turn, a policy target might be the support of single mothers or families in need. Policy instruments, in turn, are the means that governments have at their disposal to address these policy targets. Typical instruments in environmental policy are performance standards such as emission limits or standards prescribing the use of certain emission-abatement technologies. In social policy, in

turn, typical policy instruments are one-time payments, means-tested benefits, or opportunities for vocational training. The policy density increases whenever new policy targets or instruments are adopted. While the dimension of policy density thus assesses the “breadth” of governmental intervention, the measure is not sensitive to changes in the restrictiveness or generosity of existing policy measures. This is captured by the concept of policy intensity.

3.1.2. Policy intensity

The dimension of policy intensity captures changes in the calibration of policy instruments. In other words, it assesses whether existing policies become, for example, more/less strict or generous. According to Knill et al. (2012), changes in policy intensity can be assessed by two indicators: the intensity level and the intensity scope. The level of a policy instrument changes if, for instance, the emission limits for passenger cars become stricter and change from 120 to 95 g/CO₂ per kilometre. The same is true when the level of child benefits changes from a payment of 200 to 250 euros. The scope of policies changes when policies become more or less encompassing. This might be the case if, for instance, a given emission standard no longer applies only to newly registered but to all cars on the market. The different “dimensions” of substantive policy changes and their interlinkage are presented in Figure 1.

3.2. Measuring the complexity of the legislative context

As the previous discussion implies, extracting measures of policy substance from legislative texts is a challenging endeavor and often requires the researcher to dispose of deep knowledge of the policy area and the status quo at any given point in time. Can we simplify this information extraction by inferring changes in policy substance from the legislative context in which those changes are embedded? In this section, we discuss several measures that capture the legislative context in which the policy substance is conveyed, all of which relate to different aspects of the underlying law: its size, its technicality, the way it is formulated, as well as its embeddedness and interdependence.

3.2.1. Size

One of the most common indicators that can be used to distinguish laws empirically is their size. Researchers have used a variety of measures to capture the size of laws like the number of recitals (e.g., Kaeding, 2006; Steunenberg & Rhinard, 2010; Toshkov, 2008), the number of pages (e.g., Golub, 2006) or the number of words (e.g., Gratton et al., 2021; Jakobsen & Mortensen, 2015; Kousser, 2006). Others suggested using the number of policy elements like articles, paragraphs, and indents to measure the “structural size” of legislative texts (Hurka et al., 2022; Katz & Bommarito II, 2014). Empirically, however, those different indicators are usually highly correlated. In our study, we use the number of words, the number of articles, and the number of recitals to measure the size of the law.

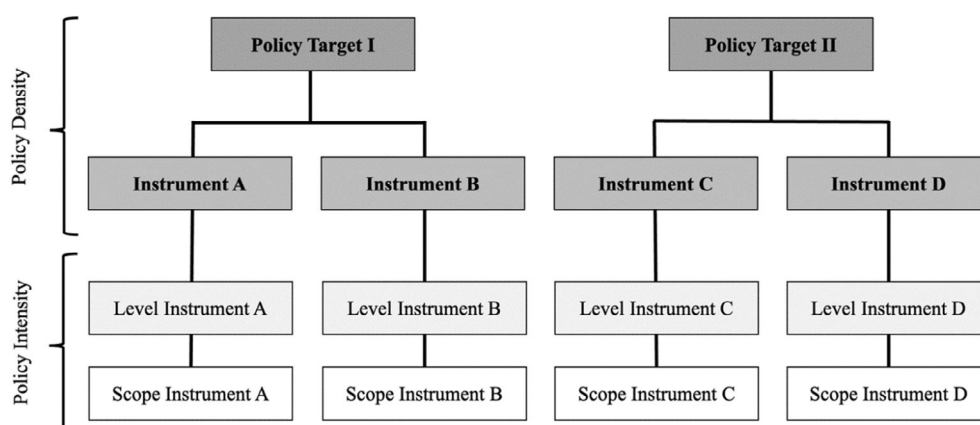


FIGURE 1 Dimensions of substantive policy changes and their connections. Based on: Knill et al. (2012).

Indicators of size have the main advantage that they are readily available and allow for a relatively straightforward assessment of the legislative context in which a policy decision is embedded. Measures of size enable us to distinguish situations in which a new policy target or instrument is introduced as part of a comprehensive and encompassing legislative initiative from situations in which the target or instrument comes with less “legislative baggage.” Theoretically, there are good reasons to assume that the first situation should be more prevalent. The more new policy targets and instruments are introduced in a law, the larger the law should become. In our research context, the key question is how strong this relationship is in practice. Is the size of a law a good predictor for the degree of substantive policy change the law entails or do we need to separate the two both conceptually and empirically?

3.2.2. *Technicality*

Another relevant aspect of a law that potentially affects the costs of information acquisition for an end user is its technicality. As Schuck (1992, p. 4) noted: “Technical rules require special sophistication or expertise on the part of those who wish to understand and apply them.” In other words, technicality affects the ease by which laymen are able to grasp and process the content of a legal provision without consulting other sources. To some degree, technicality is a direct consequence of the policy area we are dealing with. For example, morality policies like the death penalty, abortion or euthanasia have often been regarded as non-technical policies, which arguably simplifies and facilitates the participation of citizens in policy debates (Mooney, 1999, p. 676). Other policy areas, like tax policy, typically contain highly specialized terminology and require those who deal with the policy to dispose of very detailed, domain-specific knowledge, and expertise.

Yet, when it comes to the technicality of laws, there is also quite substantial variation within policy areas. In our empirical context, we will show that EU laws in the area of climate and environment differ quite substantially with regard to their technicality. To capture this variance, we propose to evaluate two indicators: (a) the number of definitions listed in a law and (b) the scope of the law’s annex. First, laws typically contain a list of definitions for certain terminology that is being used in the enacting terms of a law. The number of those definitions can be interpreted as a rather straightforward indicator for the technicality of a law, if we assume that definitions are required whenever the precise meaning of a term is not immediately self-evident and requires clarification. Second, very technical matters are often not dealt with in the law’s enacting terms, but are moved to the law’s annex. Annexes often contain tables, formulas, physical indicators, and other information on measurement and calculation, that is, the technical details of the law.

3.2.3. *Formulation*

Another aspect that affects the design of policy texts is how they are formulated. Previous research has uncovered substantial variance both with regard to the syntactic and the semantic properties of legislative texts. Hurka (2022) argued that the difficulty of the language we find in a legislative text is a consequence of the political and institutional costs of policy formulation that decision-makers encounter during their negotiations. When preferences diverge and the decision-making process becomes more inclusive, the resulting policy compromise increases in linguistic complexity. Other studies have shown that this linguistic complexity has implications for how legislative negotiations unfold. Rauh (2021, p. 17) showed that the variability of the terminology used in legislative proposals of the European Commission affects the probability of legislative amendments during inter-institutional negotiations. Hurka and Haag (2020) analyzed that also the length of those negotiations is affected by the linguistic complexity of the initial policy proposal. At the individual level, Senninger (2020) showed that the textual sophistication of policy texts is a powerful predictor not only for how complex end users perceive the policy to be, but also for the degree of delegation provisions those policy texts contain (see also Franchino, 2004).

Accordingly, the language in which a policy is communicated in a legislative text holds some informational value on how the law that contains the policy substance is formulated, but not what the law is about. In other words, neither the length of a law nor the number of policy targets or instruments it contains are necessarily related to the way decision-makers formulate the underlying legal provisions. Long and encompassing laws can be formulated in simple language, while short and concise laws can use difficult sentence structures. In this study, we use the Flesch–Kincaid Reading Ease score (FRE; Flesch, 1948) to evaluate the simplicity of the language employed in the legislative texts under scrutiny. Higher FRE scores indicate more readable texts resulting from shorter words and sentences.

3.2.4. Embeddedness and interdependence

New laws hardly ever exist in isolation but become part of a pre-existing “policyscape” (Mettler, 2016). Yet, the degree to which a new law needs to take the existing legal order into account varies across policy areas and over time. In very mature policy areas (e.g., social policy), any additional piece of legislation needs to be made consistent with the existing rule stock, while nascent policy areas are more or less a “blank slate” (e.g., environmental policy in the 1970s). This “embeddedness” of a new law into the existing legal order is an important component of the complexity of legislative design. As Senninger (2020) demonstrated, a higher amount of cross-references to other pieces of legislation crucially drives the perceived complexity of a policy text.

Yet, laws not only vary with regard to their embeddedness in the legal landscape, but they also feature varying degrees of internal interdependence (Hurka et al., 2022). Articles and paragraphs often reference each other for various reasons. Sometimes, an internal cross-reference is used to add a specification or clarification to a previous legal provision (e.g., “Member States shall update the notification submitted pursuant to paragraph 2, with relevant new information, and submit it to the Commission without delay”). But internal cross-references also occasionally introduce derogations (e.g., “By way of derogation from paragraph 1...”) or point to a delegation provision that is specified in another part of the text (e.g., “The power to adopt delegated acts referred to in Articles 7(2) and 12(1) shall be conferred on the Commission”). Accordingly, internal cross-references can be used for a variety of reasons, but they invariably increase the “cost of knowledge acquisition” (Katz & Bommarito II, 2014, p. 358) for those who seek to process and understand the meaning of the policy text, by requiring end users to consult additional information to evaluate the legal provision.

In this study, we count the number of external cross-references to assess the law’s (external) embeddedness and we count internal cross-references to assess its (internal) interdependence. We divide this count by the number of articles we find in the legislative text to make sure that our measures for embeddedness and interdependence are independent of the overall length of the policy text (see also Hurka et al., 2022, p. 1518 f.). Figure 2a,b summarize all indicators on (i) policy substance and (ii) on the legislative context considered in the analysis.

3.3. Linking policy substance and legislative context

Figure 2a,b summarize the discussion above graphically. Yet, why should measures of policy substance actually be linked to the legislative context in which this substance is embedded? From a theoretical perspective, the link

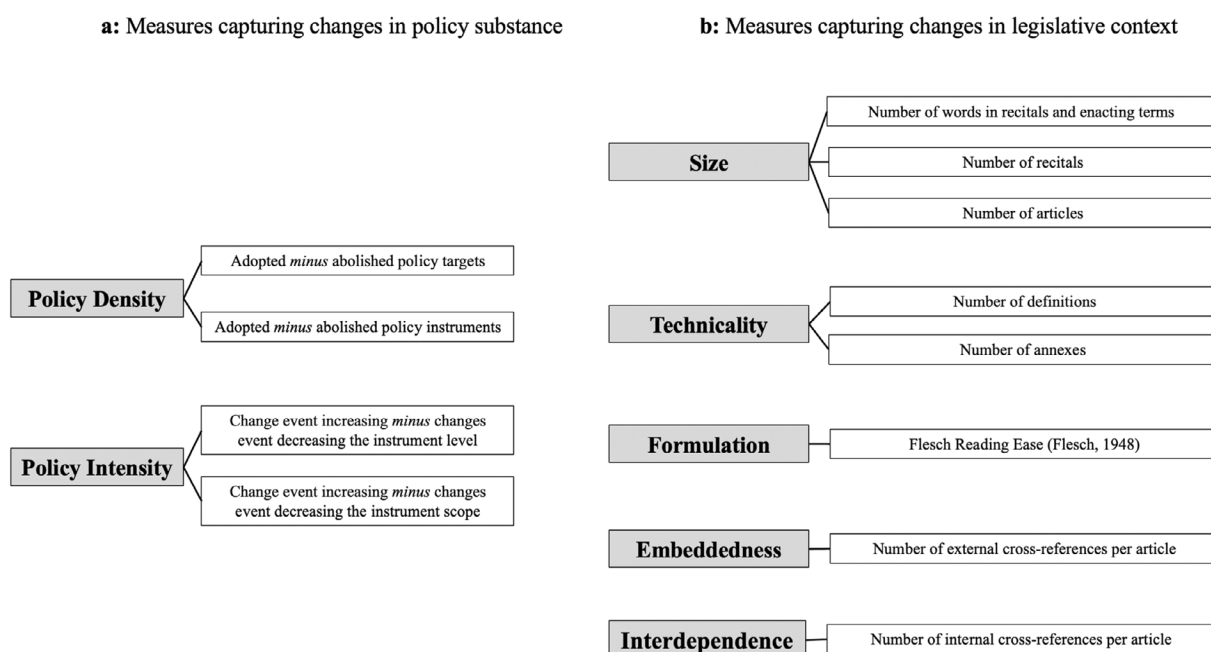


FIGURE 2 (a) Measures capturing changes in policy substance. (b) Measures capturing changes in legislative context.

between policy substance and indicators of size is arguably the most straightforward. It seems quite intuitive that the length of legislative texts should increase with the number of targets and instruments specified in the text. Likewise, the more changes are added at the instrument level, the longer legislative texts should become. Measures of technicality could be related to policy density and intensity in different ways. While we might expect the number of required definitions to increase with the density of targets and instruments, the scope of annexes could be affected by the degree of change at the instrument level, which often takes place in annexes. Next, also the way legislation is formulated might be affected by policy substance. Specifically, when policy density and intensity increase, concise legislative drafting might become more challenging, which could lead to more convoluted and inaccessible legal scripture. Similarly, patterns of cross-referencing might be affected by the policy substance contained in legislation. In fact, the more policy targets and instruments are added in a piece of legislation, the higher the need to clarify their relationship with each other and with the external legal environment. We consider all of those linkages between policy substance and legislative context rather plausible from a theoretical perspective. But do they also hold empirically?

4. Data foundation

We examine the connection between indicators of (1) changes in policy substance; and (2) the legislative context in the area of EU environmental and climate policy. Focusing on this policy area allows us to merge data from two different projects. While the ACCUPOL project provides information on policy substance (policy density and intensity), the EUPLEX project offers data on the legislative context (measures on the legislative size, technicality, formulation, embeddedness, and independence). Moreover, climate change can be considered one of the key challenges of our times. Improving our understanding of how to best measure and compare climate policies might help other researchers, assessing the governments' climate ambitions or the effectiveness of climate measures (see e.g., Bernauer & Böhmelt, 2013; Schmidt & Fleig, 2018).

4.1. Data collection and integration

The information on the policy substance indicators introduced in Section 3.1 comes from the ACCUPOL project. In this project, the changes in policy density and intensity were assessed by manually scrutinizing all relevant EU legislations that have been adopted in the 1975 to 2021 time frame. A detailed coding manual helped to extract the relevant information (changes in policy targets, instruments, and instruments' calibration) from the legal documents. Overall, the focus is on a pre-defined list of about 120 policy targets spread across the subfields of air, water, nature conservation, and climate policy. Climate policy, in turn, can be separated again in climate change adaption and mitigation policy (for an overview see Part 1 of the Online Appendix). Moreover, 16 policy instruments are covered. This includes hierarchical (e.g., obligatory standard, technological prescription), market-based (e.g., carbon taxes, trading schemes) as well as soft (e.g., labeling schemes, educational measures) policy measures.

Information on the complexity indicators introduced in Section 3.2 was collected in the context of the EUPLEX project (Hurka et al., 2022). This project relies on an automated approach of data collection and measurement, applying methods of natural language processing. In the context of this paper, the focus is mainly on the legal text of the recitals ("main text") and the enacting terms. This deliberately excludes the annexes of legal texts as they often contain mere technical information like formulas or tables. While the number of annexes is an important indicator of the technicality of a law (see Section 3.2.2), their content is not particularly helpful in assessing the linguistic complexity of a law or the length of its legal provisions. Therefore, we count annexes to get a sense of the law's technicality, but we do not use them to calculate measures of length, readability or interdependence/embeddedness.

When combing these two datasets, we have full information—that is, information on both policy substance and context indicators—for 116 legal acts adopted at the EU level. This includes 41 directives, 64 regulations, and 11 decisions. A list of all legal acts under analysis is provided in Part 2 of the Online Appendix. Figure 3 displays how the 116 legal acts under scrutiny are distributed over time. It shows that the vast majority of climate-related

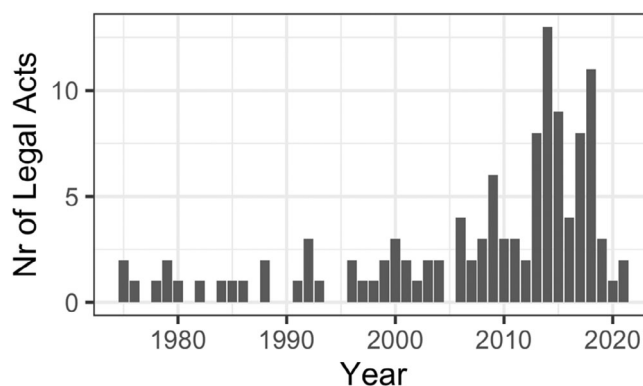


FIGURE 3 Distribution of climate-related legal acts adopted at the EU level over time (1975–2021).

legal acts were adopted from 2010 onwards. This can be primarily explained due to the strong increase in policies tackling climate change.

The average legal act in our sample adds three new environmental and climate policy targets and instruments and includes about 11 reforms increasing the stringency of the climate policy instruments applied. Dismantling events are more or less absent and limited to changes in policy intensity. Overall, only 5 out of the 116 legal acts (4 percent) abolish existing policy provisions or reduce their stringency or scope. This is well in line with existing insights on policy dismantling in the area of environmental policy suggesting that “active policy dismantling constitutes a clear exception at EU level and that an extensive rollback of established environmental standards is not detectable” (Steinebach & Knill, 2017, p. 438; see also Burns et al., 2020; Gravey & Jordan, 2016).

With regard to the structural features, the legal acts are on average 5216 words long and include 18 articles, 20 recitals, 11 definitions, and 3.5 annexes. The legal acts make on average two internal and one external reference (per article) to other parts of text or legal documents. The average readability score is 11.2 which equals a text that is “very difficult to read [and] best understood by university graduates” (Pérez-Guerra, 2020, p. 245).

5. Assessing the empirical relationship between policy substance and legislative context

We assess the empirical relationship between policy substance and legislative context in legal documents in the following. Our unit of analysis is legal documents. We examine the link between changes in policy density (new policy targets and instruments) and the five dimensions (size, technicality, formulation, embeddedness, interdependence) of the legislative contexts by means of linear regression.¹ Thereafter, we do the same for the relationship between changes in policy intensity (changes in instruments’ level and scope) and (again) the five dimensions capturing the legislative context. We standardize all our input variables to half a standard deviation so that we can directly contrast their relative importance (Gelman, 2008).

Table 1 summarizes the results concerning the link between changes in policy density and the legislative context. The finding is simple: for none of the eight variables, we find a significant relationship between policy density and the measures of the legislative context. The strongest—yet still very weak—correlation can be observed between the policy density and the number of definitions. This is indicated by the R^2 value of 0.014 that, in a bivariate model, equals a correlation coefficient of 0.12 ($\sqrt{0.014}$). Additional policy targets and instruments (sometimes) seem to need new definitions. A new policy provision addressing the emissions from industrial plants, for instance, must specify what counts as an industrial plant and what does not. Overall, however, the correlations observed can be considered almost negligible.

The picture is slightly, even if not much, different when looking at the link between changes in policy intensity and the legislative context. The results are presented in Table 2. Here, we find a significant relationship between changes in policy intensity and the number of words and recitals. For both variables, we find a low level of correlation. The correlation coefficient is 0.21 ($\sqrt{0.044}$) for the association between policy intensity and the number of words; and 0.29 ($\sqrt{0.082}$) for the association between policy intensity and the number of articles. It

TABLE 1 Relationship between changes in policy density and legislative context

	Size		Technicality		Formulation	Embeddedness	Interdependence
	(I)	(II)	(IV)	(V)			
Number of words	0.937 (3.045)						
Number of recitals		1.375 (1.133)					
Number of articles				1.146 (1.135)			
Number of definitions			1.379 (1.133)				
Number of annexes				1.033 (1.136)			
Flesch Read Ease					1.154 (1.1351)		
Number of external references						−0.545 (1.139)	
Number of internal references							0.380 (1.139)
Constant	3.129*** (0.566)	3.129*** (0.564)	3.129*** (0.564)	3.129*** (0.566)	3.129*** (0.565)	3.129*** (0.567)	3.129*** (0.567)
N	116	116	116	116	116	116	116
R ²	0.006	0.013	0.014	0.007	0.008	0.001	0.001

Note: Number of observations (N), Standard errors (SE) in parentheses. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

TABLE 2 Relationship between changes in policy intensity and legislative context

	Size		Technicality		Formulation	Embeddedness	Interdependence	
	(I)	(II)	(III)	(IV)				(V)
Number of words	7.051 [*] (3.045)							
Number of recitals		5.789 (3.069)						
Number of articles			9.561 ^{**} (2.985)					
Number of definitions				4.082 (3.093)				
Number of annexes					2.853 (3.105)			
Flesch Read Ease					−4.914 (3.082)			
Number of external references						1.492 (3.113)		
Number of internal references								5.486 (3.073)
Constant	11.164 ^{***} (1.516)	11.164 ^{***} (1.528)	11.164 ^{***} (1.486)	11.164 ^{***} (1.540)	11.164 ^{***} (1.546)	11.164 ^{***} (1.534)	11.164 ^{***} (1.550)	11.164 ^{***} (1.530)
N	116	116	116	116	116	116	116	116
R ²	0.044	0.030	0.082	0.013	0.007	0.022	0.002	0.027
Note: Number of observations (N), Standard errors (SE) in parentheses. [*] p < 0.05; ^{**} p < 0.01; ^{***} p < 0.001.								

Note: Number of observations (N), Standard errors (SE) in parentheses. ^{*} $p < 0.05$; ^{**} $p < 0.01$; ^{***} $p < 0.001$.

TABLE 3 Relationship between changes in policy density/intensity and legislative context using combined measurements

	Policy density			Policy intensity		
	(I)	(II)	(III)	(IV)	(V)	(VI)
Size	1.392 (1.246)			9.023*** (3.320)		
Technicality		1.543 (1.281)			4.437 (3.500)	
All			2.261 (1.818)			10.071* (4.913)
Constant	3.129*** (0.564)	3.129*** (0.564)	3.129*** (0.563)	11.164*** (1.550)	11.164*** (1.540)	11.164*** (1.523)
<i>N</i>	116	116	116	116	116	116
<i>R</i> ²	0.011	0.013	0.013	0.061	0.014	0.036

Note: Number of observations (*N*), Standard errors (SE) in parentheses. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

thus seems that, if at all, it is the number of words and articles that can be linked to changes in the policy substance.

In the previous analysis, we looked for the relationship between individual measures of policy substance and measures of the legislative context. However, it is well possible that the measures of the legislative context can only in combination effectively capture changes in policy substance. In Table 3, we thus provide additional analyses. First, we merge the measures on legislative size (words, recitals, articles) and technicality (number of definitions, number of annexes) into single measurements. Second, we constructed one big, all-encompassing measure that collapses all eight variables into a single measurement by simply adding their values and dividing them by the number of variables. This proceeding is possible as all variables were previously standardized to one standard deviation.

Models I to III present the relationship between policy density and the combined measures for size, technicality, and our “catch-all” variable; models IV to VI do the same for the link with policy intensity. By and large, the findings re-confirm the insight gained in the previous analysis. Changes in policy density cannot be systematically linked to features of the legislative context. By contrast, policy intensity is, at least to some extent, associated with the legislative context. Here, it is (again) primarily size-related aspects that are connected with change in policy substance, even though to a low extent. Yet, and that is important to highlight, we do not gain an analytical advantage by merging the different size-related measures (words, recitals, and articles) into a single variable. While the correlation coefficient for articles alone is 0.29 (see again Table 2), it is 0.25 ($\sqrt{0.061}$) for the “catch-all” measurement. The association is thus stronger for the single than for the combined measurement.

6. Discussion: Implications for policy research

The central insight from the previous analysis is that measures capturing policy substance and the structural characteristics of legal acts context are not systematically linked. In other words: changes in the structural features of legal acts cannot be used as an approximation for changes in policy substance. The core implication following from this finding is that the choice of measurement indicators requires a careful assessment and should reflect the scholar's underlying research interests. In other words, the selection of indicators for measuring changes in policies, rules, or regulations should depend on the questions that guide the research project.

Scholars interested in, for instance, the question of how sectoral policy stocks affect policy outcomes and performance, are well advised to use indicators that actually reflect the substance of the policy output: how does the policy portfolio look like? How has it changed over time? By contrast, if the central goal is to study the transaction costs that come with a certain policy, evaluating the scope of the law that carries the policy substance is a promising way to go. Simple measures that reflect the size of a law help us to understand the workload that is associated with handling a certain law. But as our analysis shows, those structural factors associated with

legislative design are only weakly connected to the policy substance contained in a legal act. Major substantive change can thus be contained in quite small laws, whereas large laws can also yield only little substantive change in policy substance.

Scholars interested in how much expertise is required to implement and evaluate a law, the most appropriate approach is to use indicators that capture the law's technicality. In this paper, we used the number of definitions or the number of annexes as ways to capture this technicality. Alternative options would be the use of specialized language (e.g., Latin terminology, rare words), the use of formulas, or references to certain measurement units (kilograms, kilometers per hour, or parts per million). For scholars interested in the complexity of the underlying policy compromises, in turn, it might be beneficial to look more closely into how the policy text is formulated. Less readable language is often the outcome of more challenging policy formulation processes, i.e., more diverging preferences, and more inclusive decision-making procedures (Hurka, 2022).

Finally, scholars keen to explain patterns of policy integration and challenges associated with it need to assess the extent to which laws are embedded into the existing legal landscape and the degree of their in(ter)dependence. As our data show, this embedding is only weakly correlated with measures of policy substance and other measures of legislative design. Short, non-technical, and simply formulated laws can be highly integrated with existing law, while long, technical, and complex laws can stand for themselves and be rather independent of the existing legal landscape.

The above list of potential applications of different measurement approaches is not exclusive. It primarily intends to underline the essential claim of this paper. The different approaches to assessing changes in policies, rules, or regulations vary in their analytical sensitivity. The approaches are hence more or less well-suited to capture the relevant empirical information needed to answer certain research questions. Further research in the analysis of policy and legal change should hence (more) explicitly emphasize the nexus between research interest and the measurement implications emerging from this interest.

7. Conclusion

In this paper, we departed from the observation of a growing scholarly interest in the analysis of aggregate developments in policies, laws, and regulations. Examining more than 100 legal acts in the area of EU environmental and climate policies, we found that the various measures capturing policy substance and the structural characteristics of legal acts context are not systematically linked. As a consequence, changes in the structural features of legal acts cannot be used as an approximation for changes in policy substance. The different indicators are not substitutable. While there are growing studies that take rules as data for addressing a broad range of different research questions, careful reflection is needed on which data we collect from rules and for which explanatory purposes we use these data.

Our study comes with the limitation that we only analyzed EU laws on climate and the environment. Accordingly, even though we have no obvious theoretical reason to expect our findings to vary across policy areas or levels of government, our data does not allow us to rule out the possibility that substance and context are more closely related in other empirical scenarios. It remains to be seen whether the discrepancy between what we want to know and what we can measure can be resolved in future research. In recent years, scholars have increasingly tried to extract meaningful information from legislative texts in a (semi-)automatized manner. For example, several studies have used rule-based approaches and machine learning to identify delegation provisions in legislation (Anastasopoulos & Bertelli, 2020; Kosti, 2021; Vannoni et al., 2021). Others showed that named-entity recognition can be employed to systematically extract information on policy addressees from legislative texts (Vannoni, 2022). In the next few years, we are also quite likely to witness first attempts to use transformer-based language models and employ machine learning to identify policy instruments in legislation. It is certainly no exaggeration to state that if we succeeded in extracting meaningful information on policy substance from legislative texts in an automated manner, this would constitute a game-changing development in comparative public policy, as it would enable us to study comparative policy dynamics at a large-N scale beyond easily available, but notoriously imprecise indicators of policy change such as measures of the legislative context.

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Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Endnote

- 1 Since one might argue that measures of policy density and intensity are counts of policy change events, we include estimates from a quasi-poisson regression in part 3 of the Online Appendix. Our findings are consistent across the different model specifications.

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Supporting information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Appendix S1: Supporting Information