Measuring Regulatory Complexity

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The regulatory overhaul that followed the great financial crisis has triggered a hefty debate about the complexity of financial regulation. For instance, Haldane and Madouros (2012) articulate the view that bank capital regulation has become so complex as to be counter-productive and likely to favor regulatory arbitrage. The Basel Committee on Banking Supervision itself is aware of the issue, and considers simplicity as a desirable objective, to be traded off against the precision of regulation (BCBS, 2013). In the United States, similar concerns have led to a proposal to exempt small banks from some rules provided that they appear sufficiently capitalized (see Calomiris (2018) for a discussion).

While there is a widespread concern that regulation has become too complex, ``regulatory complexity'' remains an elusive concept to quantify. An often-used measure is the length of regulation. For instance, Haldane and Madouros (2012) use the number of pages of the different Basel Accords (from 30 pages for Basel I in 1988 to more than 600 pages for Basel III in 2014). While informative, such a measure is quite crude and difficult to interpret. For instance, should one control for the fact that Basel III deals with a significantly higher number of issues than Basel I? Is a longer but more self-contained regulation more complex, or simpler? To guide us through such questions, we lack a framework to think about what complexity means in this context and how it can be measured.

The core idea of this paper is to observe that a regulation can essentially be seen as an algorithm performing some operation: it is a list of instructions that are applied to an economic agent and returns a regulatory action (e.g., a sanction). In other words, we propose to interpret any financial regulation as an algorithm that takes financial institutions as inputs and returns a regulatory action as an output. This parallel opens the possibility of using an extensive literature in computer science on algorithmic complexity and apply it to the study of regulatory complexity. The complexity of a regulation is then measured by the complexity of the associated algorithm.

As a proof of concept, in this paper we start with simple measures proposed in the computer science literature. We apply these measures in a variety of contexts. We first use them to compute the complexity of an artificial regulation in a normative model of bank regulation. We then “translate” an actual regulation, the Basel I capital requirements, into a functioning algorithm, and compute measures of the complexity of this algorithm. We also compute these measures based on the regulatory text itself, both for the Basel I capital requirements and for the Dodd-Frank Act, a much broader text. Finally, we propose a novel experimental protocol to test the relevance of our measures of regulatory complexity, or any other measure.

The first section of the paper also introduces a framework to formally define what is a measure of regulatory complexity, and the different dimensions of complexity that can be captured. In particular, we make a distinction between: (i) “problem complexity”, a regulation is complex because it aims at imposing many different rules on the regulated entities; “psychological complexity”, a regulation is complex because it is difficult for a human reader to understand; (iii) “computational complexity”, a regulation is complex because it is long and costly to implement. Given that our measures rely on the analysis of the text describing a regulation, they can capture problem complexity and psychological complexity, but not computational complexity.

We then introduce the new measures we propose. Among the many measures of algorithmic complexity that have been studied in the computer science literature, we focus in this paper on the "Halstead measures", pioneered by Halstead (1977). These measures rely on a count of the number of "operators" (e.g., +, -, logical connectors...) and "operands" (variables, parameters...) in an algorithm, and the measures of complexity aim at capturing the number of operations and the number of operands used in those operations. As we will show below, in the context of regulation these measures can help capturing the number of different rules ("operations") in a regulation, whether these rules are repetitive or different, whether they apply to different economic entities or to the same ones, etc.

Our choice of the Halstead measures is motivated by two factors. First, these measures are simple and transparent, and thus well-designed for a "proof of concept" study showing that applying measures of algorithmic complexity to financial regulation is potentially fruitful. Second, due to their simplicity, the computation of these measures can to some extent be automated and generalized to many regulatory texts, so that our approach can easily be replicated and used by other researchers.

We then apply these measures in different contexts.

To motivate why properly measuring regulatory complexity is important, we first study a simple theoretical model of capital regulation in which there is a trade-off between the complexity and the risk-sensitivity of regulation, as claimed by BCBS (2013). In our model, a regulator designs a capital regulation relying on risk buckets, as in Basel I. We can use our measures to compute the complexity of the regulation chosen. We then study the trade-off for the regulator between achieving a more precise regulation and reducing regulatory complexity, which determines the optimal number of risk-buckets and thus the complexity of the optimal regulation. We obtain in particular that the complexity of the regulation is concave in the number of risk buckets: our measures capture the fact that a regulation based on this structure is intrinsically repetitive, and that each new risk bucket is less complex at the margin. More generally, this example shows that our measure can be used in normative models of regulation. For instance, this allows in the context of a model to study whether a complex regulation achieving the first-best is indeed more desirable than a simpler one that still achieves a high level of welfare.

Second, we show how to measure the complexity of such a capital regulation in practice by considering the design of risk weights in the Basel I Accords. This is a nice testing ground because this part of the regulation is very close to being an actual algorithm. We compare two different methods: (i) We write a computer code corresponding to the instructions of Basel I and measure the algorithmic complexity of this code, that is, we use the measures of algorithmic complexity literally; (ii) We analyze the text of the regulation and classify words according to whether they correspond to what in an algorithm would be an operand or an operator, and compute the same measures, this time trying to adapt them from the realm of computer science to an actual text. The measures we obtain using both approaches are highly correlated, from which we conclude that our measures can be used without actually "translating" a regulatory text into a computer code, which is of course a time-consuming task, as they can be proxied by studying the text directly.

Third, and given the encouraging results obtained with the Basel I Accords, we show how the measures can be computed at a much larger scale by applying our text analysis approach to the different titles of the 2010 Dodd-Frank Act. We give some descriptive results on which titles are more complex according to different dimensions. In particular, we note that some titles have approximately the same length and yet differ very significantly along other measures, which shows that our measures capture something different from the mere length of a text. Because the Dodd-Frank Act covers many different aspects of financial regulation, when doing this analysis we created a large dictionary of operands and

operators in financial regulation, which we plan to make available to researchers interested in using these measures on different texts.

Fourth, and finally, we describe an experimental protocol that can be used to test the power of our measures. Experimental subjects are given a regulation consisting in (randomly generated) Basel-I type rules, and the balance sheet of a bank. They have to compute the capital ratio of a bank and to say whether the bank satisfies the regulatory threshold. The power of a measure of regulatory complexity is given by its ability to forecast whether a subject returns a wrong value of the capital ratio, and the time taken to answer. Moreover, we can test whether the relation between the measure of regulatory complexity and the outcome depends on the student's background and training, etc. In this preliminary version of the paper, we only outline an experimental protocol and leave the conduct of the experiment for future research. Importantly, our protocol can be used to validate any measure of regulatory complexity based on the text of a regulation, not only ours, and thus opens the path to comparing the performance of different measures.

References

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Biography

Jean-Edouard Colliard obtained a PhD in 2012 from the Paris School of Economics and is a former student of the Ecole Normale Supérieure (Ulm). Before joining HEC, Jean-Edouard worked for two years as an economist in the Research department of the European Central Bank.

His main research areas are the regulation of financial institutions and the microstructure of financial markets, including topics such as financial transactions taxes, over-the counter markets, bank capital requirements, or the European Banking Union. Jean-Edouard's research has been published in leading finance and management journals such as the Journal of Finance, the Review of Financial Studies, the Review of Finance, and Management Science. He teaches courses on Financial Regulation for students of the "Majeure Finance", the MSc in International Finance, and the Executive MSc in Finance.

Jean-Edouard received the "Young Researcher in Economics" Award of Foundation Banque de France in 2017, the Eurofidai-BEDOFIH Data Award 2017, the "Young Researcher Award" 2015 of AMF (the French Securities Markets Authority), and the 1st SUERF/Unicredit & Universities Foundation Research Prize 2013.