The stock exchange rulemaking firehose: A law-as-data approach

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Abstract

I use law-as-data methods to bring a new perspective on rulemaking by self-regulatory organizations (SROs) in the securities industry, like the stock exchanges, FINRA, and the MSRB. Using a new dataset of about 700,000 daily Federal Register filings scraped from the GPO's bulk XML data, I examine about 33,000 SEC filings, some of which are its own but the vast majority of which it files on behalf of the SROs. As currently framed, this project has several aims. It begins to present unexplored descriptive questions about the production of SRO rulemaking, including which SROs file, how the SEC responds, and the increasing importance of post-Dodd Frank "fee filings." In one analysis focusing on stock exchange rulemaking, I assess changes in the textual sentiment of SRO rule filings during periods of crisis, finding suggestive evidence that SRO rule changes focus more on uncertainty-sentiment words during periods of market volatility or crisis. I discuss extensions of the broader project, including examining judicial-decision shocks on the complexity and length of SEC and SRO analysis in rule change proposals, and examining the evolution of rules as textual precedent under conditions of exchange consolidation. These inquiries, I suggest, help inform the political economy of stock exchange regulation, as well as our understanding of how the SEC's oversight of SROs compares to other modes of industry self-regulation.

Keywords: securities regulation, administrative rulemaking, self-regulation, stock exchanges, natural language processing, law as data

JEL Codes: C55, G23, G28, K22, K23

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1 Author's prefatory note to AALS readers

Thanks for engaging with this work! This project introduces a text-as-data approach to a broad but understudied area of securities regulation—rulemaking by industry self-regulatory organizations. As a holistic introduction, this article combines several topics and research questions that have arisen as I've developed this project. Parts of the project will appeal to different audiences.

To help guide the reader, this prefatory note identifies themes in the article and how they are likely to be split into the future. I am particularly interested in views on how to split this off into multiple projects:

- An article for a law review or peer reviewed journal audience about the process of SRO production, focusing on what is now section 7 below on the role of SEC oversight of SROs. Drawing on mixed methods, this article would combine text-as-data analysis and interviews with SEC and SRO staff, and assess the institutional processes of rule production. This article would also look at how rules are negotiated in ways that will not be captured in the Federal Register textual data. This project largely examines public interest aspects of rule production; textual comparison between SEC analysis of its own rules and that of the exchanges; evidence of public participation and of agency/SRO responsiveness; the disciplining effect of judicial review on the SROs rule process; and the like. This article would draw mostly on what are now parts 5 and 7.

- An article for a law review audience, to be coauthored with Prof. Geeyoung Min (Michigan State), about exchange rule production as a problem of for-profit regulation. The dataset contains the full panel of US-regulated SROs during the period of stock exchange demutualization and consolidation. This project will raise questions about mimicry and evolution, as well as about the effect of business model on rule content. This article would draw mostly on what are now parts 5 and 6.

- A short piece targeted for the peer reviewed Scientific Data publication, slated to be produced with Prof. Min and other collaborators. The article would be an introduction to a cleaned, open-source dataset of the Federal Register filings for use in text analysis.

- An article for a comparative / peer review audience, prospectively to be coauthored with an international expert on stock exchange regulation I have approached on the topic.

2 Introduction

The securities regulation structure in the United States is predicated upon the founding myth that "self-discipline is always more welcome than discipline imposed from above" (Jennings 1964, p. 678). In addition to perceived legitimacy, self-regulation is thought to draw on technical expertise and be more flexible (Michael 1995). This ethos is reflected in the Exchange Act, which establishes the framework for the self-regulatory organizations (SROs) we are familiar with today, including the Financial Industry Regulatory Authority (FINRA), stock exchanges like NASDAQ and the New York Stock Exchange, clearing agencies like DTCC, and the Municipal Securities Rulemaking Board.[1]

The robust system of federally overseen industry self-regulation contemplates rulemaking and enforcement with a public-interest backstop by the Securities and Exchange Commission (SEC). That agency is mandated to review proposed SRO rule changes to ensure they align with the public interest and investor protection. The SEC's Division of Trading and Markets reviews the filings; depending on the evaluation, the proposed rule can be approved, disapproved, or modified (Kappos et al. 2023). However, the process of review is not uniform; some rules can come into effect immediately, while others require approval. There is, moreover, a very low threshold for a "proposed rule change" necessitating a filing and SEC review: any new policy, practice, or interpretation not implied by existing SRO rules.

Indeed the SROs have many rules governing their markets and members, and more still proposed rule changes. Readers might call to mind specific SRO rules — perhaps the NASDAQ board diversity rule, NYSE's listing criteria, or FINRA's suitability rule. But these rules are broader in scope; the SEC's recent loss before the D.C. Circuit in *Grayscale Investments* (2023)[2] involved an SEC denial of a proposed SRO rule change to list a new exchange-traded product.[3]

SRO rulemaking illustrates the tensions inherent in self-regulation. At the heart of this discourse lies a potential agency conflict: that stock exchanges and other industry self-regulators, due to their potential for private interest-led policy goals, might not optimally serve the public interest (Fleckner 2006; Dombalagian 2021; Carson 2003). With the SEC's review process being resource-intensive and time-consuming, we might be concerned that the current structure does not effectively oversee or the rules being produced.

While scholars have written extensively about particular SRO rules or bodies of them, from a bigger picture perspective securities law scholarship has said precious little about the shape

1. The Securities Exchange Act of 1934 ("Exchange Act" or "'34 Act") defines a self-regulatory organization as "any national securities exchange, registered securities association [FINRA], or registered clearing agency, or (solely for purposes of [provisions important to this article,] Sections 19(b), 19(c), and 23(b)) the Municipal Securities Rulemaking Board." Exchange Act §3(a)(26).

2. — F.3d —, 2023 WL 5536704 (D.C. Cir. Aug. 29, 2023).

3. See sections 5.2 and 8.2.2 below.

of SRO rule production. Do we know enough about the current system to begin to inquire into whether it is functioning in the public interest? The challenge lies in this bird's eye view — understanding the full impact of SRO rulemaking, in particular rulemaking by stock exchanges in the United States. Over time, it has become evident that the volume of SRO rule filings exceeds the SEC's rule filings. A casual reader of the Federal Register[4] might occasionally have noticed a large number of filings from SROs. More holistic review of the data (e.g., figure 1) illustrates that since 2008, the SRO rule production process has generated in daily issues of the Federal Register on average between two and three times as many filings as the SEC.

This paper undertakes what is believed to be the first macro-scale empirical study of SRO rulemaking, shedding light on the mechanisms, outcomes, and implications of this self-regulatory system. Using a new dataset of about 700,000 daily Federal Register filings scraped from the GPO's bulk XML data, I examine 23,862 SRO filings and 9,590 SEC filings. I use computational "law-as-data" and natural-language-processing methods to examine empirically the rise and nature of SRO rulemaking in the securities industry, with a goal of shedding light on basic unexplored questions about the production of stock exchange rules in securities law. These basic questions include which SROs are filing rule proposals, what the proposals are about, how the SEC responds, and how SRO regulatory attention has shifted over time (such as with respect to "fee filings" and artisanal exchange-traded products). The analysis of these and other filings can help us understand the political economy of stock exchange regulation, as well as inform our understanding of how the SEC's oversight of SROs affects the regulatory environment more broadly.

The paper's structure goes like this. In part 3, I situate SROs within the structure of securities regulation in the U.S. and describe the rulemaking process. Next, in part 3.2, I review the scholarship on stock market regulation and law-as-data approaches to rulemaking of this sort. I describe the Federal Register data on which I rely in part 4.

I report initial results in part 5, including a discussion of the kinds of rules being produced, as well as the changing textual markers of SRO rule content over time. I use topic modeling methods to focus on how topics reflect the interests of market participants or the public interest over time. In addition, I examine how the words used in SRO rule change filings can reveal the shifting attention and concerns of regulators around periods of financial stability to test hypotheses about risk-based and prescriptive rulemaking. By examining changes in the frequency of words tagged with certain sentiment (e.g., `uncertainty`), I assess how regulatory sentiment changes during periods of crisis and what this may mean about the role of SROs in the regulatory landscape.

The rest of the article's main analysis raises questions about the political economy of stock exchange rule production. I consider in part 6 how the industrial organization of the market for stock exchange services, as well as the business model of the exchanges, have changed over time. I

4. You know the type.

consider in particular the role of hard-to-challenge filings in which SROs set fees for users, finding that these comprise a greater proportion of SRO filings and are increasingly hard to challenge. In an extension of this part of the project, I will consider how consolidation in the SRO market has affected the stickiness and precedential use of SRO rule text — so-called "copycat" rule filings — within and across exchange families.

I consider in part 7 the role of SEC oversight, including public interest aspects of rule production. In particular, I estimate the local average treatment effect (LATE) of judicial shocks on SEC review of SRO rulemaking, using regression discontinuity design (RDD) methods surrounding exogenous judicial decisions.

The final part addresses implications for equity market structure reform proposals, cryptocurrency regulation, and broader theoretical questions about governance in self-regulatory organizations — including how rule production by for-profit quasi-private regulators shifts between reflecting the interests of market participants and the public interest over time.

3 Federal oversight of SRO rulemaking

This section situates industry self-regulatory organizations in capital markets, as well as how these SROs produce rules.

3.1 The SEC, the SROs, and their rules

3.1.1 Self regulatory organizations in U.S. capital markets

Congress has extended the SEC's power over the securities markets, including stock exchanges and over-the-counter markets, in a series of further statutes like the Maloney Act of 1938 and the Securities Act Amendments of 1975 (Mahoney 2020; Platt 2023). As part of its mission today, the SEC is responsible for ensuring that exchanges, among several dozen industry self-regulatory organizations (SROs), comply with federal laws and regulations governing their operations. As illustrated in tables 5 and 6, active SROs include stock exchanges, like the New York Stock Exchange and NASDAQ and their affiliates, plus brokerage industry regulator FINRA, clearing agencies, joint industry plans, and more (Edwards 2017). Other SROs have deregistered or been consolidated during the time period relevant to this project, as table 6 shows in particular.

The SEC produces its own rules governing markets and their participants. But it also has statutory authority to oversee the SROs that themselves oversee and regulate market participants (Wallace and Dryden 2009; Cleveland 2005). Each of these SROs has statutory authority to adopt rules for its members, subject to the SEC's blessing. As table 1 tells us, some of them are prolific

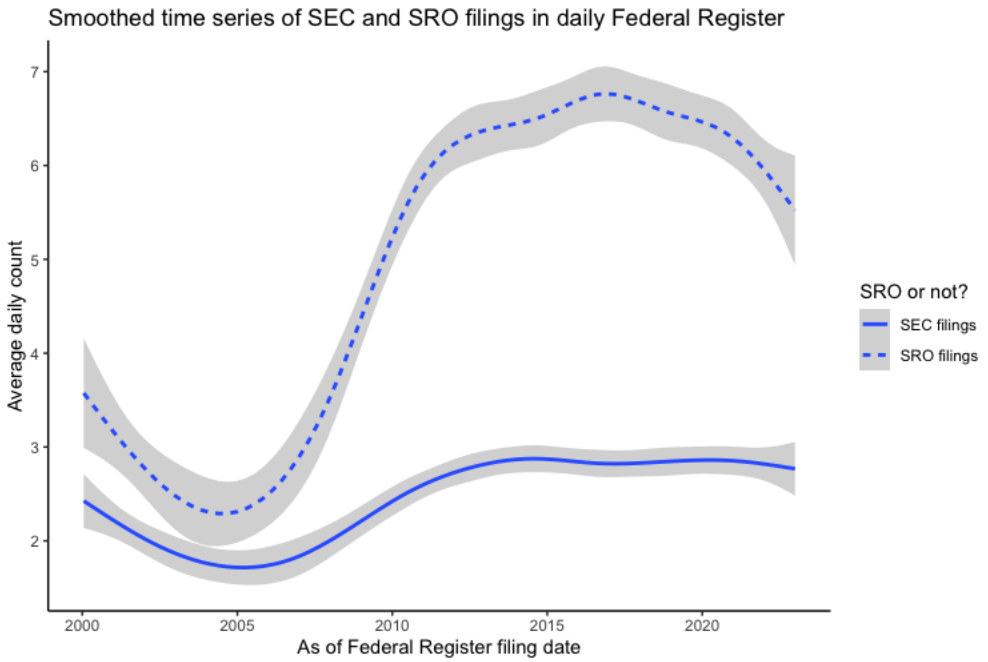


Figure 1: LOESS time series of average daily count of SEC notices of SRO rules, and all other SEC filings.

rule filers. Some illustrations may be useful.

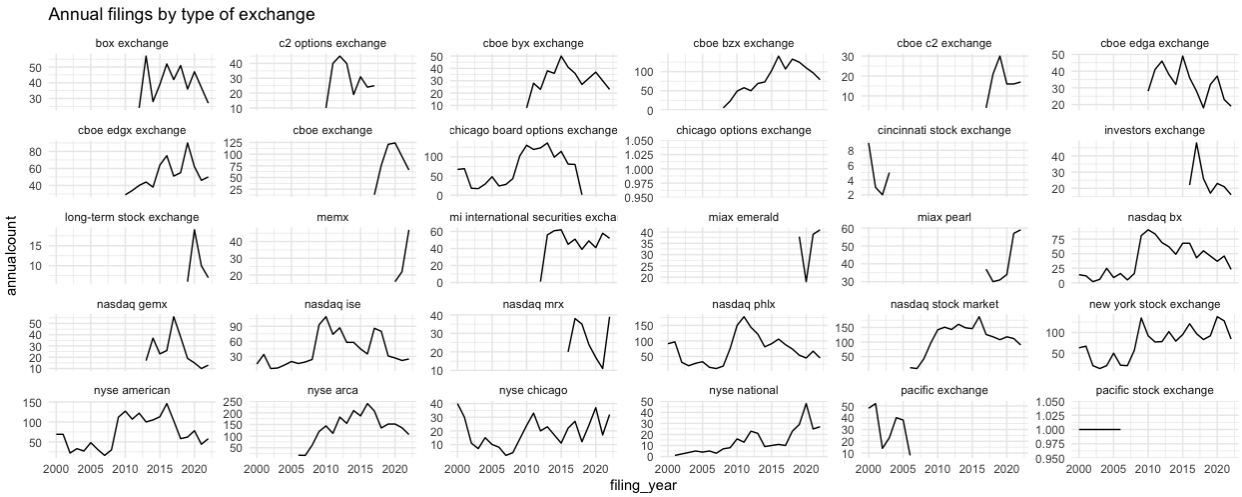


Figure 2: Number of filings per SRO

Consider first stock exchanges, which provide not only listing services for issuer companies,[5] but also execution facilities and market services for people who want to trade – liquidity providers and takers (Fox, Glosten, and Rauterberg 2015). Securities exchanges such as the New York Stock Exchange (NYSE) or NASDAQ might have rules concerning listing standards, trade order types,

5. See, e.g., Cain (2003).

levels	counts	levels	counts
nyse arca	2336	nyse national	298
nasdaq stock market	1912	ice clear europe	292
new york stock exchange	1732	nasdaq gemx	254
nyse american	1680	miax pearl	248
nasdaq phlx	1666	c2 options exchange	234
financial industry regulatory authority	1613	pacific exchange	223
chicago board options exchange	1328	nasdaq mrx	184
cboe bzx exchange	1222	investors exchange	173
nasdaq ise	984	chicago mercantile exchange	149
nasdaq bx	927	miax emerald	136
cboe edgx exchange	678	cboe c2 exchange	104
options clearing corporation	584	memx	85
miami international securities exchange	515	lch sa	73
cboe exchange	495	long-term stock exchange	42
nyse chicago	440	cboe futures exchange	41
box exchange	440	stock clearing corporation of philadelphia	39
cboe edga exchange	427	onechicago	27
depository trust company	414	emerging markets clearing corporation	26
cboe byx exchange	409	boston stock exchange clearing corporation	24
national securities clearing corporation	355	cincinnati stock exchange	19
fixed income clearing corporation	349	national futures association	17
ice clear credit	309	mbs clearing corporation	16
municipal securities rulemaking board	299	pacific stock exchange	3
		nasdaq liffe	2

Table 1: SRO frequency table. SROs with only one filing omitted.

and fees (Jin and Min 2021). Generally speaking, each exchange has its own set of listing requirements, which might encompass standards for board composition, director independence, and audit committee matters (Dombalagian 2015; Heminway 2005). These requirements typically also include minimum financial standards.

Other possible rules could include order types, practices for market makers, circuit breaker rules, data fees, and the like. As market centers, exchanges have rules governing the kinds of order types that may be submitted for execution (Fox and Rauterberg 2017). Exchanges may charge fees to access the services they provide.[6] In these ways, stock exchange rules are relevant not only to members but to the broader public markets, even when they are about the structure and operation of the stock exchanges (Miller 1985).

Not all self-regulatory organizations are stock exchanges. Clearing agencies such as The Depository Trust & Clearing Corporation (DTCC) facilitate post-trade activities. Some of its rules cover the procedures for the settlement of trades, including timelines and mechanisms for transaction confirmation; margin requirements; and events of member default. Awrey and Macey (2022), for instance, assess consolidation in the market for clearing services.

levels	counts
national securities exchanges	19195
registered clearing agencies	2616
registered securities associations	1613
municipal securities rulemaking board	299
notice registered securities future product exchanges	71
securities futures associations	17
exempt clearing agencies	3
exempt exchanges	1

Table 2: SRO filings

In addition, the Municipal Securities Rulemaking Board (MSRB) regulates firms that issue and sell municipal securities. Some of its rules include disclosure requirements, pricing and price manipulation, and pay-to-play in underwriting of municipal securities (e.g. Post 2018). Other SROs include entities like the National Futures Association (NFA), which has rules related to commodities and futures trading, or the Chicago Board Options Exchange (CBOE), which has rules related to options trading. These include trading rules related to minimum capital, margin, position limits, reporting; conduct rules; and dispute resolution rules.

Another prolific rule filer in a category by itself (registered securities association) is the Fi-

6. See, e.g., Bats EDGA Exchange, Inc.; Proposed Rule Change Related to Transaction Fees, 82 Fed. Reg. 43,598 (Sept. 18, 2017).

nancial Industry Regulatory Authority (FINRA). It is another major SRO that has regulatory jurisdiction over broker-dealers in securities and their associated persons (Edwards 2022; Laby 2010). In enforcement actions, it applies its regulatory rulebook. Its rules include sales practices rules, advertising and communication rules, supervisory rules, qualification and licensing requirements, and the like. Recent FINRA rules have addressed the problem of persistent violations of FINRA rules, including by raising the regulatory stakes for brokerage firms with a significant history of misconduct.[7]

FINRA has other functions as well. One of its most significant services is to provide an arbitration forum for dispute resolution between brokers and their registered representatives, as well as between brokers and clients. FINRA's rulebook includes chapters dedicated to procedures in FINRA arbitration. In addition, since 2007, FINRA has also handled enforcement and examination for most of the other stock exchanges (Edwards 2017).[8]

This project's broader ambition is to focus on stock exchange regulation. Stock exchanges have a longer and more storied history than other SROs, and have shaped financial markets and the broader economy (Tierney 2024; Banner 1998). They also are more visible to the public than many other SROs, which through shaping public perceptions and expectations can affect self-regulatory behavior. Stock exchanges involve a wide array of participants, from individual investors to large institutional players. This diversity can provide a rich source of data on how different types of participants interact with, and are affected by, self-regulatory practices and structures. Finally, because stock exchanges exist around the world, international comparisons across different context might permit more comprehensive understanding of how self-regulation functions across capital markets.

3.1.2 SRO rulemaking in securities law

SRO rules typically start with development by the organization's governing body, which may consist of members of the regulated industry. Section 19(b) of the Securities Exchange Act of 1934 requires SROs to submit proposed rules and rule changes to the SEC for review.[9] SRO rules typically must be approved by the SEC before becoming "effective," although Exchange Act Sec-

7. See, e.g., Order Approving Proposed Rule Change to Amend FINRA Rule 8312 to Release Information on BrokerCheck Relating to Firm Designation as a Restricted Firm, Release No. 34-96798, 88 Fed. Reg. 8,494 (Feb. 9, 2023).

8. On the split in SRO authority that led FINRA to handle member regulation for the exchanges, see Hunter (2005).

9. Exchange Act § 19(b), 15 U.S.C. § 78s(b); see also id. § 3(a)(27), 15 U.S.C. § 78c(a)(27) (defining the "rules of the exchange" as including "stated policies, practices, and interpretations" of the exchange that "the Commission by rule, may determine to be necessary or appropriate in the public interest or for the protection of investors"); 17 C.F.R. § 240.19b-4(a)(6) (defining a "stated policy, practice, or interpretation" as "[a]ny material aspect of the operation of the facilities of the self-regulatory organization"). When push comes to shove, an SRO may not be able to enforce against its members or other persons an SRO rule that was not approved under Rule 19b-4 if required to have been. See ABN AMRO Clearing Chicago LLC, Exchange Act Release No. 83849, 2018 WL 3869452 (Aug. 15, 2018); Gregory Acosta, Release No. 34-89121, 2020 WL 3428890 (SEC July 22, 2020) (opinion of the commission).

tion 19(b)(3) and Rule 19b-4(f) provide for effectiveness upon filing, and no SEC preapproval, for certain categories of SRO rules.

The SEC may approve, disapprove, or modify a proposed rule change.[10] Its oversight role is essential here to ensure that the statutory goals of the securities laws are met before industry is allowed to enforce its own rules. SRO rules are typically constrained by specified criteria set out in the statute that is applicable to each kind of SRO, for instance in Exchange Act Section 6(b) for exchanges and Exchange Act Section 15A(b) for FINRA (Schwartz 2007, p. 418). One consequence is that the SEC must consider whether the proposal is consistent with certain of the Exchange Act's requirements, like whether it "promote[s] efficiency, competition, and capital formation."[11]

Under Rule 19b-4, SROs must submit for review any "stated policy, practice, or interpretation" that is not "reasonably and fairly implied by" existing SRO rules.[12] With such a sensitive trigger for the regulatory obligation to file a proposed rule change under Rule 19b-4, SRO rules make up the bulk of the SEC's filings in the Federal Register. Most years, as table 1 and figure 1 illustrates, SROs are prolific rule filers, and each issue of the Federal Register includes on average about three times as many SRO rule filings as the SEC's own rule filings.

Exchange Act Section 19(b) provides for onerous APA-like notice-and-comment procedures in connection with some categories of SRO rule filings.SRO rule changes filed on Form 19b-4, as well as the SEC action on them, may be published in the Federal Register. Wading through and processing this volume of SRO rule filings is an enormous regulatory task for the SEC's Division of Trading and Markets and the Commission itself (p. 434).[13]

From the perspective of industry participants and academics, it also is a potentially significant obstacle to monitoring, understanding, commenting on, and influencing the design and adoption of SRO rules (Al-Ubaydli and McLaughlin 2017). In some sense the problem is one of consumption of disclosure, for which there may be diminishing returns (Fraas and Lutter 2016; Ben-Shahar and Schneider 2014), a topic to which we'll return in part 7.

The volume of SRO rule proposals may be too great for even those with material financial incentives to monitor and comment on these rules manually, raising the stakes of using automated methods to identify and parse these filings. Notices of proposed rules, and actions on the proposals, are published in the Federal Register, making their textual contents amenable to NLP methods and analysis, as discussed in the next section.

10. For more statutory background, see Kappos et al. (2023) and Wallace and Dryden (2009).
11. Exchange Act Section 3(f), 15 U.S.C. § 78c(f).
12. See, e.g., Tierney and Edwards (2024).
13. "The Commission's Division of Trading and Markets takes primary responsibility for reviewing SRO rule filings. Most rules are approved by the authority delegated to this Division." Wallace and Dryden (2009) (citing 17 C.F.R. 200.30-3(a)(12)); see also Heminway (2005, p. 287).

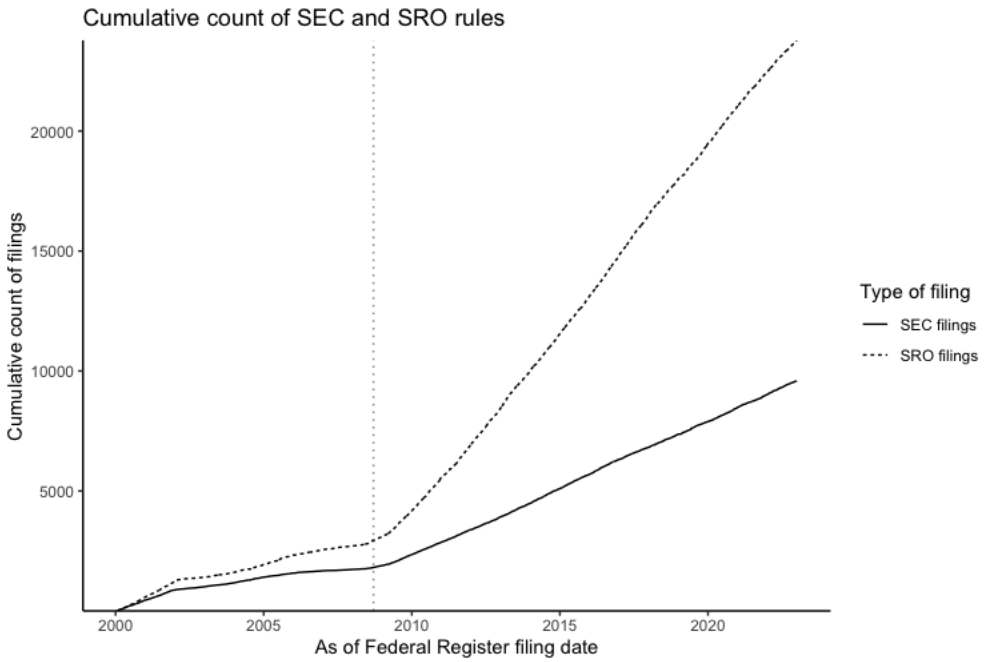


Figure 3: Cumulative count of SEC and SRO rules between January 2000 and December 2022. Vertical line is September 15, 2008, the date of the Lehman Brothers bankruptcy.

3.2 Securities law scholarship on stock market regulation

Scholars have long been concerned about the role of legal rules in mediating stock markets. Markets are constrained by their rules, including the background legal rules and relational practices against which trade can come to exist.

Stock exchanges and other SROs produce rules in their capacity as regulators (Mahoney and Rauterberg 2018; Gadinis and Jackson 2007; Dombalagian 2004; Mahoney 1997). The history of stock market regulation, and of federally overseen self regulation more broadly, is the distrust that industry will regulate itself effectively (Chan and Lim 2024; Macey and Novogrod 2012; Omarova 2010; Dombalagian 2006; Seligman 2004; Miller 1985; Lipton 1983). These concerns can be manifested in agency cost [14] and aggrandizement approaches.[15]

Yet despite its importance in regulating stock markets, the **production** of stock exchange

14. Agency cost theories, rooted in the broader framework of principal-agent problems, see SROs as agents acting on behalf of their constituents (the principals), which typically include member firms and market participants. SROs might prioritize rules that align more closely with the interests of their most influential members rather than the overall market or public good.

15. Aggrandizement theories focus on the self-interest and power-maximizing behavior of organizations and their leaders. In this view, SROs may pursue rulemaking in a way that enhances their own prestige, influence, or control within the financial market ecosystem. Driven by their desire for institutional self-preservation and expansion, SROs might prioritize rulemaking that asserts their dominance and visibility in the regulatory framework, even at the cost of efficiency or market fluidity.

and other SRO rules has received relatively little attention from legal scholars.[16] In the securities and administrative law scholarship, for example, there are only a handful of articles more than acknowledging in passing Exchange Act 19(b), Rule 19b-4, and the associated processes.[17] Jin and Min (2021), for instance, examine strict rulemaking and loose enforcement of exchange rules and conclude that the enforcement regime is best characterized as relational.

The most extensive treatment is Schwartz (2007), who criticized the pre-Dodd-Frank SRO rulemaking process for its slow pace, complexity, and risk aversion on the part of the SEC. Under that view, "the SRO rule change process is the 'critical path' of much new competition and in many instances the source of developments in market structure" (p. 411). Reflecting on intervening statutory changes in Dodd-Frank (discussed below in section 6.2), Mahoney (2020, p. 27) noted that exchanges are unlike other market participants like alternative trading systems that may make changes "without SEC approval." In this view, the SRO rulemaking process may introduce "regulatory constraints [that] deter exchanges from innovating on trading design."

Writing nearly 30 years ago, Michael (1995, p. 207) expressed "encourag[ement]" at the system of "audited self-regulation of securities exchanges and broker-dealers," and noted that "the ability and willingness of the SEC to perform its 'audit' tasks vigilantly remains the key to success." Others have focused on the role of public input without respect to the SEC's audit role.[18]

Another concern is the relationship between the SEC, SROs, and other political branches. According to Hammond (2016, p. 1771), the problem with SROs is "arbitrariness" and a lack of "accountability," given "the combination of oversight agencies' deference to SROs and judicial deference to oversight agencies [that] undermines both the constitutional and regulatory legitimacy of SROs." By comparison, Birdthistle and Henderson (2012, p. 6) argue that "the mismatch between SROs' governmental powers and private unaccountability is leading our financial regulatory system towards an unstable and unsustainable structure at a time when it most requires strength and stability." They call for "greater [SEC] control over [the] subordinate SROs."

Meanwhile, there may be reason for reciprocal concern that SEC monitoring of SROs will be

16. There are also only a handful of cases citing Rule 19b-4. See, e.g., NASDAQ OMX Group, Inc. v. UBS Securities, LLC, 770 F.3d 1010 (2d Cir. 2014); General Bond & Share Co.v. SEC, 39 F.3d 1451 (10th Cir. 1994); John Hancock Life Ins. Co. v. Wilson, 254 F.3d 48 (2d Cir. 2001) (Katzmann, J., concurring); G.K. Scott & Co., Inc. v. SEC, 1995 WL 364671 (DC Cir. June 7, 1995) (unpublished); CBOT Holdings, Inc. v. Chicago Board Options Exchange, Inc., 2007 WL 2296355 (Del. Ch. Aug. 3, 2007) (unpublished).

17. That SRO rulemaking is a largely unexplored area of securities regulation may be in part due to the relative obscurity of market regulation compared to other, more well trodden areas of securities law such as insider trading or disclosure requirements. That is perhaps surprising, for as figure 3 illustrates the SROs have been outpacing SEC rulemaking since around the 2008 financial crisis.

18. For instance Burton (2023), in a report for the Heritage Foundation in connection with an agenda for a 2025 conservative presidential administration, faults the SROs for secrecy and inefficiency in the rule production process. The report calls for "meaningful cost-benefit analysis as part of the rulemaking process" and public input in the form of "requir[ing] all SROs to publish rules in proposed format and seek public comment *before they are submitted to the SEC*" (see also, e.g. Burton 2017).

costly and thus will be underproduced (Hammond 2016). In Susquehanna Int'l Grp. v. SEC, 866 F.3d 442 (DC Cir. Aug. 8, 2017), for instance, the D.C. Circuit found that the SEC had not adequately articulated the basis for its determination that an SRO rule met the statutory criteria for approval, and faulted the SEC's process for being too deferential to the SRO's say-so.[19]

For these reasons, we might particularly care about the rule production and governance of stock exchanges, given their importance to financial market liquidity and price discovery in a capitalist economy (e.g. Thompson 2007, pp. 1151-53, 1168-1180). How might analysis of the rules stock exchanges produce inform or provide evidence bearing on theories of self-regulation and the public interest?

Consider first here the regulatory capture hypothesis, which posits regulators may be unduly influenced by the entities they regulate (Carpenter and Moss 2013). Under one definition, regulatory capture "denotes the misalignment of incentives of government actors who pursue narrow private interests that may conflict with the public interest they purport to serve" (Omarova 2012, p. 630). As Edwards (2017, pp. 606–07) notes, "most observers conclude that the regulation of financial services exhibits a high degree of capture," and SROs and their staffs in particular "may be more prone to acting in the industry's interest than" the SEC and its staff. This may be in part because securities regulators primarily hear from the regulated industry in the form of SROs, their members, and their respective lobbyists — and typically not from the rest of the general public (Wallman 2009, p. 830).

3.2.1 Jurisdictional competition for rulemaking

Scholars have examined the role of SRO and exchange rulemaking in comparative context (e.g. Cheffins and Reddy 2023b, 2023a; Chan 2021). Exchanges in different jurisdictions may adopt rules to capitalize on regulatory arbitrage, attracting issuers and investors seeking more favorable regulatory environments (Park 2012; Eidenmüller 2011; Brummer 2008; Gadinis 2008; Mahoney 1997; Kahan 1997). This could be evident in the text of the rules through references to international standards or competitive positioning.

19. In *Susquehanna* (2017), the Options Clearing Corporation had adopted a plan for managing capital contributions and allocating them between operating expenses, capital reserves, and dividends. The D.C. Circuit faulted the SEC's analysis for failing to make any findings or determinations, as required under Exchange Act §§ 17A(b)(3) and § 19(b)(2)(C)(i), that the proposed rule met the statutory requirements. According to the court of appeals, "the SEC effectively abdicated that responsibility to OCC," by stating that a statutory factor had been considered rather than making an affirmative finding, and by relying on the SRO's characterization of its evidence. Writing in BUSINESS LAWYER's *Federal Regulation of Securities* annual year in review, Fisher (2018, 887) concludes from *Susquehanna* that "serious quality control efforts are in order" for SEC review of SRO rule proposals (see also, e.g. Quinlivan 2017; Massari, Nazareth, and Rosenberg 2017).

3.2.2 Corporations as private regulators

Finally, stock exchange rulemaking may be seen as a problem known in the regulatory literature as "corporations as private regulators." This concept refers to the trend in which corporations, rather than governmental entities, take on roles traditionally associated with public regulation (Zheng 2022). Key themes in this area of study include the delegation of regulatory power, the balance between corporate interests and public welfare, and the accountability of corporations in their regulatory roles. This literature raises questions about the adequacy of self-regulation in protecting consumer interests, the role of government oversight, and the mechanisms for ensuring corporate accountability (Chan and Lim 2024; Weimer 2006).

4 This article's law-as-data empirical strategy and data sources

4.1 Law as data approaches to studying administrative rulemaking

The use of "text as data" techniques has become increasingly popular in recent years, with researchers using sophisticated methods to analyze large amounts of textual information from various sources including social media posts, news articles, books, and more (Grimmer, Roberts, and Stewart 2022).[20] Law is no exception; researchers have applied text-as-data techniques to analyze legal texts such as court decisions (Corley 2008; Livermore, Riddell, and Rockmore 2017; Chang, McCabe, and Lee 2022; Varsava 2023), contracts (Frankenreiter and Nyarko 2020), corporate governance (Frankenreiter et al. 2022), and the like. Other scholars have likewise looked at how regulated audiences respond to and shape law, such as through disclosures, earnings calls (Li and Yu 2021), central bank speeches (Maria Ferrara 2020), constitutional discourse (Pozen, Talley, and Nyarko 2019), and comment letters on agency rulemaking (Eidelman, Lam, and Livermore 2021).

The literature on "law as data," understood as a form of text-as-data, is varied and evolving (Livermore and Rockmore 2019; Frankenreiter and Livermore 2020; Varsava 2020). "Law as data" analysis has been used for a variety purposes including assessing decisionmakers' different approaches to statutory interpretation (Choi 2020), or uncovering patterns in legislation that may be difficult to detect through hand collection (Frankenreiter and Livermore 2020).

Scholars in law and finance have already applied NLP methods in the context of SEC filings. Studies in this tradition typically examine public company disclosures on EDGAR, which permit

20. NLP methods are commonly used when analyzing legal texts using law-as-data approaches due their ability to process large amounts of unstructured textual information. The difficulty is in reducing dimensionality of textual data, permitting further analysis of semantic content for other scholarly ends. Example methods include sentiment analysis, named entity recognition, part-of-speech tagging, semantic role labeling, and topic modeling (Blei 2012; Blei and Lafferty 2007; Carter, Brown, and Rahmani 2016; Patz, Thorvaldsdottir, and Goetz 2022), all of which may provide valuable descriptive insights into law's textual memorializations.

comparison with other widely available financial metrics for public companies (Loughran and McDonald 2016, 2020; Jiang, Pittman, and Saffar 2022; Lopez-Lira 2020; Frankenreiter et al. 2022). In their governance function, SROs also must submit filings with the SEC, but just of a less familiar sort. Form 19b-4 requires SROs to describe the rule or rule change they wish to enforce, as well as to submit their justifications for public review and comment in most circumstances. Like other kinds of regulated-company filings with the SEC, these are ultimately disclosures to the market about the SRO's regulatory plans.

These sorts of methods can be used to study the production of stock market and SRO rules, as well as the SEC's own rules, from Federal Register filings. NLP may allow for a more comprehensive analysis of the content and structure of these documents than is possible with traditional manual methods. By applying NLP techniques to large datasets of rule filings, we can better understand how different types of securities laws are created and enforced.[21]

NLP has potential applications for studying trends in stock market regulation over time. By leveraging large datasets with historical SRO rule filings over many years, for instance, we can track changes in regulatory attention and approach Hollibaugh (2019). This project's approach thus is like Mankad, Michailidis, and Kirilenko (2019)'s analysis of the CFTC's implementation of Dodd-Frank derivatives regulations, but focuses on the SEC and SROs instead. The time period covered by the data set, from 2000 to 2022, includes the entire history of modern equity market structure under Regulation NMS. In addition, that time period has been one of significant industrial reorganization within the capital markets industry. Textual evidence of changes in regulatory attention and approach might be used in conjunction with other relevant covariates about intervening court decisions (Choi 2021), executive politics (Kaufman 2020), and the like.

4.2 Introducing a semi-novel structured dataset of SRO rule filings

The Federal Register is the official publication of the rulemaking agenda of the United States federal government. It is published most days and agencies typically must publish their proposed rules in the Federal Register to notify the public and, in most cases, invite comment. Agency filers include the SEC, as well as the industry SROs that are required to engage in rulemaking.

The United States Government Printing Office provides access to bulk data files containing the full text and metadata of the Federal Register beginning in 2000.[22] I collect from GPO the bulk

21. Along these lines, scholars have examined linguistic differences in certain SEC enforcement releases before and after the enactment of the Sarbanes-Oxley Act of 2002 (Davalos and Feroz 2022), as well as in the decisions of FINRA arbitrators (Alexander and Iannarone 2021).

22. The availability of this data has led to an emerging literature that examines administrative rulemaking with textual methods. Choi (2021) studies the effect of a court decision on how the Treasury Department justifies its administrative rules in the Federal Register. Other examples include regulatory fragmentation (Kalmenovitz, Lowry, and Volkova 2022), complexity of law published in the Federal Register (Katz and Bommarito 2014; Wu 2022), in-

data files containing the universe of XML coded Federal Register files from 2000 through the end of 2022.

Using R, I bulk extract and clean[23] the bulk data for the period from January 2000 to December 2022 inclusive.[24] This bulk data constitutes 695,443 observations comprising rules, proposed rules, and notices in the Federal Register. I subset 33,373 filings in which the SEC is designated, one way or the other (see table 9), as the filing agency. This article focuses on only a small subset of the broader dataset.In parallel with this article, I am in the process of cleaning the non-SEC data further in preparation for releasing a public open source dataset, and preparing an explanatory paper and codebook for other users.

The first few words of the XML <SUBJECT> tag identify an SRO filing as such and also typically will describe the SRO that made the filing. I use regular expression matching to tag 23,862 filings as SRO rules and to extract the first-identified SRO as the filer.[25] This comprises a semi-novel structured dataset comprising metadata and textual contents for these SRO rule filings published in the Federal Register.[26]

4.3 Limitations on data and some mea culpas

It is worth mentioning limitations in the data and possible extensions in the analysis.

First, naive counts of filings in the Federal Register will tend to overcount SEC *and* SRO rule filings. With respect to the SEC, the Administrative Procedure Act's requirements for formal rulemaking contemplate notices to the public, and thus typically proposed significant rules will involve at least one proposal and one notice taking further action (like adopting a rule). Other SEC filings may not involve rules at all, such as regulatory disclosures like Paperwork Reduction Act justifications with respect to proposed data collections from the public.

The same may be true for SRO rule filings. For instance, SRO notices withdrawing proposed rule changes may well be published in the Federal Register and so appear in the dataset, but not reflect a new rule. In addition, as with the SEC, several filings may be associated with the same rule proposal – an initial notice, an amendment, an approval order, and the like. Raw filing

teragency coordination (Saito 2022), aviation regulation (Robinson 2017), and agency responses to comment letters (Kirilenko, Mankad, and Michailidis 2014; Levy and Franklin 2014).

23. The XML is hard to parse and there are data entry errors; table 9 shows all the way the SEC's agency name appears in the agency metadata before the cleaning process. See also Program Management Office, U.S. Government Printing Office, Federal Digital System: User Guide Document — Federal Register XML Rendition (Sept. 21, 2009).

24. In a possible future extension of the dataset's scope, additional data for the SROs only has been collected in plain text format back to 1994, for which I have already collected the files and metadata; further data is available in scanned PDFs back to the 1930s, but frankly I am not sure of the payoff of OCRing and cleaning this data.

25. See tables 1 and 2, collected from the SEC's website, for the starter list of current exchange and non-exchange SROs. I hand check the remaining untagged SRO entries for accuracy and hand code missing entries.

26. Figure 16 shows a schematic of the data acquisition process. I use TIDYTEXT and QUANTEDA in R to tokenize each filing's textual contents, remove stop words, and the like.

counts will overstate the number of SRO rules, and getting more accurate counts would require grouping not at the filing but the *regulatory file* level. SROs assign file numbers to their proposed rule changes according to a particular syntax.[27] These file numbers are typically reported in the `depdoc` field in the Federal Register XML. In the next iteration I plan to use fuzzy matching on the file number to collate filings into the "file" level as another way of trying to track changes between the proposal and acceptance stage.

Finally, by focusing on filings in the Federal Register, I only capture the output of the regulatory process. For this reason, we can detect withdrawals of filings that occur after the initial publication. But SROs work closely with their regulators, permitting more informal means by which the SEC can influence SRO rule proposals.[28] In that case, by focusing only on the output of this process, we miss capturing nuance in how the process potentially shapes proposals — such as by encouraging withdrawal (and thus nonpublication, and nonappearance in the dataset) of a proposal that is not likely to pass muster with the regulator. Rule 19b-4 filings are amenable to FOIA request, which is I guess the obvious next step here.

4.4 Open source dataset

I plan to introduce an open-access structured dataset of Federal Register filings from 2000-2022. I save this introduction, including codebook and the like, for other work.[29]

5 The substance of SRO rule changes

The purpose of this draft (as of December 27, 2023) is modest: it is to introduce a constellation of projects that use computational and natural language processing methods to shed light on basic unexplored empirical questions about the production of stock exchange and SRO rules in securities law. To that end, this section reports basic summary statistics about the rules and uses a sentiment-based textual measure to test claims about regulation and the public interest. In particular, I undertake sentiment analysis to test several hypotheses about the effect of financial

27. Current Form 19b-7 explains that "a file number ... is assigned by the SRO, [and] includes the initials of the SRO, the 4-digit year and the number of the filing for that year (SR-[SRO]-XXXX-XX)."

28. For instance, Kappos et al. (2023) report "uncertainty" in the rule filing timeline "because ... a proposed rule change has not officially 'been received by the Commission' if the filing is deemed deficient.... The Commission commonly asks exchanges to clarify aspects of a proposal or provide further elaboration in Form 19b-4 and then resubmit."

29. *Introducing an open-access structured dataset of Federal Register filings (2000-2022)* is in the works, but I have not yet had a chance to do it in the three months I have been shopping this project around so far. The difficulty is that I didn't clean the whole dataset yet, just the part I was using. The tentative target will be for Nature's peer reviewed data journal Scientific Data. I may ask one of my research assistants with data cleaning skills to co-author this with me.

crisis or instability on the proportion of words with an "uncertainty" sentiment.

5.1 Descriptive analysis of SEC and SRO rulemaking

There is a lot of low hanging fruit in this space.

This broad extension of the project would be a descriptive contribution, focusing on the substance of the rules and what they tell us about the varieties of industry self-regulation.[30]

In this context, we might predict that the content of proposed rule changes reflects the interests of major market participants more than those of smaller players or the public interest. Topic modeling techniques can reveal patterns that support or contradict this hypothesis. I employ Latent Dirichlet Allocation (LDA) to identify a distribution of topics across the filings.[31] This can provide insights into the key areas of focus in rule changes over time. In particular, we might ask whether the identified topics more closely reflect the interests of major market participants or the broader public interest.

Using some of the more relatively straightforward NLP methods – LDA modeling and sentiment, compared by tagged SRO, as well as relative to the SEC's own non-SRO rule filings – this project provides an empirical analysis of the rise of these filings, the topics of these proposals, shifts in the usage and sentiment of language, and shifts in SRO regulatory attention.

Figures 25 and 26, in the appendix, report the top terms in each of 20 topics identified through LDA, as well as the measure of gamma for each LDA topic. Future extension include:

1. How does language differ between SEC and SRO rule filings, and what are some implications for regulatory approaches? For example, what differences do we see in the economic analysis for these filings?

2. Are there any correlations between particular topics that appear more frequently in one type of filing than another, or across different types of SROs?

3. Does natural language processing reveal any trends over time regarding changes in the content or structure of either type of filing?

30. Undertaking this approach would also involve subsequent work that would highlight complementary aspects of self-regulation with respect to FINRA, clearing agencies, and other SROs that might not be as evident with stock exchanges. For instance, these SROs have a different regulatory focus than exchanges, such as FINRA's focus on brokerage firms, and clearing agencies' handling of back-end processes in transfer and settlement. The substantive rules offered by these agencies can shed light on the "behind-the-scenes" aspects of self-regulation, such as how it handles technical, operational, and systemic risk.

31. I use the `ldatuning` package to estimate an optimal number of topics (Murzintcev 2016). The package calculates the number of topics using methods from Deveaud, San Juan, and Bellot (2014), Rajkumar et al. (2010), Juan et al. (2009), and Griffiths and Steyvers (2004).

5.1.1 Outcomes

In addition, I find a distribution of responses from the SEC that showcases the complexity of this regulatory process. Exchange Act Section 19(b) provides for different statutory pathways for the SEC to act, or not, on SRO rule proposals. These include mandatory notice-and-comment periods, immediate or accelerated effectiveness with a lookback period for comments, and the institution of SEC proceedings to modify or disapprove rule filings (Schwartz 2007). SRO rules can be tagged using textual markers of each of these different pathways. How do other textual indicia (like topic distribution) differ by the marker of delayed-or-immediate-effectiveness pathway (or of SEC response, like disapproval of the rule change)?

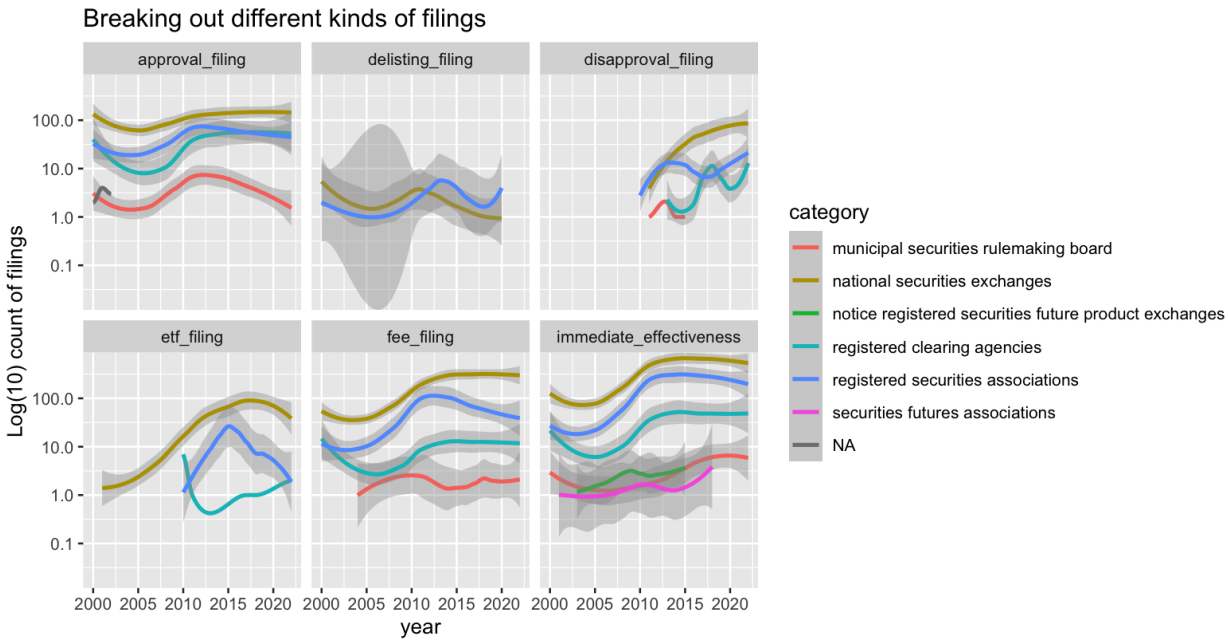


Figure 4: Time series of different kinds of filings. Y axis is the log count of filings. The different filing categories include Approvals, Delistings, Disapprovals, ETPs, Fee Filings, and Immediate Effectiveness. Plotted are the LOESS time series, for each category of SRO within each series, of number of filings per year.

The SEC's responses vary, comprising approvals, denials, modifications, and immediate effectiveness designations, each of which represents a distinct proportion of the total rule set. According to this analysis, the majority of filings (57.3%) match a tag for immediate effectiveness upon filing, reflecting the straightforward nature of these specific regulatory changes under Section 19(b)(3). Another 19.9% are approval filings, with a smaller proportion (3.2%) disapproval filings. The latter, with time series on a percentage basis shown in figure 5, suggests areas where further negotiation and refinement may be necessary to meet the SEC's regulatory standards.[32]

The SEC also modifies a substantial number of proposals (12.3%), reflecting its active role in

32. Time series in respective annual counts shown in figure 22.

shaping rules to better serve the market's needs. Finally, a small proportion (1.5%) are withdrawal filings, reflecting changed circumstances for the SRO or changed perceptions of the likelihood of approval.

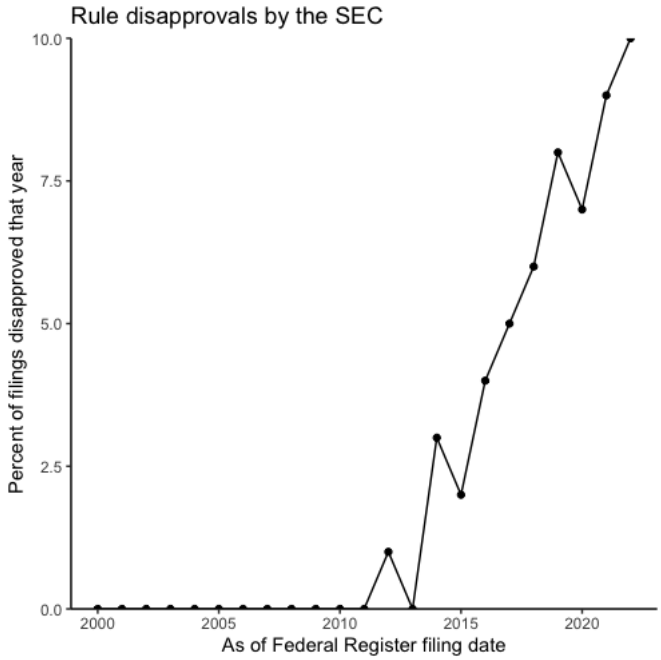


Figure 5: Disapproval filings as a proportion of annual exchange filings

Further extensions of this project will break down disapprovals as well as the SEC's orders instituting proceedings to determine whether to approve or disapprove the rule proposal.

5.2 Exchange traded products

An important area of SRO rule filing involves exchanges seeking permission to list new types of exchange traded products. Gault-Brown (2018, p. 119) calls the "19b-4 process," for "obtaining the SEC approval needed" to list a new exchange traded crypto product, "perhaps the biggest roadblock to date." The rule filing process extends beyond "significant and market-defining initiatives, including ... mechanisms to establish or permit direct listings, 'primary' direct listings, new issuer listing standards and new order types for trading on the exchange," to include requirements about new exchanged products, such as "proposals to list and trade a spot bitcoin ETP" (Kappos et al. 2023). The statutory basis for this authority is Section 19(b), which provides for SEC review and approval of "any proposed rule or proposed change in, addition to, or deletion from" an exchange's rules.[33]

33. "The listing or trading of a new securities derivative product qualifies as a proposed rule change. The SEC has deemed ETFs to be 'derivative products' for this purpose." As a result, to list a new ETP "the exchange must file a

To "normie" observers of financial markets not otherwise deep in the weeds of securities regulation, the SEC's treatment of ETPs is possibly the most salient use case of the Rule 19b-4 rule change proposal process. Bloomberg's reporter on the ETF beat reports regularly on crypto ETP filings on Form 19b-4 (e.g. Balchunas 2023). This space is also an active area of contestation before the D.C. Circuit.[34]

Figure 6 illustrates the prevalence of ETP filings by certain exchanges, showing that NYSE Arca, CBOE BZX, and Nasdaq Stock Market are top filers related to ETPs.

Figure 6: Exchange Traded Product filings time series.

proposed rule change under Rule 19b-4 ... to obtain the necessary SEC approval...." Rochelle Antoniewicz and Jane Heinrichs, *Understanding Exchange-Traded Funds: How ETFs Work*, ICI Research Perspective 20, no. 5 (September 2014), www.ici.org/pdf/per20-05.pdf (citing Amendment to Rule Filing Requirements for Self-Regulatory Organizations Regarding New Derivative Securities Products, Release No. 34-40761, 1998 WL 849547 (Dec. 8, 1998)); cf. 17 C.F.R. § 240.19b-4(e)(1) (providing for an exception where the Commission has approved class-wide trading rules for the ETP).

34. In August 2023, that court in *Grayscale Investments* (2023) granted a petition for review of the SEC's denial of a proposed rule change, which aimed to allow the listing of a spot bitcoin ETP. NYSE Arca had filed a proposed rule change to list a spot Bitcoin ETP. After the SEC denied the request, Grayscale appealed, arguing that the Commission wrongly denied their bitcoin ETP while approving others that were very similar.

The SEC had denied the application based on a "significant market" test. The SEC's decision had revolved mostly around concerns about fraud and manipulation. Their primary point was that Grayscale's ETP, due to its large asset base, could significantly influence Bitcoin prices on the CME, which in turn could lead to market manipulation. The SEC had found that there wasn't a reasonable likelihood that a manipulator of Grayscale would have to trade on the Chicago Mercantile Exchange (CME), but did not require the same of other Bitcoin futures ETPs. Grayscale countered this by pointing out that they only own 3.4% of all outstanding bitcoins, and so they couldn't dominate the Bitcoin price. They argued that any impact they might have on the spot market would be minimal and thus shouldn't influence the futures market. The panel agreed, finding that these purported inconsistencies in the SEC's treatment of the Grayscale spot ETP and other futures ETPs meant the denial was arbitrary and capricious.

5.3 Changes in uncertainty, litigious, and constraining sentiment around financial instability

The literature on the role of stock exchanges in maintaining market stability suggests a hypothesis that proposed rule changes intensify and focus more on risk management and investor protection during periods of market volatility or crisis. By contrast, Mahoney (2015) argues that rule changes after periods of market volatility or crisis reflect scapegoating and capture — regulators trying to deflect blame after earlier regulatory efforts failed to stop a crisis. These debates tee up deeper questions about the role of securities regulation, and whether it ought to be prescriptive or principles-based.

Prescriptive regulation, also known as rules-based regulation, is a traditional approach to securities regulation where detailed rules are set out, specifying exactly what firms must do or must not do. This method has the advantage of clarity, as it provides specific guidance and leaves little room for interpretation. However, it can also be rigid and might fail to adapt quickly to evolving market conditions or new financial products and services.

In contrast, risk-based or principles-based regulation provides general principles or guidelines that firms must follow, allowing for greater flexibility and adaptability. In some areas of securities law, "'principles-based' approaches predominate — those approaches allergic to providing bright-line answers to the application of law" (Tierney 2022, p. 433). Rather than focusing on specific rules, this approach is concerned with the outcomes of the firm's actions and gives firms more discretion in deciding how to achieve those outcomes. This could lead to more innovative solutions, but it could also pose more risk if firms do not adequately manage their own risks or if they interpret the principles in a way that's inconsistent with regulatory intent.

These two regulatory approaches might influence the text of proposed SRO rules in different ways. For instance, in a prescriptive regulatory environment, proposed rule changes might be more detailed, specific, and technical. The language might also reflect attempts to close loopholes or address specific instances of non-compliance. The potential for regulatory capture might be more pronounced, as powerful industry actors could influence the drafting of highly specific rules to their advantage.

In a principles-based approach, on the other hand, the proposed rules might be more general, focusing on high-level objectives and outcomes rather than specific actions. The language could reflect a broader concern for risk management and investor protection, particularly during periods of market volatility or crisis. This approach might also alter the dynamics of regulatory capture, as the broad nature of the principles could make it harder for industry actors to tailor rules to their advantage.

A comparison of this literature and background institutional knowledge of the process of rule

production generates at least three hypotheses testable by NLP methods:

Hypothesis H_1: During recessions, the text of proposed rule changes focuses more on risk-based approaches (as measured by uncertainty words) and less on prescriptive approaches (as measured by constraining or litigious words).

Hypothesis H_2: After the financial crisis of 2008, the text of proposed rule changes focuses more on risk-based approaches and less on prescriptive approaches (measured the same way).

Hypothesis H_3: For rule change filings eligible under Exchange Act Section 19(b)(3) to go effective immediately,[35] the text focuses less on risk-based approaches and more on prescriptive approaches (measured the same way).

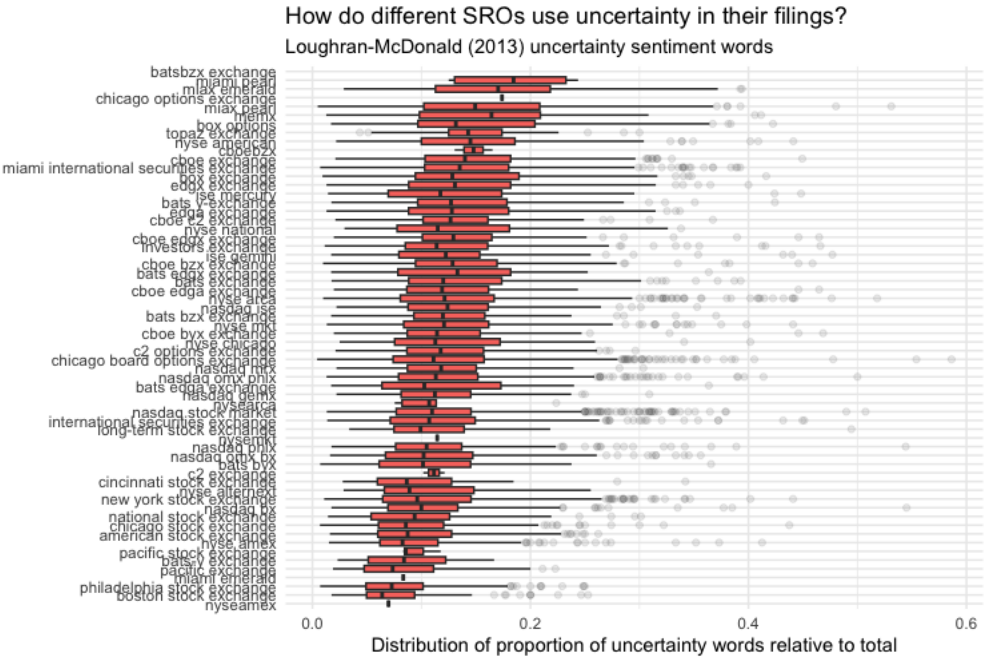


Figure 7: Use of uncertainty-sentiment words by SROs. The x-axis shows, for each SRO, a boxplot with the distribution of the use of Loughran-McDonald uncertainty words across filings by that SRO in the dataset. The underlying metric at the filing level is the proportion of uncertainty words to total Loughran-McDonald tagged words.

5.3.1 Method and Hypotheses

These hypotheses can be explored by comparing the content of proposed rules during periods of market volatility. To test these hypotheses, I analyze changes in sentiment expressed in the

35. This is because Rule 19b-4(f) permits immediate effectiveness with respect to, among other things, (1) "a stated policy, practice, or interpretation with respect to the meaning, administration, or enforcement of an existing rule," (2) a change "establishing or changing a due, fee, or other charge applicable only to a member," and (3) "concerned solely with the administration of the self-regulatory organization."

text over time. For different stock exchanges, the sentiment scores can be computed separately, providing a comparative view of sentiment dynamics, as figure 7 illustrates.

I use a domain-specific sentiment lexicon to improve the accuracy of the sentiment analysis. The Loughran-McDonald Finance Word Corpus is a financial lexicon that was developed specifically for the purpose of analyzing financial text (e.g. Loughran and McDonald 2011; Bodnaruk, Loughran, and McDonald 2015; Loughran and McDonald 2016), including financial regulatory filings. The corpus contains a list of words that are categorized into various sentiment groups, such as `positive`, `negative`, `uncertainty`, `litigious`, and the like. The 'positive' and 'negative' categories include words that typically carry positive or negative connotations in a financial context, which may differ from their sentiment in general usage. This is the primary reason to use a special dictionary: it can be used to perform a more accurate sentiment analysis of financial text than a general English lexicon, allowing us to capture the unique sentiment of words in a financial context. As Loughran and McDonald (2011) point out, "liability" has negative sentiment in ordinary English in a way it does not necessarily in a financial context.

Suppose with me, notwithstanding section 5.3.3 below, that the Loughran-McDonald dictionary is a valid measure of sentiment in regulatory filings other than 10-Ks. By applying the corpus to regulatory filings over time, we can track changes in the uncertainty expressed by the SRO, shedding light on how its situation and strategy evolve surrounding periods of market stability or volatility. I define three periods of market-wide instability based on NBER's list of business cycle recessions (National Bureau of Economic Research, US Business Cycle Expansions and Contractions), also reported in table 11, and assign a dummy variable to each filing based on whether it is within one of those recession periods. I define an "after-crisis" period as a dummy indicating whether the filing is before or after September 15, 2008, the date of the bankruptcy of Lehman Brothers.[36]

I first pre-process the text data (e.g., removing numerals and stop words). Next, using the Loughran-McDonald dictionary, I perform sentiment analysis on the rule proposals, calculating sentiment scores for each proposal based on the occurrence of positive, negative, uncertainty, and litigious words from the corpus in each rule proposal. The top words within each sentiment tag can be seen in figure 9.

The frequency of these words relative to the total sentiment-scored can be calculated at the SRO and proposal levels, as figure 7 shows with respect to the varying scores of SROs on the uncertainty metric. I use these comparative metrics for the "uncertainty," "constraining," and "litigious" words as proxies to permit analysis of the proposals' focus on risk, requirements, and enforcement respectively.

These scores can then be analyzed over time to detect shifts in sentiment corresponding to

36. See also figure 3 above.

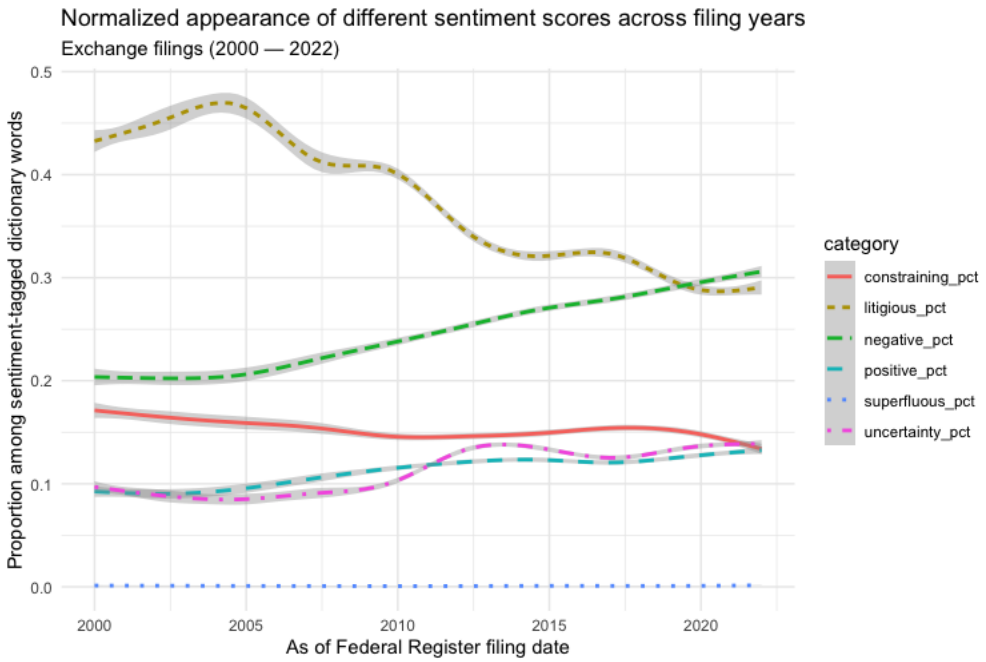


Figure 8: LOESS time series of the proportion of words within a category, among total sentiment-encoded words, grouped at the filing level. Sentiment lexicon comes from Loughran and McDonald (2011).

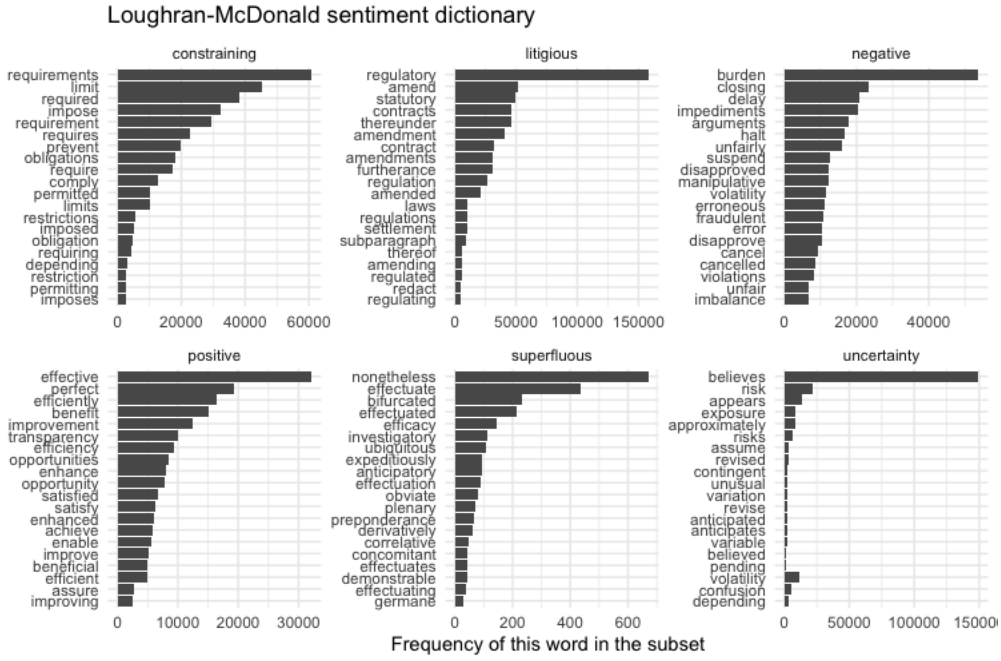


Figure 9: Top words by Loughran-McDonald sentiment among exchange filings

periods of market stability or instability. I compare sentiment scores for these rule proposals between stable and volatile periods (see also figure 8). The null hypothesis is that there no differences between the sentiment scores for uncertainty between stable and volatile periods.

I estimate several specifications for an OLS regression,[37] with the following example for specification 4 in table 3:

$$\begin{aligned}\texttt{uncertainty\_pct}_i = \beta_0 + \beta_1\texttt{recession}_i + \beta_2\texttt{after\_crisis}_i \\ + \beta_3\texttt{immediate\_effectiveness}_i + \epsilon_i\end{aligned}$$

5.3.2 Results

I report the results of these regressions with the proportion of uncertainty words as the dependent variable in table 3; additional tables 7 and 8 in the appendix reflect proportions of constraining and litigious words respectively.[38]

The findings point to some interesting dynamics in the way financial regulators respond during periods of crisis, specifically in terms of how the language of rule filings changes. These changes reflect shifts in regulatory focus and the balancing act between managing uncertainty, addressing risk, and protecting investors, and they offer a window into the regulators' mindset and priorities during different market conditions.

Focusing here on table 3 and uncertainty words, we can reject the null hypothesis that there are no differences in the use of uncertainty words during recessions, after the financial crisis, and in immediate-effectiveness filings. Consistent with hypotheses H_2 and H_3, the regression coefficients reported in the table reflect that filings after the financial crisis and immediate-effectiveness filings each reflected higher proportions of uncertainty words, significant at the $p < 0.001$ level. Rejecting the null hypothesis here would provide some support for the theory that proposed rule changes intensify and focus more on risk management and investor protection during periods of market volatility or crisis.

The increase in the use of uncertainty words in rule filings after the financial crisis and in immediate-effectiveness filings is revealing.[39] It suggests that during these periods, SROs ac-

37. All analyses were performed using R Statistical Software v4.2.2 (R Core Team 2022). Specifications 1 through 4 were modeled using the lm function, while 5 through 8 were modeled using felm, which "uses the Method of Alternating projections to sweep out multiple group effects from the normal equations before estimating the remaining coefficients with OLS" (Gaure 2023, 2013).

38. For instance, what appear to be significant negative point estimates with respect to the use of constraining words after the financial crisis disappear once we account for whether a filing shows the indicia of going effective immediately, which is itself associated with a significant negative point estimate of an about five percentage point decrease in the proportion of constraining words in those filings.

39. Implications are unclear about the use of more uncertainty words in immediate-effectiveness filings. The categories of rule changes eligible for immediate effectiveness often relate to the interpretation, administration, or enforcement of existing rules, which might involve a degree of flexibility or discretion on the part of the SRO (or FINRA as its enforcement arm). The other categories of immediate-effectiveness changes—altering dues, fees, or charges, and changes related solely to the administration of the SRO—may seem less likely to be associated with increased uncertainty. However, even here, the language could reflect uncertainties related to the potential impact

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(Intercept)	0.125 ***	0.094 ***	0.091 ***	0.089 ***				
	(0.001)	(0.002)	(0.001)	(0.002)				
recession	−0.021 ***	−0.011 ***		−0.010 ***	−0.014 ***	−0.009 ***		−0.009 ***
	(0.002)	(0.002)		(0.002)	(0.002)	(0.002)		(0.002)
after_crisis		0.034 ***	0.036 ***	0.031 ***		0.025 ***	0.027 ***	0.022 ***
		(0.002)	(0.002)	(0.002)		(0.002)	(0.002)	(0.002)
immediate_effectiveness				0.012 ***				0.011 ***
				(0.001)				(0.001)
Num.Obs.	17 905	17 905	17 905	17 905	17 905	17 905	17 905	17 905
R2	0.007	0.032	0.031	0.039	0.065	0.073	0.071	0.078
R2 Adj.	0.007	0.032	0.031	0.039	0.062	0.070	0.069	0.076
Log.Lik.	23 565.173	23 796.310	23 781.082	23 856.415				
F	126.874	299.199	566.988	240.994				
RMSE	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06

Table 3: Regression output with eight specifications, with the dependent variable as the proportion of uncertainty words among total sentiment-encoded words at the filing level. Sentiment lexicon comes from Loughran and McDonald (2011). The latter four specifications include fixed effects at the filing-SRO level. The independent variable "recession" is coded as 1 if the Federal Register publication date is within one of the recessionary periods identified in table 11, and 0 otherwise. The variable "after crisis" is coded as 1 if that date is after September 15, 2008, and 0 otherwise. The variable "immediate effectiveness" is coded as 1 if the `subject` field in the Federal Register XML matches a regular expression pattern that captures filings declared to be immediately effective, and 0 otherwise. For each variable, the first line shows the point estimate followed by an indicator for the level of statistical significance (+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001), and below that the standard error in parentheses.

knowledge the heightened levels of uncertainty and, correspondingly, propose rules that aim to manage this uncertainty. This supports the hypothesis that rule changes intensify and focus more on risk management and investor protection during periods of crisis. It also suggests that in moments of crisis, regulators might be more responsive and adaptive to changing conditions, quickly proposing rules to mitigate risks and protect investors. (It is also consistent with the Mahoney (2015) hypothesis that post-crisis rulemaking is likely to be reactive.)

By contrast, we can also reject hypothesis H_1, because the observed effect is in the other direction. Contrary to the hypothesis that the proportion of uncertainty words goes up during a recession, we see from the various tables that rule filings during recessions exhibit a statistically significant decrease in the proportion of uncertainty words, and modest and insignificant increases in the proportion of constraining and litigious words.

The decrease in the proportion of uncertainty words during recessions is counterintuitive. This could be interpreted in several ways. One possibility is that during recessions, regulators aim to project stability and avoid adding to the prevailing sense of uncertainty. In other words, their language in rule filings might be deliberately less uncertain to counterbalance the market's instability and maintain confidence. This could also reflect a shift in focus towards more immediate and tangible issues, with regulators possibly opting for a more direct and pragmatic approach to managing the economic downturn. The insignificant increase in the proportion of constraining and litigious words might reflect an increased attention to enforcement and compliance during these periods, although the changes are not statistically significant.

5.3.3 Objections and mea culpas

It is worth mentioning a possible limitation relating to the use of the Loughran-McDonald dictionary. Designed for 10-K filings, the dictionary is likely to be more accurate than ordinary English lexicons for sentiment or other text-analytical purposes. But it may still be inaccurate for the even more specialized field of SRO rulemaking and market structure. Future work in this space could generate a custom dictionary (e.g. Correa et al. 2017; Loughran and McDonald 2011), but adapted for the Rule 19b-4 process and industry jargon (see also Smelcer, Tucker, and Xia 2022).

of these changes on member behavior or the organization's functioning.

6 Rule production by for-profit regulators: Evidence from stock exchange regulation

This section is likely to be parceled off into a separate project, likely to be coauthored with Prof. Min. The dataset in this paper has a survivorship bias-free panel of exchanges' rule filings from 2000 to 2023, the span of the demutualization and consolidation trends in modern exchange regulation. This aspect of the project raises research questions about the process and incentives of rule production by stock exchanges, and applies text-as-data approaches to examine how changes in (for example) exchange business models change over time.

6.1 Exchange business models over time

Stock exchanges have undergone significant transformations over the past few decades due to several secular changes in the financial industry (e.g. Mattli 2019; Fox, Glosten, and Rauterberg 2015; Jackson 2001). The structure of the market for stock exchange services has changed dramatically since 2000, when Congress passed the Commodity Futures Modernization Act (CFMA). One of the most important trends in stock exchange market structure in the 2000s was demutualization, a process in which exchanges that had traditionally been member owned converted into publicly traded companies (Engelen and Grote 2009; Movsesyan 2007; Steil 2002; Beny 2002). As a result of demutualization, large holding companies like Intercontinental Exchange are responsible for coordinating and setting rules governing stock exchanges across many countries around the world.

Another trend in this space has been consolidation into these large exchange groups (Wójcik 2007). Technological advances and innovations have allowed exchange families to expand beyond traditional geographic borders. International Exchange, for instance, acquired NYSE Euronext in 2013. Consolidation gives larger entities greater control over global capital flows while reducing costs associated with operating multiple separate platforms at once.[40]

Besides demutualization and consolidation, competition with Alternative Trading Systems (ATSs), the merger of Electronic Communication Networks (ECNs) into most exchanges, and the rise of complex order types, data products, and fee structures have all had profound effects on the rulemaking process and revenue models of exchanges. Competition among different types of venues is having a significant impact on how SRO rules are created and enforced (Blanc 2007; Jordan and Hughes 2007). [41]

40. On the consolidation vs. fragmentation debate, see Gomber et al. (2017) and Coffee (1995).

41. See Coffee (2002), Macey and Kanda (1990), Colby and Sirri (2010), and Harvey (2008); see also Di Noia (2001);Poser (2001); cf. Pozen (1974).

As powerful exchanges have consolidated and adapted to compete with ATSs and integrate ECNs, they've gained substantial market power. This enables them to establish complex fee structures that can be difficult for regulators to oversee and for market participants to navigate. As Mahoney (2020, p. 27) has objected, "[t]he SEC is not well-suited to be a public utility rate regulator." By frequently modifying their fees and fee structures, often through SRO rule changes, these exchanges can potentially exploit this complexity to their advantage.

In addition, as Talley (2015) has explained, from a theoretical perspective, stock market regulatory competition can be seen in light of the "race to the top" vs. "race to the bottom" debates. Do companies choose markets with more stringent regulations because they offer better protection for investors, signaling quality? Or do they choose markets with lax regulations to avoid scrutiny?

This literature suggests a number of additional hypotheses potentially testable by NLP methods:

Hypothesis H_4: Effect of market consolidation. As exchanges consolidate, the literature suggests a trend towards harmonization of rules across merged entities. This is to reduce operational complexities and to provide a uniform trading environment for investors. Textually, we might expect to see a convergence in the language and structure of rules across previously separate entities.

Hypothesis H_5: Effect of competitive pressure. Scholars have long suggested exchanges have incentives to adopt rules that attract listings and trading volume. This might include more favorable listing requirements, enhanced transparency, and investor protection measures. The rules might also show evidence of innovation and adaptation to market needs. In addition, exchanges are increasingly participating in global markets, leading to the adoption of rules that facilitate cross-border trading, such as through mutual recognition agreements or harmonization with international standards.

Hypothesis H_6: Effect of demutualization. With demutualization, where exchanges transition from member-owned entities to shareholder-owned corporations, there is a shift in priorities towards profit maximization. This might lead to rules that are more business-oriented, focusing on efficiency, technology integration, and new revenue streams.

Hypothesis H_7: Effect of macroeconomic conditions and systemic risks. Larger, consolidated exchanges could pose systemic risks due to their increased importance in the financial system. We might see more rules focusing on risk management, contingency planning, and crisis management.

6.2 The role of fee filings

This section focuses on a peculiar and largely overlooked aspect of SRO rule production: the sectoral shift toward fee filings in response to competitive pressures.

Exchanges have increasingly focused on selling market data as a revenue source. They can use the SRO rulemaking process to create new data products and set fees for data access. This has sparked debates about the fairness and transparency of these fees, especially as market participants are more reliant than ever on timely and accurate data. Exchanges produce liquidity and price discovery in a context where asymmetric information can be profitable. Traders are willing to pay for access to, for example, so-called "depth of book" data that reflects the density of limit order interest at particular price bands around the "national best bid / offer." But this means an arms race to pay for data fees, at prices the exchanges set (Mahoney 2020).[42]

Fees are thus important to SROs, especially stock exchanges, for which they are a "primary source of income ... providing revenues that totaled $5.4 billion in 2016" (Markham 2019, 1210). On the flip side, brokerage industry trade association SIFMA reports from a survey of its members that brokerage "firms have continued to buy both proprietary and CTA data despite ... cost increases" at the firm level that range "anywhere from 967% to 2,916% (or more) just to get the same data in 2018 they were getting in 2010" (SIFMA 2018).[43]

Along with this data trend, we've seen greater complexity in order types, again through SRO rule changes. While these order types are thought to provide flexibility and efficiency for traders, they also create a more opaque and complex trading environment that can advantage sophisticated market participants.

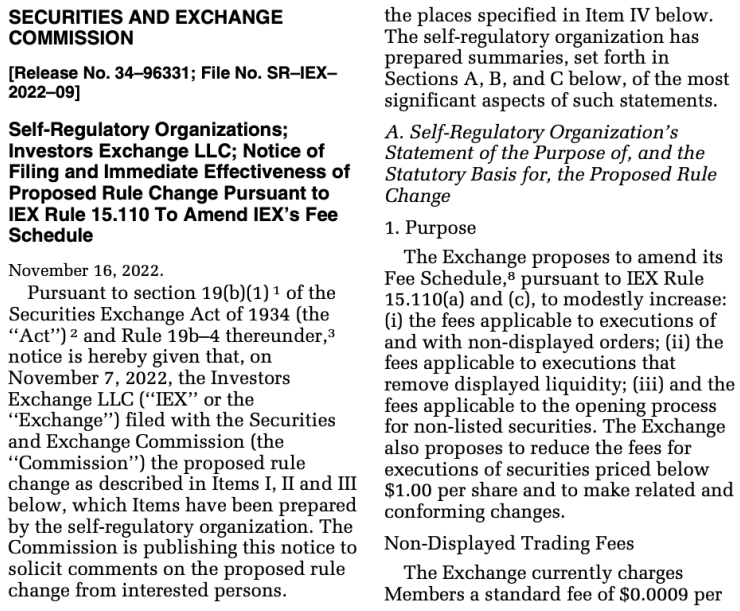
Let me illustrate with an example of an SRO proposed rule change that would implement a new fee for trade executions associated with particular order types and timing. Recall that under Section 19(b)(3), an SRO must file a proposed rule change for fees, but these can go into effect immediately. Figure 10 shows an example of a fee proposal by stock exchange IEX, filed with the SEC, which then published it in the Federal Register a week later.[44] The fee would "modestly increase ... fees applicable to[:] executions of and with non-displayed orders; ... executions that remove displayed liquidity; ... and ... the opening process for non-listed securities." IEX is an upstart exchange that has tried to innovate with respect to order types and the like, famously

42. On the PLI inSecurities podcast in 2020, the IEX exchange's John Ramsay talked about the role that the high-frequency trading arms race has played in demand by different market participants for depth-of-book data (Wolfe and Ekimoff 2020).

43. See also, e.g., Securities Litigation and Consulting Group, Inc., *An Economic Study of Securities Market Data Pricing by the Exchanges* (July 10, 2008), https://www.sifma.org/wp-content/uploads/2017/05/an-economic-study-of-securities-market-data-pricing-by-the-exchanges.pdf (arguing that the exchanges are market dominant and have monopoly pricing power with respect to, e.g., depth-of-book data).

44. In the appendix, code listing 1 shows how the first few lines of this fee filing are represented in GPO's bulk data XML.

through "speed bumps" that are thought to appeal to institutional traders seeking to avoid adverse selection by latency arbitrage traders.



SECURITIES AND EXCHANGE COMMISSION

[Release No. 34–96331; File No. SR–IEX–2022–09]

Self-Regulatory Organizations; Investors Exchange LLC; Notice of Filing and Immediate Effectiveness of Proposed Rule Change Pursuant to IEX Rule 15.110 To Amend IEX's Fee Schedule

November 16, 2022.

Pursuant to section 19(b)(1) [1] of the Securities Exchange Act of 1934 (the ''Act'') [2] and Rule 19b–4 thereunder,[3] notice is hereby given that, on November 7, 2022, the Investors Exchange LLC (''IEX'' or the ''Exchange'') filed with the Securities and Exchange Commission (the ''Commission'') the proposed rule change as described in Items I, II and III below, which Items have been prepared by the self-regulatory organization. The Commission is publishing this notice to solicit comments on the proposed rule change from interested persons.

the places specified in Item IV below. The self-regulatory organization has prepared summaries, set forth in Sections A, B, and C below, of the most significant aspects of such statements.

A. Self-Regulatory Organization's Statement of the Purpose of, and the Statutory Basis for, the Proposed Rule Change

1. Purpose

The Exchange proposes to amend its Fee Schedule,[8] pursuant to IEX Rule 15.110(a) and (c), to modestly increase: (i) the fees applicable to executions of and with non-displayed orders; (ii) the fees applicable to executions that remove displayed liquidity; (iii) and the fees applicable to the opening process for non-listed securities. The Exchange also proposes to reduce the fees for executions of securities priced below $1.00 per share and to make related and conforming changes.

Non-Displayed Trading Fees

The Exchange currently charges Members a standard fee of $0.0009 per

Figure 10: Two sample columns from the Federal Register for a fee filing by stock exchange IEX on November 22, 2022

A pertinent but almost entirely overlooked feature of stock exchange regulation is the ballooning presence of these "fee filings" among SRO rules, which are an interesting source of change in this space (Securities and Exchange Commission 2019), rising in proportion from 14% to 39% of the annual total stock exchange filings between 2000 and 2022. Figure 11 shows the time series trend in the rising share of filing notices among exchange proposed rule filings. Note from figure 11 that rising trends in the rates and proportions of fee filing notices predate the Dodd-Frank Act's reform in this area.[45] In Dodd-Frank, Congress provided that an SRO's proposed rule change to "establish[] or chang[e] a due, fee, or other charge imposed ... shall take effect upon filing with the Commission."[46] Even though such a rule goes into effect immediately upon filing, the SEC has 60 days to review the filing and decide whether to initiate proceedings to suspend the rule change.

The outcome of this process is important for exchanges and the users who pay the fees. Be-

45. As securities industry trade group SIFMA has explained in letters to the SEC, "there is no way of determining the extent to which the fees are in furtherance of a legitimate regulatory purpose or simply a means of providing a windfall to the exchange's shareholders at the expense of the investing public and member firms." Letter from SIFMA, Re: File No. SR-NASDAQ-2007-099 - Establishing Fees for Registering and Transferring Registration of Associated Persons (Jan. 23, 2008), https://www.sifma.org/wp-content/uploads/2017/05/sifma-submits-comments-to-the-sec-on-a-nasdaq-proposal-to-establish-certain-fees.pdf.

46. Exchange Act Section 19(b)(3)(A)(ii); *see* Pub. L. No. 111-203, §§ 717(c), 916, 929F(e), 124 Stat. 1652, 1833, 1854 (July 21, 2010).

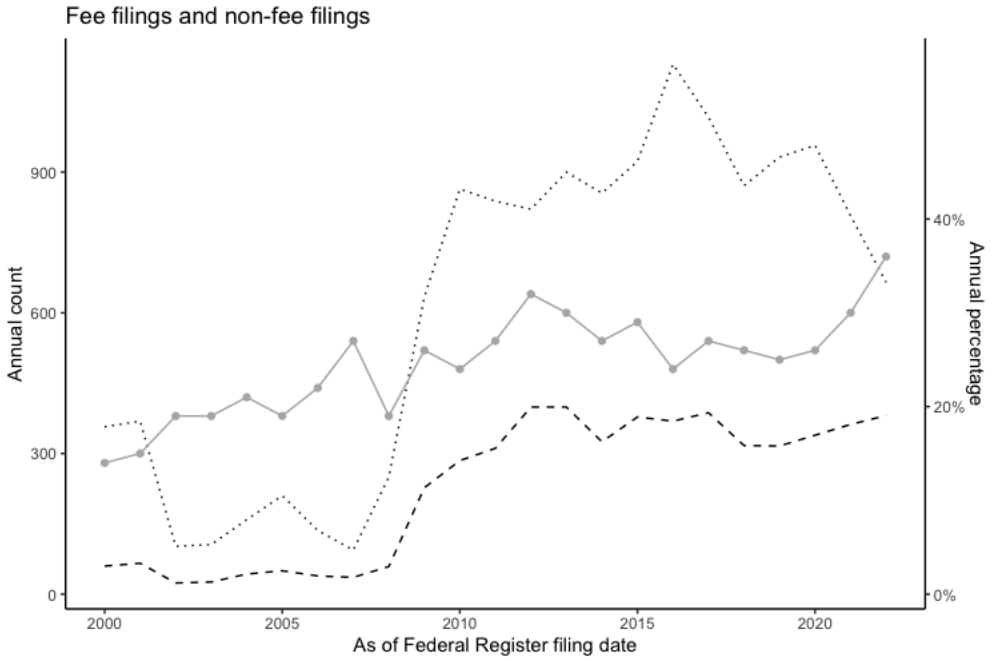


Figure 11: Annual counts and percentages of fee and non-fee filings, among the filings of national stock exchanges. The dotted line reflects non-fee filings, and the dashed fee filings. The grey line with tick marks, on the right y-axis, reflects the proportion fee filings make up of that year's filings. Data reported in table 9.

cause fee-related rule changes are legally enforceable on effectiveness, SEC review provides an important backstop against unrestricted price increases.[47] This is in parallel with broader policy concerns that people are subject to predatory overcharge of "junk fees."[48] Here, if the SEC decides not to suspend a fee rule, users are stuck. The SEC's decision not to suspend a fee rule is not reviewable.[49] In addition, the D.C. Circuit in 2020 foreclosed a different path for challenging "the reasonableness of generally-applicable fee rules."[50]

So while the changes described above — exchange consolidation into for-profit conglomerates, the rise of data feeds and complex order types, and associated fee revenue — are thought to

47. As the D.C. Circuit explained in NASDAQ Stock Mkt. v. SEC, 961 F.3d 421 (DC Cir. June 5, 2020), "when an SRO wishes to impose or change a fee for its services or products, it must file a rule change with the Commission, 15 U.S.C. § 78s(b), and the Commission must ensure that the rule change is 'not designed to permit unfair discrimination between customers, issuers, brokers, or dealers' and does not 'impose any [unnecessary] burden on competition,' id.§ 78f(b)(5), (8)." In reviewing SIFMA's challenges to these fees, the SEC adopted the so-called "market-based test" for assessing reasonableness. See Securities Industry and Financial Markets Association, Exchange Act Release No. 84432, at *22 (SEC Oct. 16, 2018), rev'd by NASDAQ, 961 F.3d 421; see also, e.g., Ferraro (2011) and Rysman and Schwabe (2021).

48. For other recent efforts in this space, see Stefania Palma. 2022. "Biden's Antitrust Adviser Warns of 'Profusion of Junk Fees' in US Economy." *Financial Times,* November 20, 2022; Unfair or Deceptive Fees Trade Regulation Rule Commission Matter No. R207011, 87 Fed. Reg. 67413 (Nov. 8, 2022).

49. NetCoalition v. SEC, 715 F.3d 342 (DC Cir. 2013)

50. *NASDAQ Stock Mkt,* 961 F.3d 421; see also SIFMA and Bloomberg LP, Order Vacating Prior Order and Requesting Additional Briefs, Exchange Act Release No. 89504, 2020 WL 4569089 (Aug. 7, 2020). On judicial review in this area, see, for example, Cox (2015).

have brought about efficiencies and innovations, they've also raised significant regulatory challenges. One question is how to ensure that the SRO rulemaking process, which was originally intended to harness industry expertise for the public good, is not co-opted to serve the private interests of powerful exchanges at the expense of market integrity and fairness.

Additional questions may bear on what NLP methods can tell us about trends in these fee filings relative to other disclosures by SROs about the sources of their revenue (Mahoney 2020). What do these trends reveal, in turn, about the political economy of stock market regulation — about whose interests matter in the production of SRO rules?

Finally, it is worth considering what methods would be applied in this extension of this project. I am envisioning an event study comparing exchange fee rule production to non-fee rules surrounding Dodd-Frank.

6.3 Stock exchange consolidation and the genesis of rule filings as text precedents

In addition to these topic modeling approaches, we might also address the industrial organization of the stock exchange industry as a market for intermediation services (e.g. Talley 2015; Pirrong 2014, 1999).

Stock exchange rules are a kind of transaction involving industry counterparties, regulators, and the public (Jin and Min 2021). In a world of contractual incompleteness and transaction costs, repeat players have an incentive to develop and reuse transactional precedent. That contracts may be relational complicates the matter.

Based on a survey of SROs, the SEC OIG has identified concerns — which it was unable to substantiate or "confirm" — that there may be "inconsistencies in the agency's approval of 'copycat' rules," or those "based on similar rules of another SRO or of the Commission" (Office of Inspector General 2016, p. 21). In addition, consolidation among industry SROs means that there are now several families of stock exchanges owned by common parents, families in which exchanges serve specialized functions. So transactional precedent may become sticky or show drift, regardless of desirability.

NLP methods can shed light on some of these questions. Most directly, Scott, Marantz, and Ulibarri (2022) study boilerplate text in agency regulatory documents and report a low degree of text reuse in the most administratively interesting and complex parts of the assessment at the end of an agency decisionmaking process. In addition, Nyarko (2021) examines material contracts filed with the SEC to determine the the role of law firm influence on the presence of dispute resolution clauses, and in particular the role of transactional precedents on the stickiness of contract language. Taking a different approach by measuring textual similarity with Levenshtein

distance, Anderson and Manns (2017) examine the role of attorney drafting in tailoring standard templates for merger agreements (Neal and Davis 2005, see also, e.g.,).

How, if at all, has this consolidation affected the transmission of SRO rule text between members of the same exchange family? What can similar methods, measuring the degree of standardization and similarity to "precedent" rule filings, tell us about the extent to which exchanges use prior 19b-4 filings as textual precedents for later 19b-4 filings? To what extent does consolidation make SRO rule text sticky?[51]

7 Strategic disclosure in the rule change process

This section turns away from the SROs themselves to examine instead the SEC-SRO relationship (Karmel 2010; 2006, e.g.). This process implicates traditional questions in the securities regulation scholarship about the optimal design and effectiveness of self-regulation in the securities industry (e.g. Mahoney 2020; Ma 2020; Hammond 2016; Gadinis and Jackson 2007; Macey and O'Hara 2005; Badway and Busch 2004; Dombalagian 2004; Michael 1995). This project's empirical approach helps inform questions, explored in section 8.3, about whether the design of stock market self-regulatory rulemaking is in the public interest.

7.1 Does complexity of the SEC's analysis respond to a judicial-review shock?

One interesting question involves changes in the depth and complexity of the analysis when the SEC, in a filing, articulates why it is approving the proposed rule. This reflects a deeper topic of significant interest in legal studies: how complex language is used in legal and regulatory documents (e.g. Hansford and Coe 2019; Benoit, Munger, and Spirling 2019).[52] Regulatory filings are often quite technical and have to be precise to avoid the ambiguity that generates loopholes and misinterpretations. Transactional incompleteness will make this unavoidable to some degree.

Exogenous influences on agency review may shape both the way that the SEC and its staff deploy complex language in Federal Register filings, as well as the way that the SROs frame and present their proposed rule changes to the staff. Thus, if the D.C. Circuit were to require the SEC to undertake more fulsome analysis in its rules,[53] it could increase the textual complexity and

51. Under consolidation of stock exchanges, we should expect a rise in the private market for securities law, given incentives for markets to both offer attractive, low-cost-of-compliance listing and trading services (Brummer 2008). Given this model of stock exchange competition as sellers in a market for private law, should we expect regulatory ossification or innovation? On ossification in rulemaking, see Pierce (2012), Yackee and Yackee (2012), and Livermore (2007).

52. For analogous work in the comparative exchange regulation context, consider Chan (2021).

53. See, e.g., Business Roundtable v. SEC, 647 F.3d 1144 (D.C. Cir. 2011); Chamber of Commerce v. SEC, 412 F.3d 133 (2005).

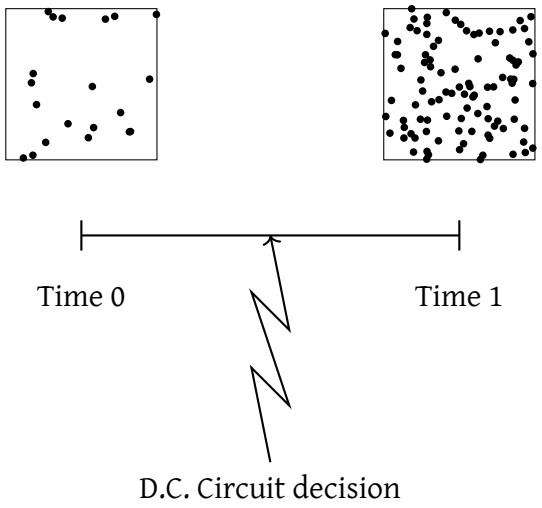


Figure 12: A stylized timeline of complexity, with the fill density of boxes above the timeline reflecting some measure of textual complexity.

token length as the agency attempts to be as precise and thorough as possible.

Scholars have noted the role of textual complexity in conveying meaning between legal actors, a problem that I think of as "regulatory obfuscation under asymmetric information." Scholars have considered the role of strategic obfuscation through bureaucratic delegation (Loftis 2014; Tran 2021). For instance, Stellner (2022) reviews the roles of "incomplete revelation hypothesis, management obfuscation hypothesis and agency theory" in conveying information through disclosure. In the accounting literature, managers have been found to use language that is more obfuscatory in corrupt firm disclosures (Jaeschke, Lopatta, and Yi 2018), as well as in responses to SEC comment letters (Condie 2017).

Scholars in political science have made similar findings, such as between the Supreme Court and Congress with respect to statutory interpretation cases (Owens and Wedeking 2011; Owens, Wedeking, and Wohlfarth 2013). In addition, regulatory discussions can carry informational content, at varying levels of obfuscation (e.g Apel, Grimaldi, and Hull 2022). Legal professionals may use complex language to obscure certain aspects of a document, make it more difficult for non-experts to understand, or shape the framing (e.g. Tierney 2020).

The principles behind the information-revelation models in this literature, focusing in a two-stage relationship such as between the Supreme Court and Congress, may apply with respect to judicial review of agency action. Judges interpreting SRO rules (or, more broadly, SEC rules) may consume the agency's rationales and explanations; their complexity might influence interpretation. A complex, detailed analysis by the SEC could provide more fodder for interpretation and potentially sway a judge's decision. On the flip side, supposing the SEC were worried about an increasingly anti-administrativist approach, we might likewise expect the SEC to generate more

detailed and complex texts to withstand this scrutiny. We encountered this once before, with the discussion of the *Susquehanna* (2017) decision.

Hypothesis H_8: Regulatory obfuscation under informational asymmetry. By measures of textual complexity (such as FOG and Fleisch-Kincaid reading level scores), the SEC's analysis and the SRO's analysis will increase in complexity with greater risk of review or reversal by a federal court.

Here, I examine hypothesis H_8. I examine textual indicia of the complexity of the SEC's analysis surrounding judicial decisions that act as shocks. In this version, I discuss *Susquehanna* (2017) and in future versions I extend to Business Roundtable v. SEC, 647 F.3d 1144 (DC Cir. 2011).[54] In these cases, the D.C. Circuit faulted the SEC for being insufficiently rigorous in its review of SRO rules. The SEC faced similar scrutiny in Chamber of Commerce v. SEC, 412 F.3d 133 (DC Cir. 2005), a case involving an SEC rather than SRO rule. As I have written elsewhere about the role of agency nonacquiescence at the SEC, because Exchange Act matters like SRO rules can *always* be appealed by right to the D.C. Circuit, adverse decisions from that court "potentially constrain[] the agency's [nonacquiescence] choice set in ways other courts' decisions do not" (Langvardt and Tierney 2022, fn. 62).

My research method employs a Regression Discontinuity Design (RDD) method to assess the causal impact of each case on the textual complexity of the SEC's regulatory filings, using readability scores (Fleisch-Kincaid, FOG, etc.) and token lengths as outcome variables, to find the local average treatment effect of an intervention of interest—here, a court decision.[55] The crux of the design rests on the treatment assignment determined by the timing of the D.C. Circuit's decision faulting the SEC for inadequate supporting analysis around each of these decisions.

The RDD exploits the fact that treatment assignment is determined by whether an observed covariate exceeds a known threshold along some variable. In this case, the variable is temporal, and the threshold is the moment a new rule becomes effective. The idea is to compare observations lying closely on either side of this threshold, under the assumption that they should be almost identical in all respects except for the application of the new rule. If significant differences in outcomes are observed between these two groups, it's plausible to attribute it to the impact of the rule change. For example, if the "law" changes at a given time, the rule changes 'treated' by the change (just after the threshold) can be compared with those 'untreated' (just before). Any discontinuity at this threshold would be evidence of the causal impact of the law

54. Thanks to Eric Talley for suggesting this extension.

55. On the method, see, e.g., Lee and Lemieux (2010). I am open to persuasion that this should be a fuzzy RDD design given that the threshold for treatment is the filing date in the Federal Register, which may lag by weeks the filing by the SRO of Form 19b-4 with the SEC. The concern here is that some pre-"treatment" filings will have snuck through and avoided "treatment" even though they are formally above the threshold.

change.

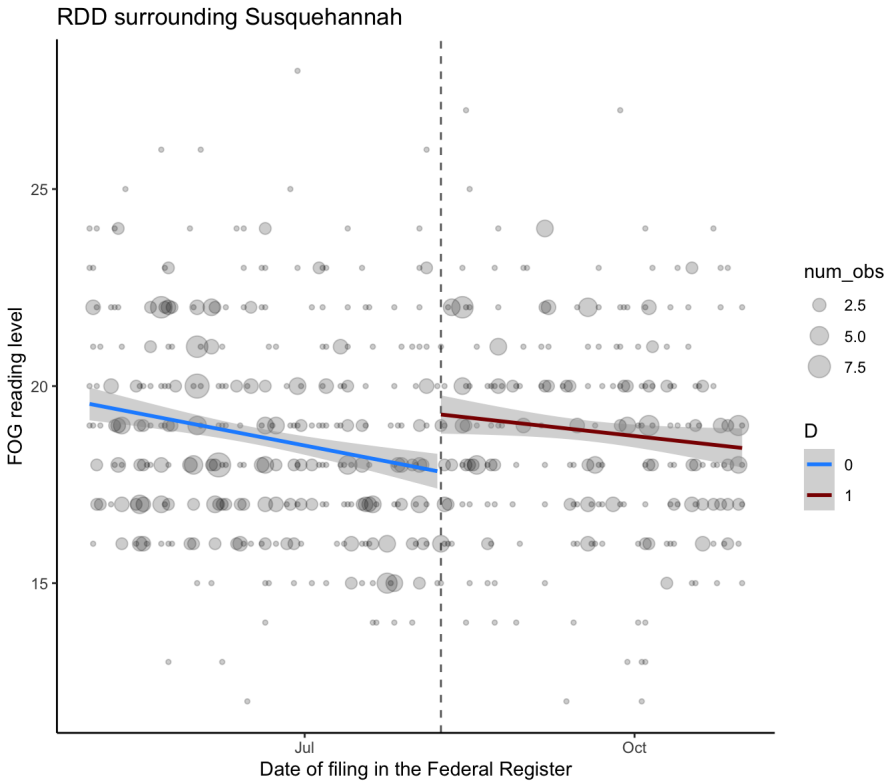


Figure 13: Regression discontinuity design estimating the local average treatment effect surrounding Susquehanna using FOG

A strength of this approach is the ability to mimic a randomized experiment in an observational setting, letting us infer causal relationships when controlled experiments can't be carried out.[56] Yet there are well-known limits to the method, such as heavy reliance on the assumption that observations just on either side of the threshold are otherwise identical, and the only difference between them is the application of the rule. This assumption may not always hold, especially if individuals can manipulate the assignment variable to place themselves on the 'preferred' side of the rule. Here, figures 23 and 24 provide suggestive evidence that there is no such bunching or manipulation around the threshold.

Another limitation is that it only provides a 'local' effect of the rule change—the point estimate for the LATE is only valid around the vicinity of the cut-off point and may not be representative of the effect in the larger population. For this reason, though the RDD method can shed light on immediate effects of rule changes, it may not be as useful in studying longer-term effects, unless multiple thresholds or changes can be observed and compared over time.

Here, I compare the textual complexity of the documents issued just before the decision (the

56. For a survey of the method, see Villamizar-Villegas, Pinzon-Puerto, and Ruiz-Sanchez (2022).

	(1)	(2)	(3)	(4)
(Intercept)	15.502 ***	18.835 ***	15.502 ***	18.835 ***
	(0.197)	(0.212)	(0.079)	(0.085)
running_var	0.086 *	0.077 +	0.086 ***	0.077 ***
	(0.036)	(0.039)	(0.015)	(0.016)
Num.Obs.	136	136	834	834
R2	0.040	0.028	0.040	0.028
R2 Adj.	0.033	0.021	0.039	0.027
RMSE			5.33	4.97

Table 4: Estimates of the LATE surrounding Susquehanna. Significance: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' Specifications regress the running variable on Fleisch-Kincaid (1) and (3), and FOG (2) and (4). Specifications (1) and (2) are adjusted by kernel weighting, while specifications (3) and (4) are unweighted. Kernel weight is defined by $1 - \frac{(abs(cutoff - running\ var))}{bandwidth}$

control group) with those issued just after the decision (the treatment group). This threshold-based design, with documents' issuance dates serving as the threshold variable, relies on the assumption that documents issued just before and after the decision are comparable, except for the impact of the court decision itself. The aim is for this RDD method to let us isolate and measure the LATE of a D.C. Circuit decision on complexity of the SEC's formal regulatory analysis, offering valuable insights into how legal decisions shape agency behavior and communication.[57]

I estimate several specifications for an OLS regression with the following example for specification 3 in table 4, for which figure 13 also shows a graph:

$$\texttt{Fleisch Kincaid}_i = \beta_0 + \beta_1 \texttt{Running Variable}_i + \epsilon_i$$

These results are consistent with rejection of the null hypothesis that Susquehanna had no effect on textual markers of complexity in SRO rule change filings. In other words, the results suggest that the decision in *Susquehanna* (2017) had a statistically significant local average treatment effect of increasing the Fleisch-Kincaid reading level of SRO rule filings by 0.086 and increasing the FOG score of the filings by 0.077. The SEC, in other words, seems to modestly but statitically significantly increase the level of complexity of its analysis following a judicial review shock.

One caveat. Not all portions of the published rule change proposals are likely to be affected in the same way, as figure 14 illustrates. For instance, precatory text and a description of the SRO's

57. RDD allows exploration of a quasi-experimental setup in an observational context and can provide robust evidence of a causal relationship if certain assumptions hold (S. Cunningham 2021). In doing this analysis, I test for optimal bandwidth around the cut-off and will perform other robustness checks. Kernel weighting also gives more emphasis to filings closer to the decision's date, enhancing the comparability of the treatment and control groups.

proposed changes are unlikely to be affected by a judicial decision signaling marginally greater scrutiny of the SEC's justifications for acting on rule changes. Rather, we should expect that the section set aside for the SEC's discussion, seen in representative filings as a section headlined "Discussion and Commission Findings," will be more acutely affected by the rule change. My initial analysis included the entire text (and thus in this thought might be biased toward false negatives).

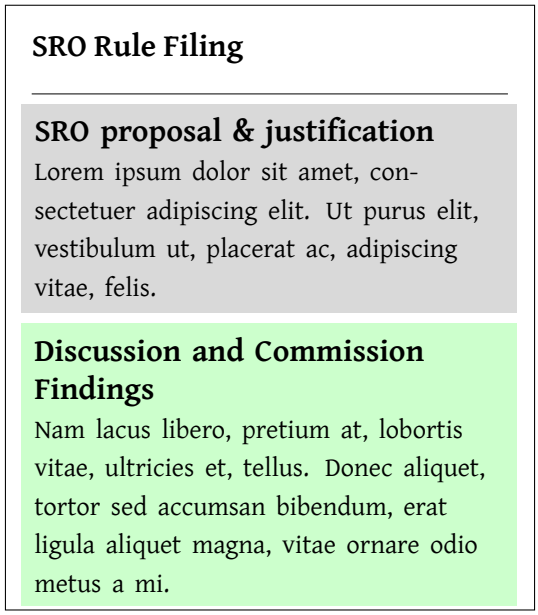


Figure 14: Illustration of an SEC rule filing, distinguishing between the SRO's own text and the SEC's text in response.

The next version of this project will replicate the analysis for the *Business Roundtable* (2011) and *Chamber of Commerce* (2005) cases. Additional robustness testing of the initial analysis will involve cleaning the textual data of interest to isolate (and focus on for NLP analysis) the text of the SEC's findings and discussion.[58]

In addition, this literature suggests a number of additional hypotheses potentially testable by NLP methods, which I consider in future work:

Hypothesis H_9: Readability and firm performance. Economic and accounting research often examines the relationship between the readability of financial disclosures and firm performance. For instance, studies have shown that firms with poorer performance or higher risk might use complex disclosures to obfuscate unfavorable information. Li's (2008) seminal work in this area found that firms with lower earnings or higher earnings uncertainty tend to produce less readable reports. This suggests a strategic use of complexity in disclosures as a response to underlying

58. With thanks to Jens Frankenreiter for the suggestion, a further robustness check will be to compare changes in complexity of analysis in SEC rule changes versus SRO rule changes surrounding these decisions.

economic conditions.

Hypothesis H_{10}: Market Reactions to Disclosure Clarity. Another strand focuses on how the market reacts to the clarity of disclosures. Research indicates that clear and concise disclosures are associated with less information asymmetry and lower cost of capital (Leuz and Wysocki, 2015). This suggests that when companies provide clearer information, it enhances investor trust and can lead to more favorable market outcomes for the company.

Hypothesis H_{11}: Mergers and mimicry. Mergers and consolidations among stock exchange families likely lead to increased mimicry and learning, resulting in more similar rules among exchanges within the same corporate group over time.

Hypothesis H_{12}: Innovation and Competition. According to the literature on competitive adaptation in self-regulation, one could hypothesize that the language and content of proposed rule changes reflect the stock exchange's efforts to adapt to competition from other exchanges and trading platforms. Exchanges that face greater competition from other exchanges or trading platforms will exhibit a higher rate of rule innovation, as they seek to differentiate themselves and attract more listings and trading volume.

Hypothesis H_{13}: Hypothesis on Regulatory Responsiveness. Exchanges are likely to demonstrate quicker regulatory responses in their rule changes following major financial scandals or crises, reflecting an effort to maintain market integrity and investor confidence.

Hypothesis H_{14}: Hypothesis on Market Dynamics and Rule Complexity. There will be a correlation between market complexity (such as the number of listed companies, trading volume, and product diversity) and the complexity and frequency of rule changes, suggesting that more dynamic markets require more nuanced regulatory frameworks.

Hypothesis H_{15}: Hypothesis on Regulatory Cycle. There will be identifiable cycles in regulatory activity, with periods of intense rule-making following crises or significant market developments, followed by periods of relative stability.

8 Implications

8.1 Other forms of self regulation

As the primary regulator of stock exchanges in the United States, the SEC oversees securities industry self regulation within its statutory jurisdiction. The Federal Register dataset is not limited to the SEC or to SRO rules, and there may be important lessons that can be drawn by comparing the dynamics discussed in this project with other instances of federally managed industry self-

regulation.

In other areas of regulation, SROs are overseen by other federal regulators like FERC or the CFTC. For example, the Federal Energy Regulatory Commission (FERC) regulates electricity markets through its oversight of regional transmission organizations (RTOs). These RTOs are responsible for managing wholesale electricity markets in their respective regions. Similarly, the Commodity Futures Trading Commission (CFTC) oversees futures exchanges such as CME Group Inc., which offers a variety of financial products including commodities futures contracts and options on futures contracts.

Scholars have examined the processes in which SRO rules are produced in these other regulatory contexts (Leblebici and Salancik 1982; Hammond 2016; L. A. Cunningham 2016; Moot 2010).[59] Scholars have observed that the CFTC approves almost all proposed SRO rules, raising concerns about how the statutory burden is allocated in the usual case — on SROs in seeking SEC approvals, but on the CFTC in pursuing disapproval (Fischer 2015). Meanwhile, these regulatory contexts may be close enough to permit meaningful cross-agency comparison, as in Choi (2021)'s use of the Federal Register to compare how a change in deference owed to this IRS changes its use of statutory interpretation relative to other agencies' use.

This kind of transsubstantive look at the production of federally overseen self-regulation may also inform ongoing and vibrant debates among administrative law scholars about delegation and legitimacy in the administrative state. As Edwards (2022) observes, recent anti-administrativist challenges related to things like appointments, removal, and commission structure are likely to spread to SROs.

This raises the stakes for how we think about the role of SRO rulemaking in our constitutional structure.[60] As Edwards (2022) observes, recent anti-administrativist challenges related to constitutional structure issues like appointments, removal, and commission structure are likely to spread to SROs. Recently in *Alpine Securities Corp. v. FINRA*, No. 1:23-cv-01506-BAH (D.C. Cir. Jul. 5, 2023), the D.C. Circuit issued an injunction pending appeal of a FINRA expedited enforcement proceeding involving sanctions like expulsion of the firm from the brokerage industry. Judge Walker issued a concurrence suggesting that, under recent Supreme Court precedent, FINRA hearing officers exercise the executive powers of the United States. As Tierney and Edwards (2023) ar-

59. In a symmetrical fashion as in the securities industry, futures exchanges, or boards of trade, may "make rules, monitor the actions of individuals and entities trading on their contract markets, enfore compliance with their rules, and discipline those that violate the rules" (Fischer 2015, p. 76). RTOs and futures exchanges make rules through a process of consultation with their members. This includes soliciting input from market participants, conducting economic analysis, and engaging in public comment periods. The federal overseers review these proposed rules to ensure they are consistent with the applicable laws and regulations. If the proposed rule is approved by the regulator, it can be implemented by the RTO or exchange.

60. Consider Krent (2011, 1990). On the longstanding circuit split over SROs as state actors, see, e.g. Lukacs (2012–13), Nafday (2010), Karmel (2009), Cleveland (2005), and Stone and Perino (1995).

gue, between *Alpine* and *SEC v. Jarkesy*, pending before the Supreme Court, we are on the verge of reconsidering the very nature of self-regulation in our system.

8.2 Implications: *ripped from the headlines* edition

8.2.1 Equity market structure reform proposals

The modern system of SROs is the consequence of the Securities Acts Amendments of 1975, which brought about the national market system in securities (Werner 1975). Critics have faulted Regulation NMS for "hinder[ing]" the "organic development" of a competitive national market (Peirce 2018, 661–62) and have suggested a deregulatory approach that is said to promote autonomy and flexibility (Mahoney 2020; Clayton and Redfearn 2020).

One consequence of the current national market system is the consolidation of exchanges within corporate groups, as well as the proliferation of order and fee types. These questions bear on competitiveness, innovation, and the extent to which exchanges — in the era after demutualizing and becoming for-profit entities — are spinning off agency costs as some SRO governance theories suggest (cf. Tierney 2022).

These debates about how to structure capital markets are not stale. In December 2022, the SEC approved a package of new market structure rules that are thought to tend to push transactions into greater liquidity and transparency, like the exchanges.[61] It is unclear whether these market structure rules will go into effect, as a draft (as of December 27, 2023) spending bill would prohibit the SEC from pursuing three of them (Waddell 2023). In any case, if they or future reforms do go through, it might have second-order effects on the competitiveness of exchanges relative to alternative trading systems. We should therefore expect to see a greater degree of innovation in auction formats if the equity market structure reform proposals are adopted.

8.2.2 Cryptocurrency and exchanges

Stock exchanges face significant regulatory pressure, not only within their sector from alternative trading systems, but also from other asset classes. Before a secular slowdown in cryptocurrency markets, we saw significant growth among trading platforms for cryptocurrencies (Johnson 2020–21).

The SEC has increasingly taken the tack of referring to some cryptocurrencies as "crypto

61. See, e.g., Proposed Rule: Order Competition Rule, Exchange Act Release No. 96495, 88 Fed. Reg. 128 130 (Jan. 3, 2023); Proposed Rule, Regulation Best Execution, Exchange Act Release No. 96496, 88 Fed. Reg. 5,440 (Jan. 27, 2023); Proposed Rule, Regulation NMS: Minimum Pricing Increments, Access Fees, and Transparency of Better Priced Orders, Exchange Act Release No. 96494, 87 Fed. Reg. 80,266 (Dec. 29, 2022); Proposed Rule, Disclosure of Order Execution Information, Exchange Act Release No. 96493, 88 Fed. Reg. 3,786 (Jan. 20, 2023).

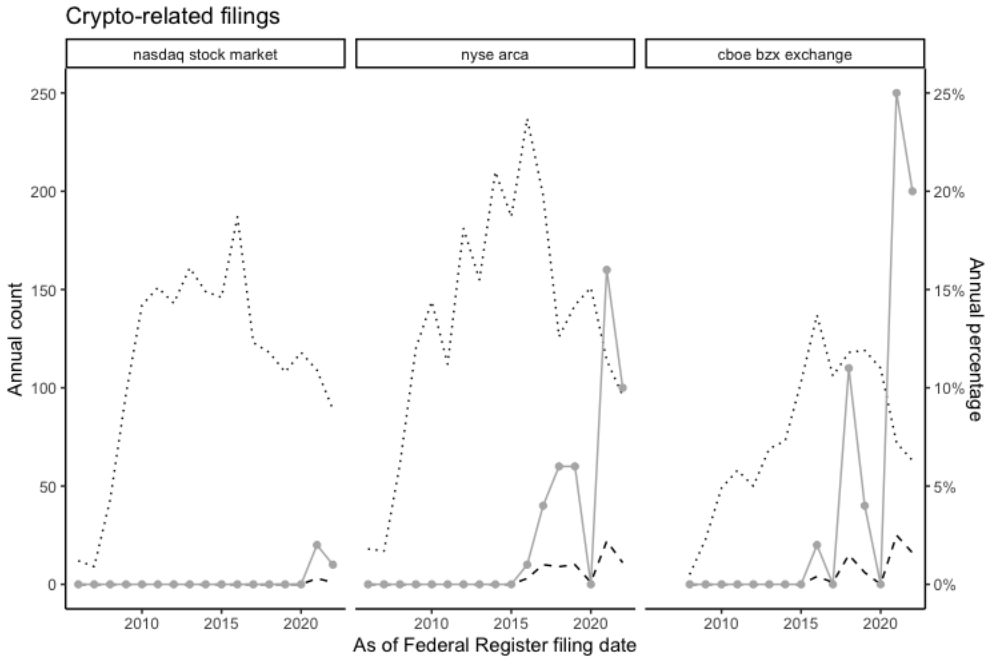


Figure 15: Crypto-related filings at the three exchanges with more than de minimis number of filings that matched with regex tags for "bitcoin" or "crypto". A future update will include the term "blockchain." Axes as in figure 11 above.

asset securities," as a way of sidestepping threshold definitional questions in the case of assets that meet the "investment contract test." But the implication is that the panpoly of the securities laws might apply in the case of crypto asset securities, including laws applicable to broker-dealers and exchanges in securities. With respect to SRO rulemaking, the crypto issue has arisen in part because of attempts by exchanges to offer proposed rule changes that would list bitcoin ETFs.[62] Figure 15 shows the prevalence of crypto-related filings for three exchanges.

Rulemaking in the Federal Register also constitutes a significant zone of contestation for the shape of this rulemaking. In summer 2022, the SEC proposed to expand the definition of "exchange" in Regulation ATS in ways that would require a greater degree of cryptocurrency market participants to register as brokers or dealers in securities under Reg ATS.[63] Cryptocurrency industry participants responded negatively to the Reg ATS reform proposal, contending that is a kind of sub silentio rulemaking to extend regulatory requirements to crypto market participants. In forthcoming work, my sometime coauthor Langvardt (2023) characterizes the industry backlash as reflecting a fundamentally techno-libertarian free speech absolutism. He assesses rhetoric in comments submitted to the SEC to think about litigation risk associated with the rulemaking process, also discussed in Tierney (2020). A possible future extension of this paper and Langvardt and

62. See, e.g., Quinlivan (2017).
63. See Securities Exchange Act Release No. 94062 (January 26, 2022), 87 FR 15496 (March 18, 2022).

Tierney (2022) may be to apply NLP methods to the comment process surrounding that reform proposal and the other equity market structure reform proposals to identify textual markers of expressed ideology or sentiment in comment letters (e.g. Eidelman, Lam, and Livermore 2021).

There is a potential doctrinal implication of regulation of cryptocurrency exchanges. Their governance — and certain "code-as-law" smart contracts — may become susceptible to Rule 19b-4's filing requirement: they would likely be rules of a crypto asset securities exchange that would be subject to these requirements if not eligible for and subject to an exemption from that rule under, for example, Regulation ATS.[64]

8.3 Whose interests are implemented in SRO rules?

The study of SRO rule filings can reveal a great deal about the political economy of stock market regulation.

To begin, it can provide insight into the interests that securities law serves. Industry groups have significant influence over how regulatory rules are crafted and implemented (Tierney and Schlozman 1986; Yackee and Yackee 2006). The core concern with self-regulation is that the adopted rules, and patterns of enforcement, will reflect industry-specific concerns and preferences rather than those of the public, investors, or other stakeholders (e.g. Peirce 2015). Studying SRO rule filings can shed light on how regulatory power is distributed among different actors in the financial system.

In particular, it may be possible to identify how different constituencies wield influence in areas of regulation, and who is absent from these processes. In other work, I hypothesize that first-moving firms may forestall regulatory intervention by offering contract terms or other service features that are better than existing law permits to frame regulators' views of the status quo (Tierney 2020).

What is more, examining SRO rule filings can provide basic but important insight into how SRO rulemaking works. The firehose of rule filings has made it impractical for securities law scholars to assess the scope and nature of FINRA, stock exchange, and other SRO rulemaking. That obstacle has meant that, historically, scholars and observers have lacked even basic high-level understandings of the filings of SROs. An approach leveraging NLP methods can help make these practices more legible, and thus more amenable to the kind of social welfare analysis used to assess various forms of stock market regulation. That knowledge is critical to democratizing "the law" of capitalism in the weak sense of unlocking knowledge about the workings of stock market regulation from industry insiders.

64. In a crypto bear market, do audiences care as much about crypto asset security exchange governance? This seems much less urgent to focus on today than last year.

The law and political economy literature has explored the role of stock exchanges in neoliberal financialization, particularly in terms of their ability to facilitate capital accumulation (e.g McCluskey 2003; Hockett and Omarova 2017). Stock exchanges are seen as a key component of neoliberalism because they enable investors to access large amounts of capital quickly and easily, allowing them to make more speculative investments with higher returns. This increased liquidity allows for faster growth and greater profits for those who can take advantage of it. In addition, stock exchanges provide an important mechanism for bonding and monitoring corporate performance, which helps ensure that companies remain accountable to shareholders. Finally, the presence of stock markets also serves as a signal that governments are committed to promoting economic growth through market-based solutions rather than relying on state intervention or regulation.

Despite these advantages, there are also concerns that arise from the multiple hats that stock exchanges wear, as for-profit demutualized entities with tradable shares, and as regulators of their members and the public. For instance, as Bradley (2002, 2001) has argued, there may well be negative externalities from a robust market for control of demutualized stock exchanges.

Other recent work in this space reflects the contestation over the public interest in the design of self-regulation (Ford 2024; Walters 2023, 2022). Progressive scholars of market structure regulation have described this as a "moral economy" approach (e.g. Herrine 2023).[65] This project thus raises broader questions of what we can learn from the history of capital markets regulation: how can we design future capital markets regulation in an era increasingly concerned with democratic control over the economy and "just transitions" (Eisenberg 2018)?[66] In other words, what can SRO regulation do to inform how we design capital markets regulation to promote human flourishing and not merely the sectoral interests of financial capital (Andrias and Sachs 2021, cf.)? Though these are at the outer bounds of this paper's subject, in my view these broad questions of what finance is for (Block 1996; Schiller 2012; Pistor 2019) are no less important or speculative.

9 Conclusion

Industry self-regulation has seemed to unleash a firehose of rule change filings that are hard to keep up with. Understanding what SROs do is crucial to seeing how we structure capital markets, and this project is a first step at that inquiry.

"I would like to say thank you on behalf of the group and ourselves and I hope we've passed

65. One implication, discussed in Tierney (2023, p. 58), is an orientation toward a "commitment to the public interest and being unafraid to push boundaries in regulatory actions."

66. On political economy and agency over the economic conditions that affect one's life, see Wright (2010).

the audition."

- John Lennon, *The Beatles (1969)*

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Tables

Table 5: List of non-exchange securities industry self-regulatory organizations

Designation	Category and SRO	Former affiliation
	Joint Industry Plans	
—	17d-2 Plans for Allocation of Regulatory Responsibilities	
NMS	National Market System Plans	
	Registered Securities Associations	
FINRA	Financial Industry Regulatory Authority	National Association of Securities Dealers (NASD)
	Registered Securities Future Product Exchanges	
CFE	CBOE Futures Exchange	
CBOT	Chicago Board of Trade	
CME	Chicago Mercantile Exchange	
—	OneChicago	formerly registered; see Release No. 34-91117
MGEX	Minneapolis Grain Exchange, Inc.	
NQLX	NQLX	formerly registered
	Securities Futures Associations	
NFA	National Futures Association	
	Registered Clearing Agencies	
LCH SA	Banque Centrale De Compensation	
BSECC	Boston Stock Exchange Clearing Corporation	
CME	Chicago Mercantile Exchange LLC	formerly registered
FICC	Fixed Income Clearing Corporation	
ICC	ICE Clear Credit LLC	
ICEEU	ICE Clear Europe Limited	
NSCC	National Securities Clearing Corporation	
OCC	The Options Clearing Corporation	
SCCP	Stock Clearing Corporation of Philadelphia	
DTCC	The Depository Trust Company	

Table 6: List of stock exchanges

Designation	Current name	Former affiliations
BOX	Box Exchange LLC	Box Options Exchange LLC
CboeBYX	Cboe BYX Exchange, Inc.	Bats BYX Exchange, Inc. (BatsBYX) BATS Y-Exchange (BYX)
CboeBZX	Cboe BZX Exchange, Inc.	Bats BZX Exchange, Inc. (BatsBZX) BATS Exchange (BATS)
C2	Cboe C2 Exchange, Inc.	
CboeEDGA	Cboe EDGA Exchange, Inc.	Bats EDGA Exchange, Inc. (BatsEDGA) EDGA Exchange (EDGA)
CboeEDGX	Cboe EDGX Exchange, Inc.	Bats EDGX Exchange, Inc. (BatsEDGX) EDGX Exchange (EDGX)
CBOE	Cboe Exchange, Inc.	
IEX	Investors Exchange LLC	
LTSE	Long-Term Stock Exchange, Inc.	
MEMX	MEMX LLC	
MIAX	Miami International Securities Exchange, LLC	
EMERALD	MIAX Emerald, LLC	
PEARL	MIAX PEARL, LLC	
BX	Nasdaq BX, Inc.	NASDAQ OMX BX Boston Stock Exchange (BSE)
GEMX	Nasdaq GEMX, LLC	ISE Gemini (ISEGemini) Topaz Exchange (Topaz)
ISE	Nasdaq ISE, LLC	International Securities Exchange
MRX	Nasdaq MRX, LLC	ISE Mercury (ISEMercury)
PHLX	Nasdaq PHLX LLC	NASDAQ OMX PHLX
NASDAQ	The Nasdaq Stock Market LLC	
NYSE	New York Stock Exchange LLC	
NYSEARCA	NYSE Arca, Inc.	
NYSEAMER	NYSE American LLC	NYSE MKT (NYSEMKT) NYSE Amex (NYSEAmex) American Stock Exchange (Amex)
NYSECHX	NYSE Chicago, Inc.	Chicago Stock Exchange, Inc. (CHX)
NYSENAT	NYSE National, Inc.	National Stock Exchange (NSX)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(Intercept)	0.149 ***	0.163 ***	0.164 ***	0.186 ***				
	0.001	0.002	0.002	0.002				
recession	0.010 ***	0.005 +		0.003	0.006 +	0.003		0.003
	0.003	0.003		0.003	0.003	0.003		0.003
after_crisis		−0.016 ***	−0.017 ***	0.002		−0.010 ***	−0.011 ***	0.005
		0.002	0.002	0.002		0.003	0.003	0.003
immediate_effectiveness				−0.056 ***				−0.055 ***
				0.001				0.002
Num.Obs.	17 905	17 905	17 905	17 905	17 905	17 905	17 905	17 905
R2	0.001	0.003	0.003	0.075	0.022	0.022	0.022	0.088
R2 Adj.	0.001	0.003	0.003	0.075	0.019	0.019	0.019	0.085
RMSE	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09

Table 7: Regression output with eight specifications, with the dependent variable as the proportion of constraining words among total sentiment-encoded words at the filing level. Sentiment lexicon comes from Loughran and McDonald (2011). The latter four specifications include fixed effects at the filing-SRO level. The independent variable "recession" is coded as 1 if the Federal Register publication date is within one of the recessionary periods identified in table 11, and 0 otherwise. The variable "after crisis" is coded as 1 if that date is after September 15, 2008, and 0 otherwise. The variable "immediate effectiveness" is coded as 1 if the `subject` field in the Federal Register XML matches a regular expression pattern that captures filings declared to be immediately effective, and 0 otherwise. For each variable, the first line shows the point estimate followed by an indicator for the level of statistical significance (+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001), and below that the standard error in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(Intercept)	0.340 ***	0.441 ***	0.443 ***	0.420 ***				
	(0.001)	(0.003)	(0.003)	(0.003)				
recession	0.041 ***	0.006		0.008 *	0.024 ***	0.006		0.007 +
	(0.004)	(0.004)		(0.004)	(0.004)	(0.004)		(0.004)
after_crisis		−0.111 ***	−0.112 ***	−0.127 ***		−0.089 ***	−0.091 ***	−0.103 ***
		(0.003)	(0.003)	(0.003)		(0.004)	(0.004)	(0.004)
immediate_effectiveness				0.052 ***				0.051 ***
				(0.002)				(0.002)
Num.Obs.	17 905	17 905	17 905	17 905	17 905	17 905	17 905	17 905
R2	0.006	0.073	0.073	0.107	0.114	0.139	0.139	0.170
R2 Adj.	0.006	0.073	0.073	0.107	0.111	0.137	0.136	0.167
RMSE	0.13	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Fixed effects?	No	No	No	No	Yes	Yes	Yes	Yes

Table 8: Regression output with eight specifications, with the dependent variable as the proportion of litigious words among total sentiment-encoded words at the filing level. Sentiment lexicon comes from Loughran and McDonald (2011). The latter four specifications include fixed effects at the filing-SRO level. The independent variable "recession" is coded as 1 if the Federal Register publication date is within one of the recessionary periods identified in table 11, and 0 otherwise. The variable "after crisis" is coded as 1 if that date is after September 15, 2008, and 0 otherwise. The variable "immediate effectiveness" is coded as 1 if the `subject` field in the Federal Register XML matches a regular expression pattern that captures filings declared to be immediately effective, and 0 otherwise. For each variable, the first line shows the point estimate followed by an indicator for the level of statistical significance (+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001), and below that the standard error in parentheses.

Table 9: Unclean agency data

agencies1
department of securities and exchange commission
securiies and exchange commission
securites and exchange commission
securities and exchange commission
securities and exchange
securities and exchange commission
securities and exchange commimssion
securities and exchange commision
securities and exchange commisison
securities and exchange commission
securities and exchange commission (release no. 34-62694;
securities and exchange commission –
securities and exchange commission [removed private field]
securities and exchange commission-
securities and exchange commission[sec file no. 270-208, omb control no. 3235-0213]
securities and exchange commissionÿ09
securities exchange act of 1934
securities exchange commission
securitites and exchange commission
security and exchange commission
securtites and exchange commission
securtites and exchange commission /

Table 10: Top filing dates

Federal Register Date	SRO or not?	Daily filing count
2019-06-06	—	32
2021-11-05	—	21
2022-01-03	—	19
2022-03-08	—	19
2018-01-16	—	18
2022-05-13	—	17
2021-10-25	—	15
2022-01-27	—	14
2011-09-02	—	13
2018-03-19	—	13
2013-10-22	SRO	69
2011-04-13	SRO	42
2010-12-15	SRO	37
2019-12-30	SRO	29
2010-02-10	SRO	27
2018-12-27	SRO	26
2019-04-17	SRO	26
2017-06-01	SRO	25
2017-12-15	SRO	25
2019-01-31	SRO	25

Recessionary period	**Beginning date**	**Ending date**
1	03/01/2001	11/30/2001
2	11/30/2007	06/30/2009
3	02/01/2020	04/30/2020

Table 11: Recessionary periods defined by NBER.

Table 12: Annual counts of fee filings and all other filings

Year	Non-fee filings	Fee filings	Percent fee filings
2000	357	60	14
2001	369	66	15
2002	102	24	19
2003	106	26	19
2004	159	43	21
2005	210	50	19
2006	136	39	22
2007	94	36	27
2008	250	59	19
2009	634	227	26
2010	864	285	24
2011	838	311	27
2012	821	399	32
2013	900	399	30
2014	855	325	27
2015	923	378	29
2016	1130	369	24
2017	1017	387	27
2018	871	317	26
2019	932	316	25
2020	957	339	26
2021	807	362	30
2022	665	381	36

Additional figures

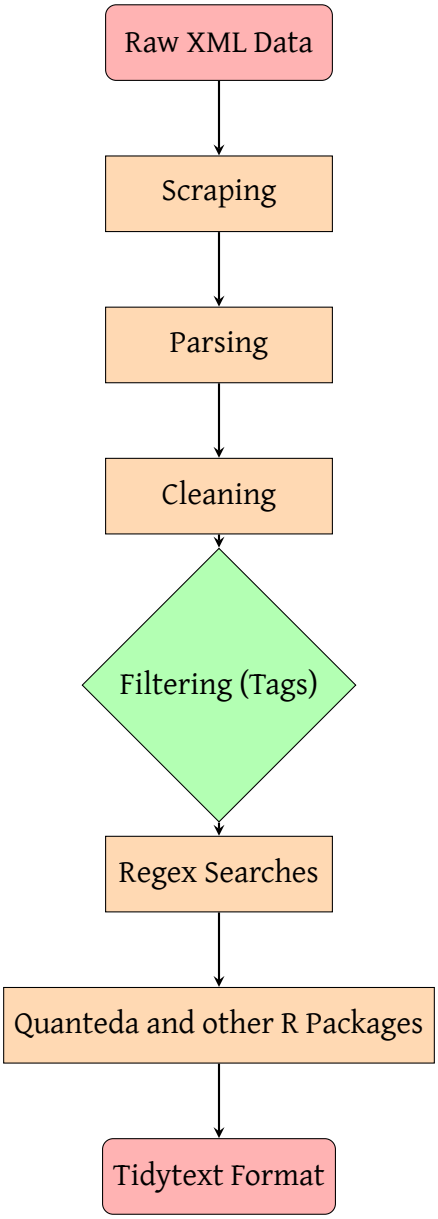

Figure 16: Process for data acquisition

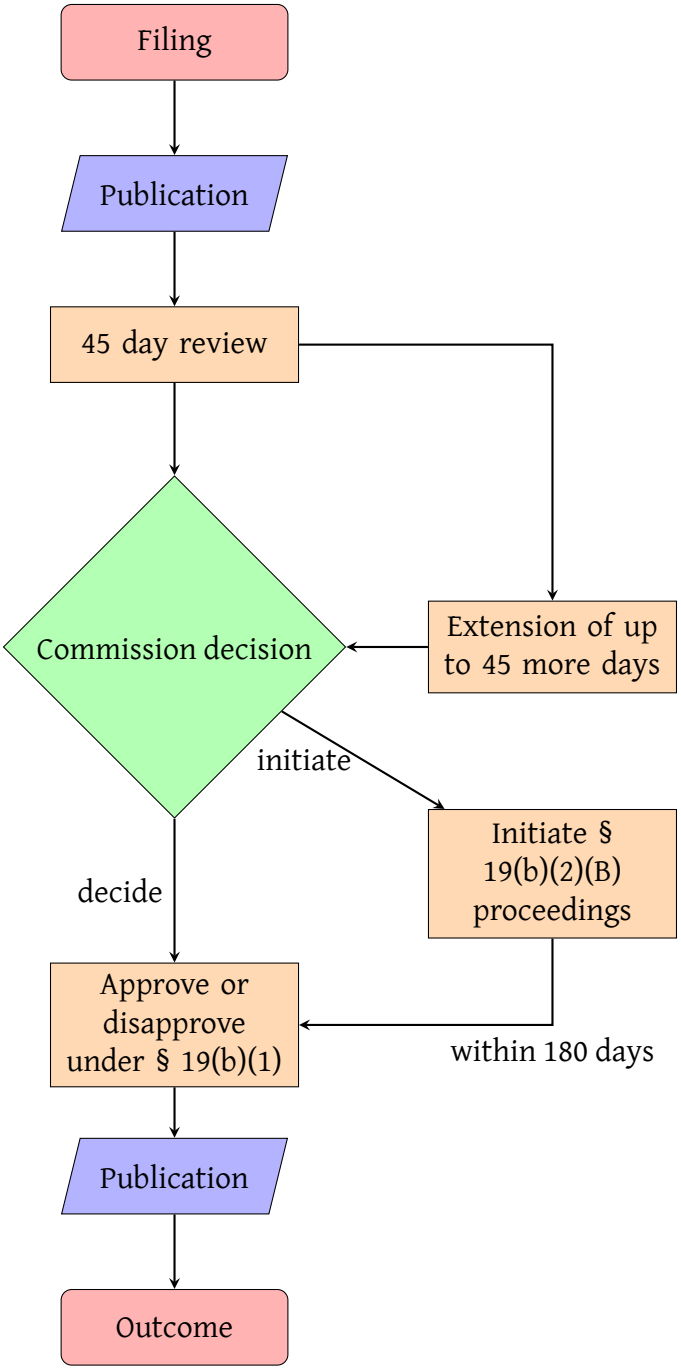

Figure 17: Schematic of the SEC's decision making process in 19(b)(3) proceedings

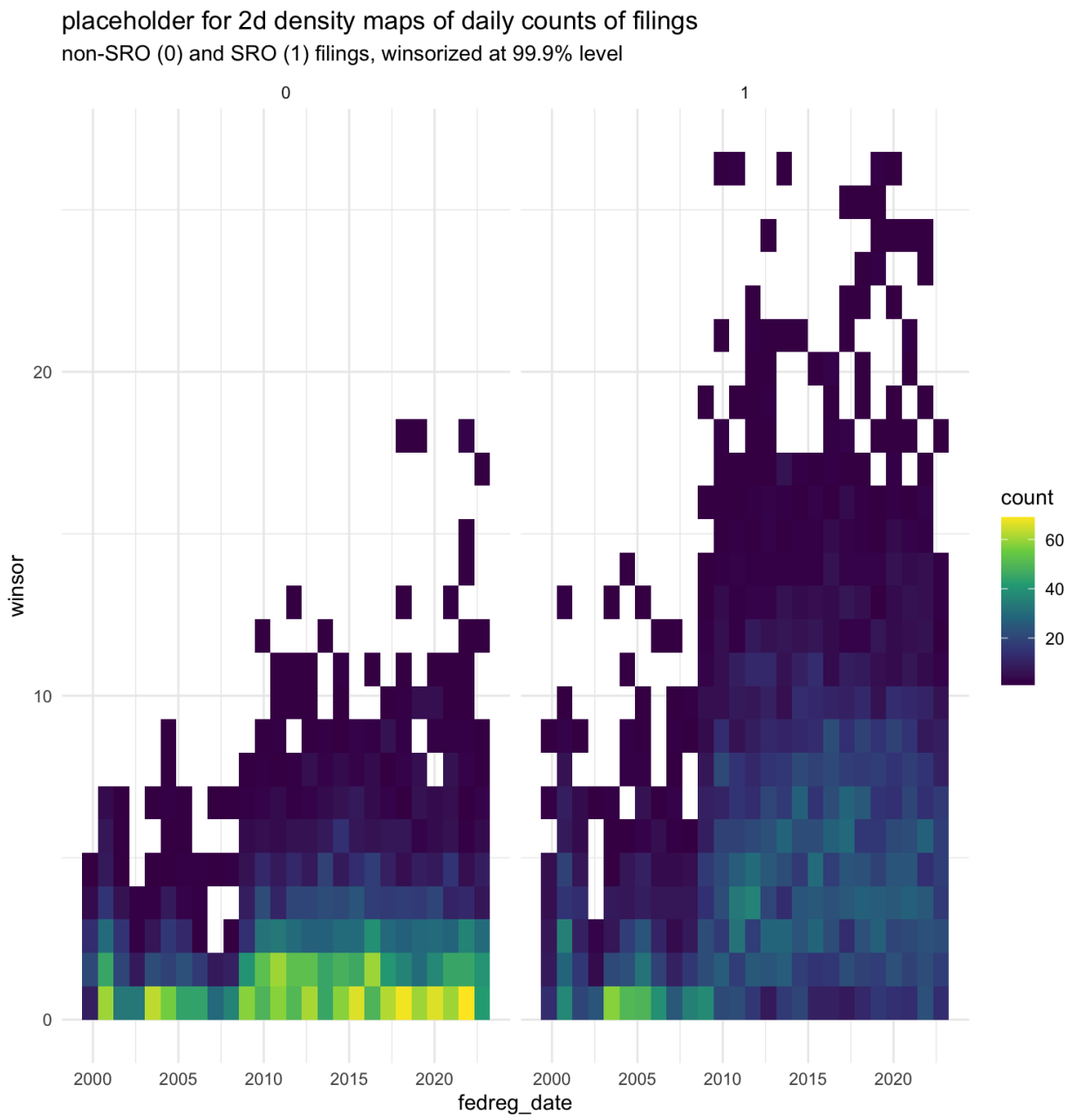

Figure 18: 2d density maps of rule filing counts, winsorized at 99.9% level

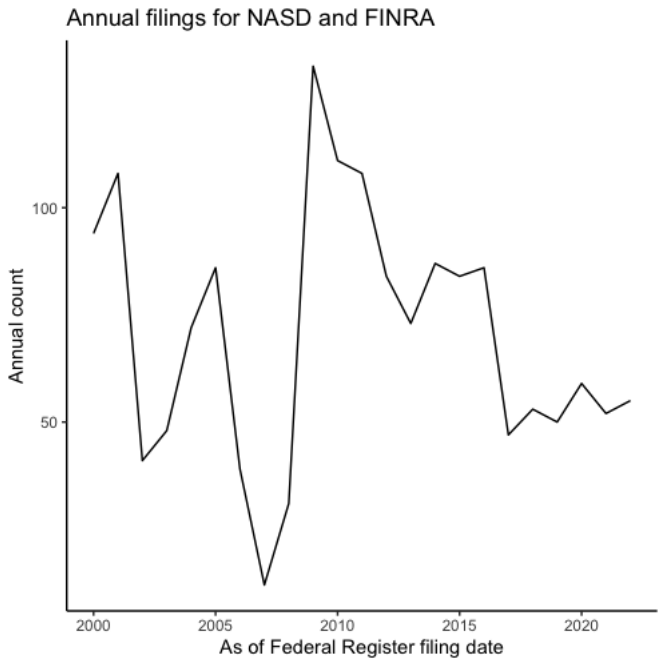

Figure 19: FINRA filings

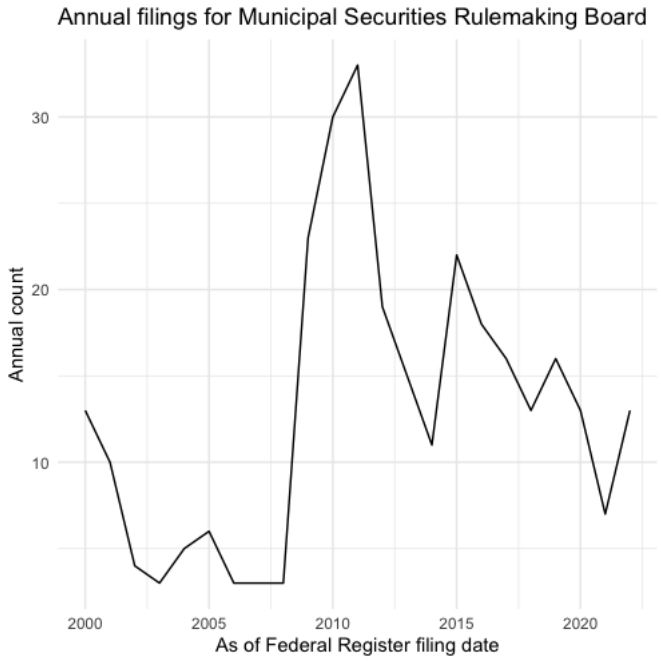

Figure 20: MSRB filings

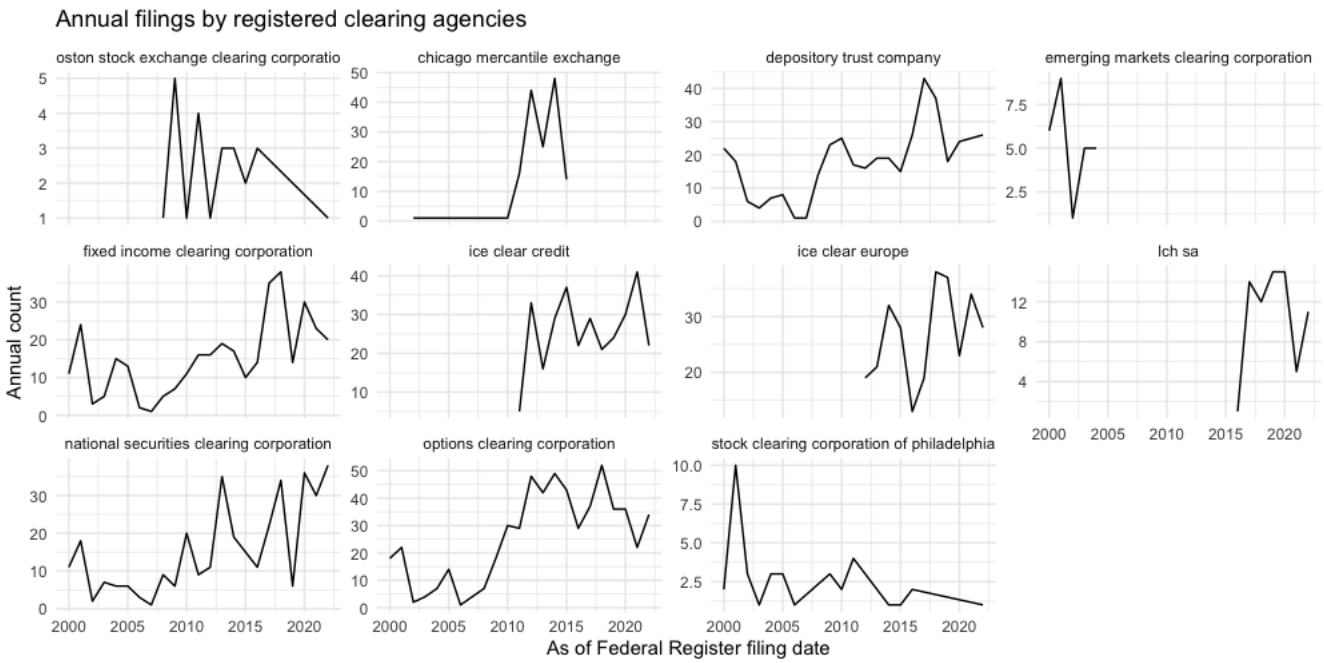

Figure 21: Clearing agency filings

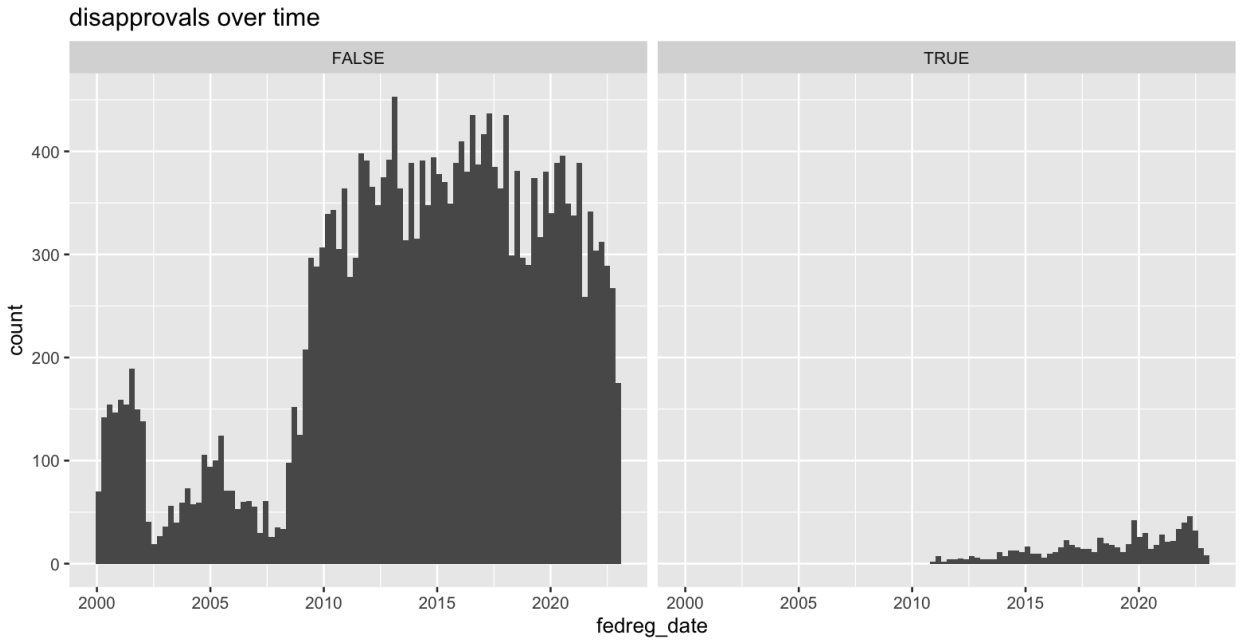

Figure 22: Disapproval counts

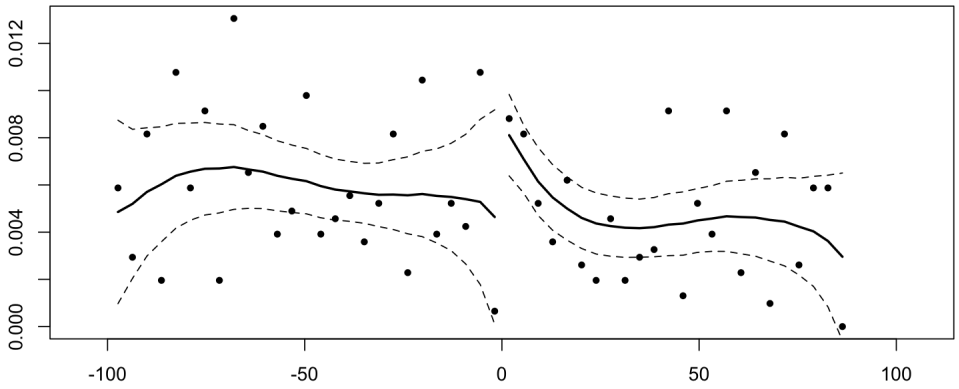

Figure 23: Results of the McCrary sorting test for *Susquehanna*

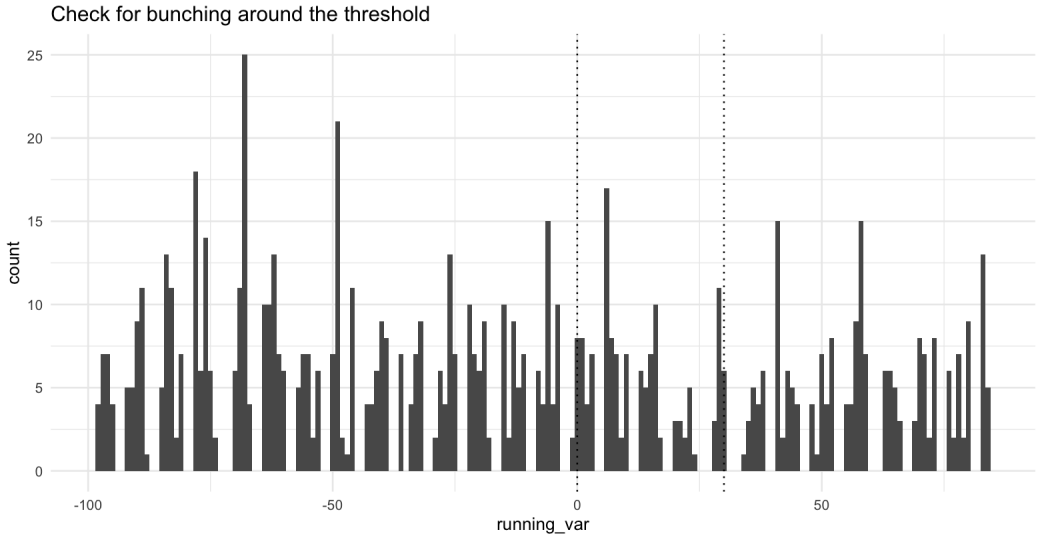

Figure 24: Results of bunching test around the threshold for *Susquehanna*. The first vertical dotted line is at T_0, the date of Susquehanna's decision, while the second vertical dotted line is at T_{30}, or the number of days in the SEC's rule review period following the decision in the case.

Appendix A. Code listing

Listing 1: XML sample code for IEX fee filing

```
<NOTICE>
            <PREAMB>
                <AGENCY TYPE="S">SECURITIES AND EXCHANGE COMMISSION</
                   AGENCY>
                <DEPDOC>[Release No. 34-96331; File No. SR-IEX-2022-09]</
                   DEPDOC>
                <SUBJECT>Self-Regulatory Organizations; Investors Exchange
                    LLC; Notice of Filing and Immediate Effectiveness of
                   Proposed Rule Change Pursuant to IEX Rule 15.110 To
                   Amend IEX's Fee Schedule</SUBJECT>
                <DATE>November 16, 2022.</DATE>
                <P>
                    Pursuant to section 19(b)(1)
                    <SU>1</SU>
                    <FTREF/>
                     of the Securities Exchange Act of 1934 (the ""Act)
                    <SU>2</SU>
                    <FTREF/>
                     and Rule 19b-4 thereunder,
                    <SU>3</SU>
                    <FTREF/>
                     notice is hereby given that, on November 7, 2022, the
                         Investors Exchange LLC "("IEX or the ""Exchange)
                        filed with the Securities and Exchange Commission
                        (the ""Commission) the proposed rule change as
                        described in Items I, II and III below, which
                        Items have been prepared by the self-regulatory
                        organization. The Commission is publishing this
                        notice to solicit comments on the proposed rule
                        change from interested persons.
                </P>
                <FTNT>
                    <P>
                        <SU>1</SU>
                        15 U.S.C. 78s(b)(1).
                    </P>
                </FTNT>
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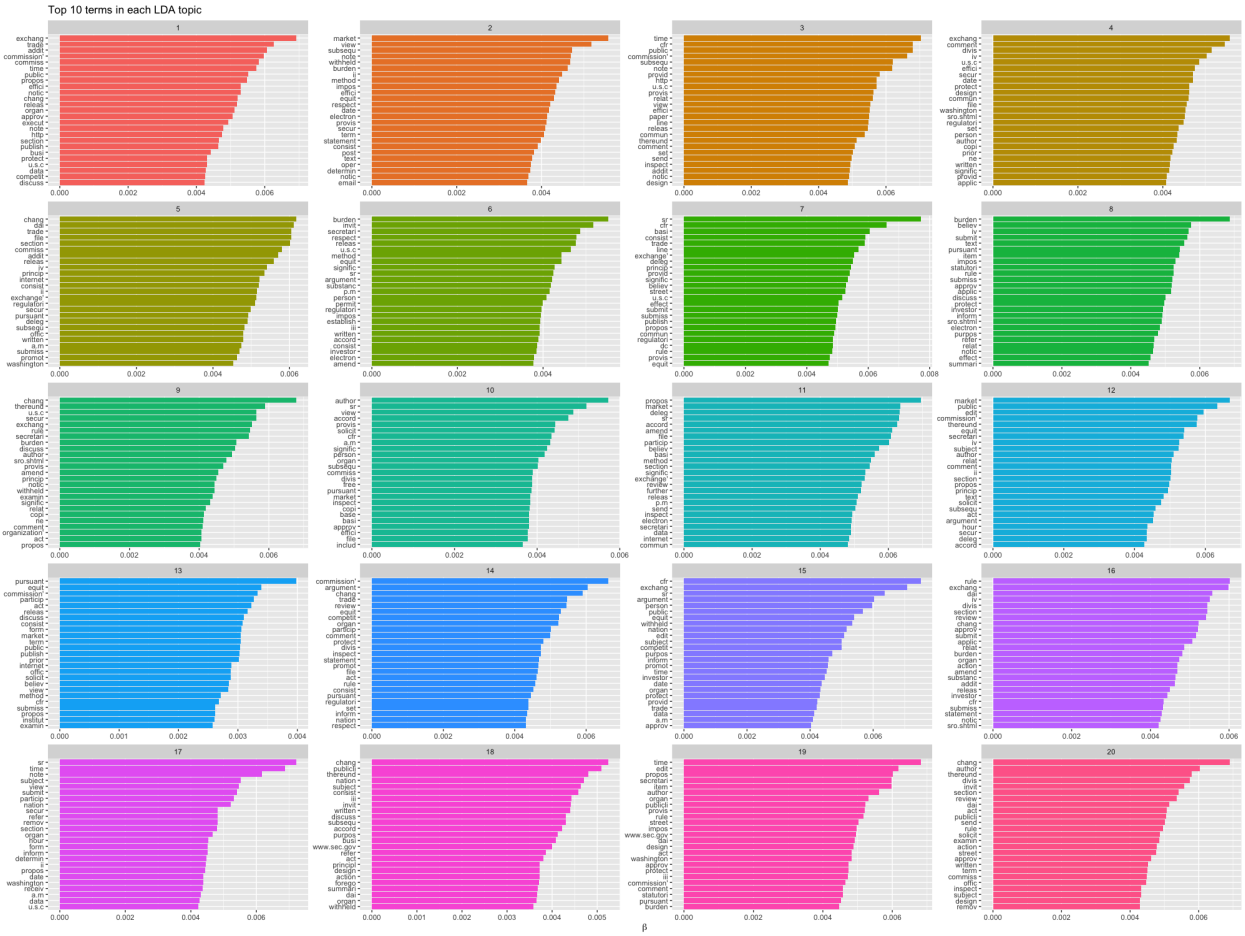

Figure 25: Top ten terms in each LDA topic

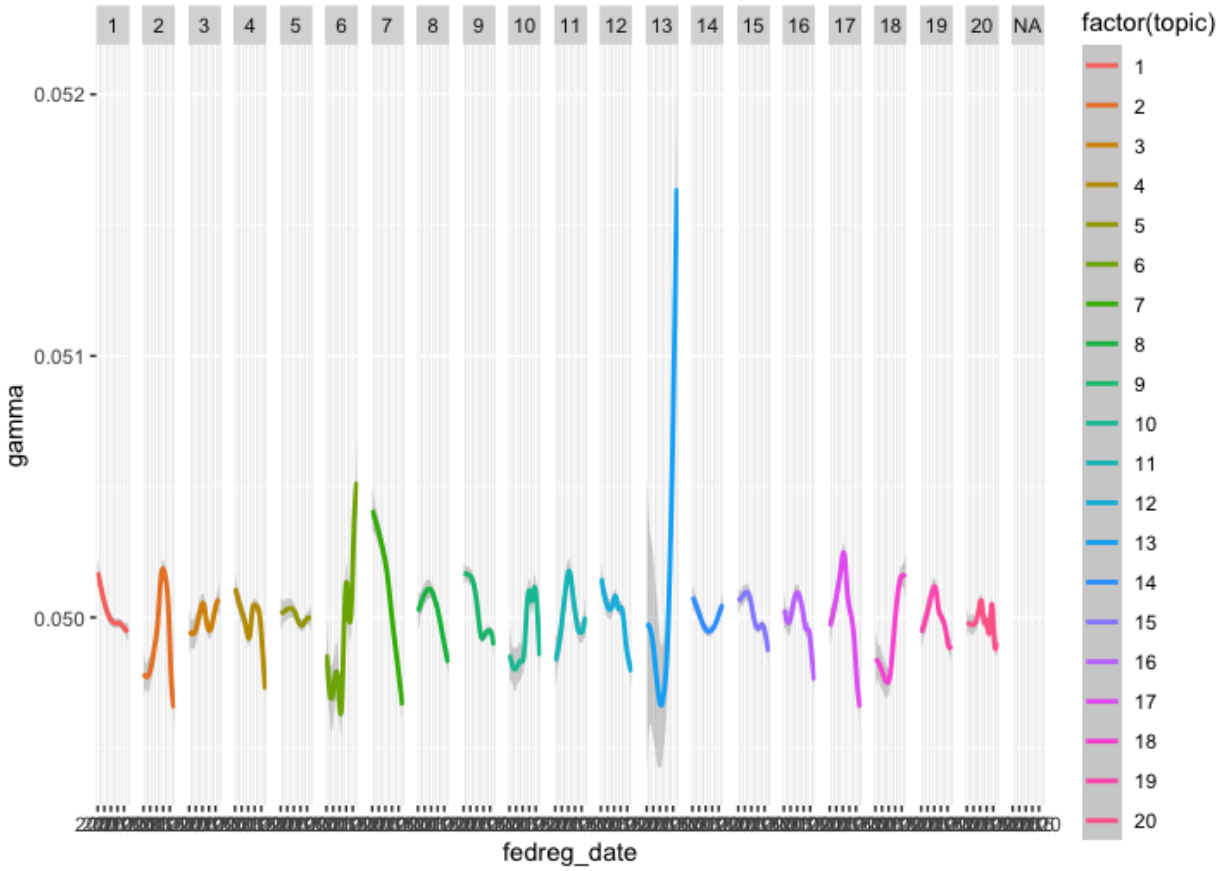

Figure 26: Measure of gamma for each LDA topic