Regulatory Fragmentation*

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Abstract

Regulatory fragmentation occurs when multiple federal agencies oversee a single issue. Using the full text of the Federal Register, the government's official daily publication, we provide the first systematic evidence on the extent and costs of regulatory fragmentation. We find that fragmentation increases the firm's costs while lowering its productivity, profitability, and growth. Moreover, it deters entry into an industry. These effects arise from regulatory redundancy and, more prominently, regulatory inconsistency between agencies. Our results uncover a new source of regulatory burden: companies pay a substantial economic price when regulatory oversight is fragmented across multiple government agencies.

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1. Introduction

The federal government is the most influential actor in the United States economy, and many studies document the significant burden imposed by the government on companies. The literature tends to focus on one aspect of the burden: the cost of complying with specific regulations, such as disclosure requirements, safety protocols, or antitrust restrictions. In this paper we highlight a different notion of burden, *regulatory fragmentation*: the regulation of a single topic by multiple federal agencies. As of September 2021, the Government Accountability Office (GAO) has issued 11 annual reports on the fragmentation, overlap, and duplication of federal activities (GAO (2021)). Policy makers debate how to eliminate some of the regulatory fragmentation (Department of Treasury (2017); Government Accountability Office (2016)), and the Business Roundtable warns that fragmentation "poses significant challenges to American businesses and can dampen economic activity across the wider U.S. economy" (Business Roundtable (2019)). Nevertheless, there is surprisingly little research on the burden of regulatory fragmentation. Our paper aims to fill this gap, by offering the first measure of regulatory fragmentation in the United States and documenting its economic impact on companies.

Our analysis is based on novel data from the Federal Register (FR), which is the official daily publication of the federal government. All federal agencies publish comprehensive accounts of their activities in the FR, including both drafting new regulations and enforcing existing ones. As such, the FR offers a unique opportunity to identify the topics supervised by each agency. We download the full text of the FR's daily editions since 1994, and we use a machine learning technique known as Latent Dirichlet Analysis (LDA) to categorize the government's activities into 100 topics.[1] We then calculate the fragmentation of each topic across federal agencies. The key

[1] Our results throughout the paper are not sensitive to alternative topic classifications.

takeaway is that the regulation of many topics is fragmented across multiple government agencies.

Motivated by these facts, we assess the economic impact of regulatory fragmentation on companies. On the one hand, companies could benefit from oversight by multiple agencies. In the early stages of regulation, firms can focus on the agency that they can best influence. After final rules are set, firms can choose to follow the least restrictive ones, analogous to firms benefiting from choice of court venue (see, e.g., Bebchuk and Hamdani (2002)). Both factors potentially contribute to a race to the bottom among regulators, which benefits firms. On the other hand, regulatory fragmentation could be costly for firms. The involvement of multiple agencies can lead to contradictory or duplicative requirements, thus increasing the costs of compliance. Moreover, the multi-agency landscape creates uncertainty on which regulations the firm must satisfy. Since the firm cannot fully anticipate new regulatory decisions, its ability to plan is debilitated.

The two hypotheses lead to opposite predictions. If regulatory fragmentation is burdensome, it should lead to higher costs and to lower profitability, productivity, and growth. However, if fragmentation is beneficial, it should reduce costs while increasing profitability, productivity, and growth. To test our predictions, we develop a firm-specific measure of regulatory fragmentation. In addition to accounting for the fragmentation of each topic across federal agencies, our measure also accounts for the relevance of each topic for each firm. We formalize this intuition as follows. First, as mentioned above, we measure the fragmentation of each topic across government agencies, using textual analysis of the Federal Register. Second, we compute the importance of each topic for each firm×year observation, defined as the fraction of words in the firm's annual report devoted to the topic. Finally, we multiply the fragmentation of the topic by its relative importance for each firm and sum the products for all 100 topics.[2]

[2] Our data are publicly available: https://www.dropbox.com/s/mw23g61s2p9xhjs/companyyear_measures.csv?dl=0

To validate our measure, we identify Federal Register documents that explicitly mention public firms by name (using data from Chen and Kalmenovitz (2020)). We find that firms with high fragmentation are mentioned by significantly more agencies.[3] In addition, we also search the firms' annual reports for explicit mentions of federal agencies. Within the finance industry, where there is a greater propensity to mention regulating agencies, firms with high fragmentation mention significantly more agencies. Together, these exercises provide independent verification for our fragmentation measure.

Our measure varies both in the cross-section and within-firm over time. In the time-series, regulatory fragmentation has decreased for most firms, consistent with efforts by policy makers across the government (GAO (2021)). However, there is heterogeneity in this trend. For example, the topic "Grants: Housing and Community Development" has become increasingly fragmented across agencies, and analogously the regulatory fragmentation of the firm Sunrise Assisted Living (which is primarily engaged in housing projects) has increased. In the cross-section, inter-industry patterns are insightful. For example, financial companies operate under greater fragmentation than many other industries: while financial companies concentrate on a relatively small number of topics, those topics tend to be regulated by multiple federal agencies.

A broad set of empirical tests indicates that regulatory fragmentation is detrimental to firms. Companies with higher fragmentation spend larger fractions of their revenues on sales, general, and administrative (SG&A) costs, while exhibiting lower total factor productivity (TFP) and lower profitability (ROA). We further conjecture that if regulatory fragmentation consumes company resources and causes fewer projects to have a positive net present value, firm growth should slow. Consistent with this, we find that fragmentation reduces both sales growth and asset growth. We

[3] We do not view those exercises as alternative measures of fragmentation, and we discuss the reasons for that in the main text. For example, oftentimes firms are regulated by agencies that they do not mention explicitly in their 10-K.

further find evidence consistent with the high costs of fragmentation deterring new entrants and pushing out some of the incumbents. In sum, consistent with concerns expressed by the GAO and the Business Roundtable, our empirical analyses strongly support the hypothesis that regulatory fragmentation is costly.

Our findings are robust to a large set of controls and saturated fixed-effects specifications. To disentangle regulatory fragmentation from the sheer quantity of regulation, we proxy for the latter using the number of words in the FR devoted to each regulatory topic. To disentangle the fragmentation of each regulatory topic (across government agencies) from the effects of companies operating across many areas, we control for firm size (total assets), number of business segments, and the dispersion of topics discussed in the firm's 10-K. To account for the possibility that distressed firms draw the attention of multiple regulators, we control for known determinants of investment opportunities (Tobin's Q and cash flows). To address the concern that high fragmentation may be correlated with restructuring or expansion into new product markets, we remove firms whose assets changed more than 20% in absolute value and firms who moved into a new industry (based on Hoberg and Phillips (2016)). Finally, we also include firm and year×industry fixed effects, removing industry trends and comparing two companies from the same industry who face different levels of fragmentation. The highly significant results suggest that these effects occur at the firm level and are identified within-firm over time.

In the last part of the paper, we examine two potential channels driving our results: do the costs of fragmentation arise from duplicate regulatory requirements or from inconsistent (even contradictory) regulatory requirements? To evaluate these channels, we identify FR documents that are co-authored by multiple agencies versus documents that are solo authored by a single agency. Co-authored documents are clearly coordinated and therefore unlikely to yield

inconsistent regulatory requirements. Indeed, we find that all the effects reported above are significantly weaker when agencies work together; the burden of fragmentation is higher when it yields inconsistent – as opposed to merely duplicative – requirements.

Our measure of fragmentation uniquely captures the total flow of regulatory activity, rather than just the stock of existing rules. Importantly, this flow captures both the ongoing requirements of existing rules, the early stages of new rulemaking, and the final passing of new rules. We take advantage of this breadth of data to address several follow-on questions. First, we contrast the effects across different stages of regulatory activity. Although academic studies focus primarily on final rules, these represent only 32% of the total government activity, as captured in the Federal Register. The earlier stages of rulemaking account for an additional 24%, and the remaining 44% includes actions such as hearings, transaction approvals, and enforcement actions (all classified as "notices"). We find that the negative effects of fragmentation exist within each stage of regulatory activity. Second, we contrast the fragmentation across new rules versus rule modifications. Consistent with both stages of regulatory activity consuming firm resources, we find that both have similar significant negative effects on firms. In aggregate, our findings highlight how firms are influenced by the fragmentation across many different types of regulatory activity: firms must incur costs to stay abreast of upcoming regulatory activity, to comply with new regulations, and to adapt to changes in existing regulations.

There is a growing recognition of the need to better understand how regulation in all its forms affects economic activity. Against this backdrop, our paper makes two contributions. First, current studies focus on the number of rules (La Porta et al. (1998); Botero et al. (2004); Bandiera et al. (2000); Nicoletti and Scarpetta (2003); Djankov et al. (2006); Mulligan and Shleifer (2005)), the length of the regulatory text (Dawson and Seater (2013); Al-Ubaydli and McLaughlin (2017)),

and the estimated costs of compliance (Trebbi and Zhang (2022); Gong and Yannelis (2018); Calomiris et al. (2020); Kalmenovitz (2022)). In this paper, we highlight a largely unknown aspect of regulatory burden: the "industrial organization" of the federal government. We show that the burden borne by companies depends not only on the sheer quantity of regulations, but also on the number of agencies that are involved in the design and implementation of those regulations. Our measure utilizes public data to capture the full range of the federal government's activities, thus offering a comprehensive and replicable measure of the federal government's burden.

Second, we add to the literature on the real impact of regulation. Classic theories on this topic range from public interest (Pigou (1938); Joskow and Rose (1989); Demsetz (1974); Melody (2016)) to public choice (Tullock (1967); Stigler (1971); Krueger (1974); Posner (1974); Peltzman (1976); Becker (1983); Baumol (1986); Olson (2009)). Our results emphasize how one important aspect of the government's outreach imposes significant costs on companies, both real and financial: when more government agencies strive to regulate a given topic, companies experience more negative outcomes. Overall, those results are more consistent with public choice theories, which highlight the negative externalities from the regulatory process. Our findings should not be interpreted as a conclusive piece of evidence on the efficacy of federal regulations, and yet they offer a fresh perspective on the nature of regulatory burden and its economic consequences.

2. Data

2.1 The Federal Register (FR) and the Code of Federal Regulation (CFR)

We rely on the Federal Register (FR) as our primary measure of government activities. Often described as the daily journal of the Federal Government, the FR is published every business

day.[4] The FR is divided into four sections. *Notices* include announcements such as hearings and public meetings, grant applications, administrative orders, and enforcements.[5] *Proposed rules* include petitions for rulemaking, drafts of pending regulations, and other advanced proposals. *Rules and Regulations* include the final version of rules and policy statements and interpretations of existing rules. *Presidential Documents* include executive orders and proclamations.

Each federal agency is required to publish designated documents in the Federal Register. This includes activity related to previously passed rules (e.g., details regarding rule implementation, ongoing requirements of existing rules, and company-specific actions), activity unrelated to rules (e.g., grant applications and hearings), and activity related to new rulemaking. With respect to new rulemaking, this at a minimum includes the proposed rule and the final version of the rule, but it often also includes notices of meetings and solicitation of comments. When the rulemaking process is finished, the new regulation is incorporated into the Code of Federal Regulations (CFR).

Consistent with the FR representing one step in the rulemaking process that leads to revisions to the CFR, these two sources are linked to each other. First, every proposed rule and final rule in the FR denotes the affected CFR title and part. Second, every proposed rule and final rule in the FR includes the relevant CFR subjects. In total there are 826 CFR subjects.[6]

2.2. Sample

We collect all documents in the Federal Register from the Rules and Regulations, Proposed rules, and Notices sections, over the 1994-2019 period.[7] For each of these documents, we

[4] The most current version of the Register can be found here: https://www.federalregister.gov/documents/current.
[5] An example of a notice can be found here: https://www.federalregister.gov/documents/2019/09/30/2019-21097/self-regulatory-organizations-nyse-arca-inc-order-instituting-proceedings-to-determine-whether-to.
[6] The government provides a dictionary of the subjects here and here. There are also efforts to document the relations between subjects. For instance, the three subjects "Accounting," "Business and Industry," and "Uniform Systems of Accounts" are all substantively connected to each other.
[7] We do not include in our analysis Presidential Documents (less than 0.8% of the Federal Register universe) since those are handled directly by the Executive Office of the President and not by any specific agency.

download the category of the document (rule, proposed rule, or notice), the agency that submitted the document, and the entire text of the document. For proposed rules and final rules, we additionally collect the CFR citations (title and part affected by the new rule) and the CFR subject.

On average over the whole sample period, notices present 44% of the words in the FR, proposed rules represent 24%, and final rules represent 32%.[8] The fact that notices are the biggest category is consistent with these being the broadest measure of the day-to-day activities of the government. As described above, they include details on the many hearings and meetings.

A comparison across the different types of documents in the FR indicates that each contains unique information. None of the topics that fall within the Top Ten among notices similarly fall among the Top Ten for final rules (see, e.g., Figure A.1 in the Internet Appendix). Given the benefits – in some cases the obligation – to staying abreast of issues communicated through notices, any measure that focuses just on final rules will be only a partial measure of government activity.[9]

Figure 1 shows the upward trend in all three series (notices, proposed rules, and rules) through 2016, followed by a marked drop starting in 2017, the beginning of Donald Trump's presidency. This is consistent with his stated intent of decreasing the role of the government. There are similar (but much smaller) drops each time a new president takes office, for example in 2001 and 2009, reflecting the fact that it takes time for a new president to exercise his agenda. There also tends to be an increase in the Rules section in the last year of a president's term, for example 2000, 2008, and 2016. This is consistent with the natural desire of any outgoing administration to make a last-minute attempt to implement its regulatory agenda.

[8] Notices represent an even greater share of all documents in the FR (79%). This is consistent with the fact that notices are much shorter than rules and proposed rules. Rules are frequently quite lengthy, and as they typically include detailed discussions of the rule's merits as well as a summary of the comments submitted by the public.

[9] We provide more detail on differences across these stages of regulatory activity in section 8.

3. Empirical strategy and descriptive statistics

Our overarching goal is to explore how regulatory fragmentation affects underlying firms. Our measure of the fragmentation faced by each firm-year is based on several inputs. First, we identify regulatory topics, which we do via textual analysis of the FR. Second, we determine which agencies regulate each topic; here we rely on the fact that each FR document identifies the relevant agency(ies), i.e., the agency(ies) that wrote the document. Third, we determine the relevance of each topic for each firm-year; we compare the content of the 100 regulatory topics with the content of each firm's 10K. Each of these steps is discussed in detail in the following subsections.

3.1.Regulatory topics in the FR

Our first step is to identify topics in the FR. We employ LDA, which generates a set of topics in which each topic is a cluster of words that tend to appear jointly in the text. The LDA also provides the share of each document that is dedicated to the topic. By relying on the machine to define topics, we mitigate biases that might arrive from manually defining topics, for example through word lists. Chang et al (2009) show that LDA output corresponds to human ability to detect topics, while also being objective and replicable.[10]

To carry out the LDA, we must define the number of topics. By way of comparison, Lowry, Michaely and Volkova (2020) identify 30 topics in firms' prospectuses and 8 topics in the SEC's comment letters pertaining to these prospectuses. Naturally, the government's activities are much broader and cover a wider range of topics. We therefore chose 100 topics as our baseline. In robustness checks, we consider both smaller and larger numbers of topics.

Figure 2 illustrates the topic clouds for four common topics, out of the total set of 100.

[10] LDA is increasingly recognized in finance as a powerful tool for textual analysis. Recent papers employing this methodology include Hanley and Hoberg (2019), Adams, Ragunathan and Tumarkin (2021), Calomiris and Mamaysky (2019), and Lowry, Michaely, and Volkova (2020).

Casual observation reveals that common words tend to be grouped into one topic. For example, the most salient words in Topic 3 (Panel A) are "special, habitat, population, area, list," whereas the most salient words in Topic 5 (Panel B) are "rule, exchange, change, commission, proposal."

While the LDA topic clouds clearly represent different subjects, it is not immediately apparent what those subjects are. Giving an economic interpretation to the LDA topics is useful because it facilitates interpretation of the empirical patterns observed in the data.[11] The fact that each rule and proposed rule in the FR includes a list of the relevant CFR subjects, in a consistent manner that applies equally to all federal agencies, helps us to define the economic interpretation of each topic. For each FR rule and proposed rule, we determine the percent of the document that belongs to each of our 100 LDA topics. Next, for each LDA topic, we retain the 1,000 documents within which the LDA topic is most common. Finally, we label the LDA topic based on the CFR subjects of the topic's top 1000 documents. We distinguish between three cases:

- Case 1 (77 topics): at least 20% of the 1000 documents list a certain CFR subject. For these cases, we label the topic as belonging to these subject(s).
- Case 2 (21 cases): at least 10% but less than 20% of the 1000 documents list a certain CFR subject. We label the topic with the most common CFR subject(s) found in 10% or more of documents.
- Case 3 (2 topics): The most common CFR subject(s) are listed in less than 10% of documents. These two topics do not have a clear common theme, and thus we label both as "miscellaneous."

[11] While labeling LDA topics is informative, the construction of our main empirical measures (as described below) is independent of how we choose to interpret individual topics.

For each topic, we then assign a label based on these CFR subject(s).[12] Looking at Panels A – D of Figure 2, Topic 3 is '*Endangered species'*, Topic 5 is '*Securities: investment companies*', Topic 21 is '*Grants: education'*, and Topic 23 is '*Health: insurance'*.

3.2.Regulatory fragmentation of topics

Each FR document specifies the agency (or agencies) that wrote the document, enabling us to determine the extent to which each regulatory topic (as defined in the prior subsection) falls under the purview of multiple agencies. First, we obtain the number of words per document×topic, based on the percent of the document allocated to the topic. Second, we aggregate documents by agency×year and calculate the number of words per agency×topic×year. For instance, how many words did the Securities and Exchange Commission (SEC) devote to LDA topic 58 during 2012. Third, for each topic×year, we determine the percent of the topic that is regulated by each agency. For instance, if in 2012 the SEC (Federal Reserve) devoted 100 words (1,900 words) to topic 58, then the SEC's share is 5% and the Fed's share is 95%. Finally, we square these percentages and sum them, analogous to an HHI. For descriptive purposes, we use a measure of the dispersion of each topic across agencies, which equals 1 minus the sum of these squared percentages. Formally:

$$AgencyHHI_{i,t} = \sum_{Agency} \omega_{i,a,t}^2 \quad (1)$$

$$Regulatory\ Fragmentation_{i,t} = 1 - AgencyHHI_{i,t} \quad (2)$$

where $\omega_{i,a,t}^2$ represents the (squared) percent of topic i written by agency a at time t. The dispersion of a topic potentially varies from 0 to (almost) 1, where 0 represents a case where the entire topic falls within documents written by a single agency. The highest possible value is 0.992, which reflects a case where the topic was dispersed equally between the 121 agencies.

[12] Several LDA topics are related to each other. For example, the broad area of environmental protection (one of the CFR subjects) is comprised of sub-areas such as water, air, and/or hazardous waste (each of which also has a unique CFR subject). As explained in section 5.6, our results are robust to grouping topics by broad economic areas.

Panel A of Table 1 shows the topics with the lowest and highest fragmentation across agencies. Topics with particularly low fragmentation include "Nuclear materials" and "Aviation safety: inspection", consistent with such issues being relatively focused and having a clear jurisdiction. However, it is notable that even these topics have fragmentation measures far greater than 0, in the range of 0.34 – 0.38. While many scenarios could generate such a measure, to give some intuition one possible case would be where one agency covers 75% of the topic and a second agency covers 25%. Alternatively, one agency could cover 78% of the topic, and two other agencies could each cover 11%. At the upper extreme, topics such as "Freedom of information" and "Government Procurement: Small Businesses" have agency dispersion measures of approximately 0.95. This is consistent with the general nature of these topics, which are applicable in different contexts and can thus be covered by many agencies.

In Panel A of Figure 3, we show a histogram of the fragmentation of each topic-year across agencies. The figure highlights the heterogeneity across topics. Some topics have a fragmentation less than 0.25, suggesting that regulation of these issues is highly concentrated. However, the distribution is quite skewed, with most topics having relatively high fragmentation.

3.3.Impact of regulatory fragmentation on firm-years

We now turn our attention to the ways in which this fragmentation affects companies. Our sample consists of firm-years between 1995 and 2019, with CRSP and Compustat data. We begin by applying the LDA algorithm previously trained on FR documents to each firm-year 10-K. This enables us to capture the set of issues pertinent to the firm. We calculate $P_{f,i,t}$, which is the percent of firm f's annual report that pertains to topic i at time t. We square these percentages and calculate the dispersion of topics within each firm-year as:

$$TopicDispersion_{f,t} = 1 - \sum_{Topic} P_{f,i,t}^2 \quad (3)$$

This measure varies within firms over time. Panel B of Table 1 lists firms with the highest and lowest dispersion of topics (averaged over the sample period). The first takeaway is that all firms have relatively high dispersion of topics, meaning they must comply with regulatory issues that span many different topics. The second takeaway is that the firms with the lowest topic dispersions are all financial institutions. Unlike other operating companies, financial institutions do not have substantial portions devoted to non-financial lines of business. The firm with the lowest topic dispersion is Carolina Bank Holdings: 31.1% of the firm's 10K relates to the topic 'Banks, Banking: credit unions', 11.9% to 'Securities: income taxes', and 10.0% to 'Income taxes: plus other taxes' in 2008. Panel B of Figure 3 shows a histogram, which depicts the distribution of this dispersion measure across firm-year observations. The distribution is nearly normal shaped between 0.9 and 0.99, but it also includes a left-hand tail. Approximately 9% of the observations have a topic dispersion less than 0.90.

Our main measure captures the exposure of each company-year to the regulatory fragmentation of each topic. Specifically, we compute the weighted average of the fragmentation of each topic i, where weights represent the relative importance of topic i for firm f (the portion of the firm's 10-K that relates to each topic, $P_{f,i,t}$). Formally:

$$Regulatory\ Fragmentation_{f,t} = \sum_{i} P_{f,i,t} \cdot Regulatory\ Fragmentation_{i,t} \quad (4)$$

Note that we use the label "Regulatory fragmentation" twice: once to describe the dispersion of topic i across agencies ($Regulatory\ Fragmentation_{i,t}$), and second to describe the exposure of firm f to the fragmentation of each topic across agencies (denoted with $Regulatory\ Fragmentation_{f,t}$). The difference between these variables is reflected in the subscripts. For our main economic analysis, where we estimate firm-level regressions, we rely on

the firm-level variable $Regulatory\ Fragmentation_{f,t}$.[13]

Panel C of Table 1 lists firms with the lowest and highest exposures (averaged over the sample period). There is a striking contrast between Panels B and C: firms in the financial industry have *low* dispersion of topics but *high* exposure to regulatory fragmentation. Put differently, financial companies concentrate on a relatively small number of topics, but those topics tend to be regulated by many federal agencies.[14] In contrast, firms in the medical industry have high dispersion of topics but the low exposure to regulatory fragmentation. These differences highlight the fact that we capture two distinct notions of regulatory burden: the number of topics and the number of agencies that regulate each topic.

Panel C of Figure 3 shows a histogram, which depicts the distribution of firms' exposure to regulatory fragmentation. This distribution is considerably less skewed than either the fragmentation of each topic across agencies or the dispersion of topics within firms. The distribution is nearly normal, with only a slight left skewness.

3.4. Validation of regulatory fragmentation measure

In this subsection, we seek to validate our measure by showing that it captures the extent to which companies are overseen by multiple federal agencies. We offer two approaches. The first one uses data from Chen and Kalmenovitz (2020), who identify Federal Register documents that mention companies from the S&P1500 index by name. There are 45,269 such documents mentioning 2,219 companies. For each firm-year, we count the total number of agencies that mention the company. In addition, we calculate an HHI-like measure of dispersion across agencies:

[13] Our data on firm-year measures of regulatory fragmentation, topic dispersion, and regulation quantity are available here: https://www.dropbox.com/s/mw23g61s2p9xhjs/companyyear_measures.csv?dl=0

[14] The topics "*Penalties: Banks, banking and government employees*", "*Penalties: Taxes and securities*", and "*Securities: Penalties*" represent the topics with the 7th, 13th, and 16th highest dispersion across agencies, respectively. Moreover, three additional finance-related topics rank 22nd, 24th, and 26th, across the total 100 topics.

$$Agency\ mentions\ of\ Co\ in\ FR\_Dispersion\ = 1 - \sum_{Agency} \omega_{a,f,t}^2 \quad (5)$$

where $\omega_{a,f,t}$ represents the number of times agency a mentions firm f in year t, out of total mentions of the firm during that year. Summing the squared values of $\omega_{i,a,t}$, we obtain a measure of dispersion that is analogous to our main measure of regulatory fragmentation.

Our second approach mirrors our first one: this time, we parse through the 10-K annual reports to identify explicit mentions of federal agencies. We calculate the number of agencies mentioned in the 10-K and a measure of dispersion, defined as:

$$Agencies\ Mentionned\ in\ Co\ 10K\_Dispersion\ = 1 - \sum_{Agency} \omega_{a,f,t}^2 \quad (6)$$

where $\omega_{a,f,t}$ represents the number of times firm f mentions agency a in year t, out of total mentions of agencies by the firm in that year. Summing the squared values of $\omega_{i,a,t}$, we similarly obtain another measure of dispersion, analogous to our main measure of regulatory fragmentation.

Panels A and B of Table 2 report descriptive statistics. Starting with data from the FR, we find that the average (median) company is mentioned by only 2.3 (2.0) agencies within a year. Relative to all companies that an agency oversees, this is arguably quite low. Moving to data from 10-Ks (bottom portion of Panel A), the average (median) company mentions 3.5 (3.0) agencies within a given year, with an interquartile range of 2.0 to 5.0. One of the agencies that is nearly always mentioned is the SEC. In sum, these measures contain relevant information, but they are almost certainly incomplete measures of the regulatory oversight faced by companies.

Panel C explores the overlap between the two measures. For each of the 14,592 company-years with at least one mention in the FR, we determine the number of agencies that mention the company in that year, and we then determine whether the firm mentions all the same agencies within its 10K. We find the percent of overlap is only 23.6%. From the other perspective, the overlap is even smaller: there are 14,214 firm-year observations that mention one or more agencies

in their 10K, but all these agencies cite the company (in their FR documents) in only 5% of cases.

An advantage of these measures is that they capture an important aspect of regulation: companies would mention agencies that are highly relevant to their business models, and agencies would mention companies that are the subject of specific regulatory actions.[15] As such, we expect the measures to be correlated with our primary measure of regulatory fragmentation. We test this by estimating a set of regressions, which are reported in Panel D of Table 2. The dependent variable is the dispersion measure based on FR or 10-K (equations 5 and 6 above), and the main independent variable is our primary measure: $RegFragmentation$. To be clear, we are not seeking to establish a causal relation here, rather to see if the measures of fragmentation are reasonably correlated. We include company, year, and industry-year fixed effects, and we cluster standard errors by industry. We find that the first measure, which captures the extent to which multiple agencies mention a company within a year, is significantly positively correlated with $RegFragmentation$: a one-standard-deviation increase in fragmentation is associated with an 5.0% increase in the dispersion of mentions in the FR. The second measure, which captures how many agencies are mentioned by the company in its 10-K disclosure form, has a similar positive correlation with $RegFragmentation$ but is not significant at conventional levels.[16]

In sum, this analysis validates our measure of regulatory fragmentation. We find that companies with high values of $RegFragmentation$ are "fragmented" along both dimensions: they are mentioned by more agencies (in the FR) and they mention more agencies (in the 10-K).

[15] We do not view those as comprehensive measures of regulatory fragmentation. First, as discussed, the coverage is limited to large S&P1500 companies which can be searched by name in the FR. Also, Cao et al. (2022) find that companies manipulate their 10-K disclosure along various dimensions, raising the possibility that they omit references to agencies that are clearly related to their business strategy,

[16] Consistent with Shive and Foerster (2017), who rely on firm mentions of regulators in firm 10K in their analysis of the finance industry, we find that agency mentions by the company in its 10K are more informative for firms within the finance industry. Within the finance industry, this measure is significantly related to our main measure of regulatory fragmentation. Results are shown in Internet Appendix Table A1.

4. The evolution of government activity over time

Panel A of Figure 4 illustrates trends in firms' exposures to regulatory fragmentation. We compute the annual average for each firm-year, within each Fama-French 12 industry. Overall, there is a downward trend in the fragmentation faced by firms. One notable exception is the period 2008-2010, when a temporary yet large shift increased fragmentation by almost 7 percentage points. After 2010, that trend reversed, and we again see a decline within each industry.

Panel B highlights the extent to which firms within an industry experience both different levels and different year-to-year changes in exposure to fragmentation. We focus for brevity on the Non-Durables industry (analyses of the remaining industries reveal similar patterns; results are available upon request). Strikingly, the variation within an industry (as shown in Panel B) is greater than the variation across industries (as illustrated in Panel A).

We also find that the most common topics have varied substantially over time (Figure A.2 in the Internet Appendix). Consistent with national trends, two of the topics with the greatest increase over the sample period include '*Health: insurance*' (490% increase, from 68,000 to 398,000 words) and '*Environment: data & studies*' (163% increase, from 152,000 to 401,000 words). Some trends also suggest cause for concern. For example, '*Aviation safety: inspection*' was one of the topics with the greatest decreases. In light of the recent Boeing disaster, this suggests that trends in regulatory attention may be informative regarding future problems. We also observe changes around key national events, for example the Financial Crisis and the 2016 Presidential election. Consistent with general perceptions regarding Trump's agenda, following his election the topics with the largest decreases (in terms of FR words) include '*Environment: government relations*', '*Energy conservation*', and '*Endangered species*'. The magnitude of the decreases (-66%, -61%, and -26%) raises concerns regarding long-term effects in these areas.

Commensurate with the trends in regulatory topics, we also observe trends among regulatory agencies (Figure A.3 in the Internet Appendix). Several of these mirror changes in topics. For example, activity of the Environmental Protection Agency decreased by 31%, in the 2017-2019 period (relative to the prior three-year period). Around the 2008 – 09 Financial Crisis, the activity of the SEC, Federal Reserve System and Commodities Futures Trading Commission increased by 18%, 130%, and 520% respectively. In contrast, activity by the Housing and Urban Development (HUD), Treasury, and Federal Energy Regulatory Commission decreased markedly.

The dramatic changes in the amount of government activity around these key events suggest that the distribution of government activity across agencies likely also changed. Figure 5 shows evidence consistent with this conjecture. Looking first at Panel A, following the Trump election two of the topics with the greatest increases in fragmentation relate to the environment: '*Energy Conservation*' and '*Endangered Species*'. This is consistent with the primary agencies responsible for these issues receiving less funding, and thus remaining oversight being spread more widely across many agencies. In contrast, two of the topics with the greatest decrease in fragmentation relate to the financial sector: '*Banks*' and '*Income & Other Taxes*'. Indeed, the Trump administration set a goal of reducing the fragmentation of financial regulation.[17] Panel B shows the topics with the biggest changes around the Financial Crisis, which coincides with the election of Barack Obama. Interestingly, some of the topics with the largest increases in fragmentation in Panel A are among the largest decreases in Panel B, and vice versa. For example, whereas the fragmentation of 'Energy Conservation' increased following the Trump election, it had decreased in 2009-2011 (relative to the prior three-year period).

[17] A recent report by the U.S. Department of Treasury makes a similar point, arguing that fragmentation and overlap could potentially lead to "ineffective regulatory oversight and inefficiencies that are costly to… businesses." See https://www.treasury.gov/press-center/press-releases/Documents/A%20Financial%20System.pdf.

5. Effects of regulatory fragmentation on economic activity

In this section, we test our main hypotheses. Our first hypothesis posits that firms incur greater costs when regulatory topics fall under the purview of a higher number of regulatory agencies. First, firms have more uncertainty regarding which regulator they must satisfy. Relatedly, firms may have to satisfy multiple regulators on certain issues. Among firms that engage in lobbying, there is less ability to focus efforts on the most important regulatory agency. This potentially contributes to both less information flow regarding regulatory initiatives (see, e.g., (Bertrand, Bombardini, and Trebbi (2014); Blanes i Vidal, Draca, and Fons-Rosen (2012)) and to regulations that are more detrimental for the firm.[18]

Alternatively, it is possible that regulatory fragmentation is beneficial to firms. When multiple regulators overlap, companies may be able to select their regulator. They may select a regulator based on a perceived ability to better influence new regulation to their advantage. Alternatively, they may select the regulator that offers the least restrictive regulations. Either of these scenarios arguably benefits firms, via a race to the bottom in regulation.

5.1 Empirical setup

Before presenting our main empirical tests, we provide descriptive statistics on average firm characteristics in Table 3. We categorize the entire sample of firm-years into quintiles based on their levels of topic dispersion (left-hand columns), and into quintiles based on their exposure to regulatory fragmentation (right-hand columns). For brevity, throughout our firm-level analyses we refer to firms' exposure to regulatory fragmentation simply as regulatory fragmentation.

Several features are worth highlighting. First, regulatory fragmentation is relatively constant across the topic dispersion quintiles, indicating that these are two distinct phenomena.

[18] Consistent with our analysis of firm-level effects, we do not empirically analyze social welfare-type issues that potentially stem from regulatory capture.

Second, neither topic dispersion nor regulatory fragmentation is strongly related to firm size, as measured by sales. Third, SG&A expenses are positively related to both measures, providing preliminary evidence that regulatory fragmentation and topic dispersion are both associated with higher costs. Fourth, firm growth (as proxied by sales growth, asset growth or Tobin's Q) is positively related to topic dispersion but negatively related to regulatory fragmentation. Firms with operations that pertain to a greater number of topics tend to grow faster, but when these topics relate to more distinct regulatory bodies the growth is slower.

We next turn to regression analyses. We control for a bevy of firm factors and fixed effects to robustly analyze the relation between regulatory fragmentation and firm outcomes. The main empirical tests of our two hypotheses use variants of the following framework:

$$y_{f,t+l} = \alpha + \beta \cdot Regulatory\ Fragmentation_{f,t} + \vec{X}_{f,t} + \tau_t + \theta_k + \mu_f + \varepsilon \qquad (7)$$

where $y_{f,t+l}$ is a firm-level outcome and $Regulatory\ Fragmentation_{f,t}$ is defined in Equation 4.[19] We include year fixed effects (τ_t), industry fixed effects (θ_k), and firm fixed effects (μ_f). In the tightest specification we replace year fixed effects with year×industry fixed effects, removing industry trends and focusing on the variation within-industry across companies. Firm-level controls ($\vec{X}_{f,t}$) include the length of the firm's 10-K (in log), property, plant and equipment (PP&E scaled by assets), profitability (EBITDA scaled by assets), sales (in log), and Tobin's Q. We also control for $TopicDispersion_{f,t}$ and for $RegulationQuantity_{f,t}$. The former variable, defined in Equation 3, represents the extent to which the firm's business extends across multiple areas. The latter variable proxies for the amount of regulation that relates to the firm's business. Formally:

$$RegulationQuantity_{f,t} = \sum_{Topic} P_{f,i,t} \cdot log(Words_{i,t}) \qquad (8)$$

[19] As noted earlier, for conciseness we refer to firms' exposure to regulatory fragmentation simply as regulatory fragmentation.

where $P_{f,i,t}$ is the percent of words in firm f's annual report in year t that pertain to topic i, and log ($Words$) is the number of words devoted to this topic in the FR in the same year. In other words, $RegulationQuantity$ is the weighted average of the number of FR words in each of the 100 topics, where weights equal the relative importance of each topic for the firm. We lag all independent variables one period and cluster standard errors at the Fama-French 48 industry level.

5.2 SG&A expenses

We begin in Table 4 by examining the extent to which the regulatory fragmentation faced by firms relates to higher SG&A expenses, as a fraction of assets. Our base specification is shown in column 1. We find that SG&A expenses are positively related to regulatory fragmentation: a one-standard-deviation increase in exposure to regulatory fragmentation is associated with 3.8% standard deviation increase in SG&A / assets.[20] When the topic areas in which the firm operates become more fragmented across regulatory agencies, the firms' costs increase. Results are similar when we replace year fixed effects with year×industry fixed effects, as shown in column 4. Here, we compare companies that operate within the same industry boundaries, thus removing industry factors that affect both the regulatory environment and company-level costs.

The significantly positive coefficients on firms' topic dispersion are also informative, as they relate to the broader debate on firm diversification. Lang and Stulz (1994), Berger and Ofek (1995) and Servaes (1996) show that diversified firms trade at a discount, but Campa and Kedia (2002), Villalonga (2004), and Tate and Yang (2015) conclude that diversification has either zero or positive effects. Our findings show that if the firm's overall activity remains unchanged (proxied by sales and length of form 10-K), but its businesses cross a more regulatory areas, then the firm incurs higher administrative costs. This holds with firm fixed effects, indicating that an increase

[20] The magnitude is calculated as coefficient*sd(regulation dispersion)/sd(SGA/AT) (i.e., 0.381*0.027/0.27).

in topic dispersion relates to higher SG&A costs the following year.

5.3 Firm profitability and productivity

Findings in the prior section provide initial evidence consistent with the costs of regulatory fragmentation. This subsection provides further evidence by examining the link between exposure to regulatory fragmentation and both firm productivity and profitability. Total factor productivity (TFP) captures firm output per unit of input. If greater fragmentation increases required inputs (i.e., more employees or more capital) per unit of output, then we will observe a negative relation between fragmentation and TFP. This would be the case if, for example, greater fragmentation requires the firm to expend more resources to satisfy regulatory requirements, thus taking input away from more productive uses.

We measure firm total factor productivity (TFP) following Imrohoroglu and Tuzel (2014) and Olley and Pakes (1996).[21] Broadly speaking, TFP is a function of firm-level value added (measured as sales minus non-labor expenses), the stock of labor (measured by number of employees), and the stock of capital (measured as gross PP&E). The model is estimated using a semi-parametric procedure, which relative to OLS has the advantages of controlling for selection biases, controlling for simultaneity biases, and accounting for firm serial correlation.

Columns 2 and 5 in Table 4 show regressions similar to those in columns 1 and 4. We regress TFP on regulatory fragmentation, regulation quantity, firm topic dispersion, and relevant controls and fixed effects. Results provide further evidence consistent with the costs of regulatory fragmentation. Across both specifications, we find a significant negative relation between fragmentation and TFP. Our strictest specification, which includes company and industry×year

[21] We thank Imrohoroglu and Tuzel for making TFP data available for years up to 2013, and for providing the code to calculate the measure for subsequent years.

fixed effects, indicates that a one-standard-deviation in fragmentation is associated with a 3.2% standard deviation decrease in TFP during the following year. When regulatory activity becomes fragmented across a greater number of government agencies, firm productivity falls.

In contrast to the significant negative relation between regulatory fragmentation and TFP, we find little evidence that either regulation quantity or firm topic dispersion is significantly related to TFP. It is striking that the fragmentation of regulatory activity across government agencies has a significant impact on firm productivity, but neither the level of regulation nor the number of regulatory areas in which a firm operates has a similar influence.

The finding that higher regulatory fragmentation generates higher overhead costs (in terms of SG&A) and lower productivity (in terms of TFP), suggests that the firms will also tend to have lower profits. Columns 3 and 6 provide evidence consistent with this prediction. A one-standard-deviation increase in regulatory fragmentation is associated with a fall in the following year's ROA that ranges from 4.7 – 5.0% of a standard deviation.

5.4 Firm growth

The findings that regulatory fragmentation is related to both higher costs and lower productivity suggests that it will negatively impact the NPV of projects, thus contributing to lower growth. We examine this conjecture in Table 5, which has a format similar to that of Table 4. Consistent with expectations, we find significantly negative effects of regulatory fragmentation on both sales growth and asset growth. Column 1 indicates that a one-standard-deviation increase in the regulatory fragmentation faced by the firm in year *t* is followed by the firm's sales growing 4.2% slower the following year. Columns 2 and 5, which use asset growth as a dependent variable, show similar effects. Focusing on column 5, which includes both firm and industry×year fixed effects, a one-standard-deviation increase in the regulatory fragmentation faced by the firm is

followed by the firm experiencing 5.7% slower asset growth in the following year. We also find that regulation quantity has a significant negative effect on both sales growth and asset growth.

It is worth highlighting that, similar to the findings for SG&A, profitability and TFP, the significant negative relations between fragmentation and firm growth occur both within-firm and within industry-year. If a firm faces an increase in regulatory fragmentation in year t, that firm tends to grow slower in the following year.

5.5 Channels underlying effects of regulatory fragmentation

In this subsection, we consider the channels underlying the above relations. We focus on a key input to firm production: labor. On the one hand, the slower growth can cause firms to hire fewer new employees. This suggests a negative relation between the regulatory fragmentation and employment. However, regulatory fragmentation also has a potential positive effect on employment, as firms may be forced to hire additional people to satisfy the increased regulatory requirements (Trebbi and Zhang (2022)).

Column 6 in Table 5 provides evidence of a positive net effect, that is, greater regulatory fragmentation leads firms to hire more employees. Higher labor costs contribute to increased overhead costs, lower productivity, and decreased profitability; as such, these results are consistent with findings in Table 4.

5.6 Robustness

We estimate several additional analyses, to further check the robustness of our conclusions. One concern is that the coefficient on fragmentation may be biased by changes in firm operations (rather than just changes in the fragmentation of topics across agencies). If this is the case, then the bias should be largest among firm-years with large changes in operations. Following this intuition, in Panel A of Table 6, we re-estimate our main regressions but exclude observations in

which the firm experienced a substantial change in operations relative to the prior year. We use three proxies for such operational changes. First, we exclude firms that changed their industry affiliation, which (to be conservative), we define using a very fine measure of 500 industry groups (Hoberg and Phillips 2010, 2016). Second, we exclude firms whose number of operating segments changed, based on Compustat business segments data. Third, we exclude firms whose assets changed (in absolute terms) by more than 20%. For each alternative sample, we re-estimate regressions in which the independent variable of interest is regulatory fragmentation, and the dependent variables are SG&A scaled by assets (columns 1-3), TFP (columns 4-6), and sales growth (columns 7-9). All results are qualitatively similar to those in our main analyses, as reported in Tables 4 and 5. This bolsters our confidence that the control variables used in the main analysis capture the effects of any changes in firm operations, and thus the coefficient on regulatory fragmentation isolates the effects of regulation being spread across multiple agencies.

In Panel B of Table 6, we include the full sample and interact regulatory fragmentation with dummy variables equal to one if the firm experienced one of these operational changes. Specifically, we use a dummy equal to one if the firm switched industry (measured by the Hoberg and Phillips 500 industry grouping), if the firm changed its number of segments, or if the firm's assets changed (in absolute value) by more than 20%. Results are consistent with inferences from Panel A. The coefficient on regulatory fragmentation continues to be significant in every specification, and the coefficient on the interaction term is insignificant in eight of the nine cases (and in the one case where it is significant, it has the opposite sign as would be expected).[22]

Our second robustness analysis seeks to ensure that results are not driven by outliers.

[22] We also attempted to conduct a structural break analysis, following Charles, Hurst, and Notowidigdo (2018). However, such an analysis is challenging in our setting, because it requires both a sufficiently large shock to the fragmentation of a topic and it requires some number of firms to have a sufficiently large sensitivity to that topic. Unfortunately, such conditions are not satisfied, thus prohibiting such an analysis.

Following Broderick, Giordano, and Meager (2020), we randomly drop 1% of the sample and re-estimate Equation 7, separately for each of the six outcome variables from Tables 4 and 5. From each estimation, we retain the t -statistic for the coefficient on our main variable, $Regulatory\ Fragmentation$. We reiterate the process 1,000 times. Figure A4 in the Internet Appendix plots the distribution of t-statistic from all iterations, against the t-statistic which we obtain in our baseline estimations with the full sample. The randomized estimates are centered around our baseline estimates, suggesting that our results are unlikely to be driven by outliers.

Third, we have re-calculated our main measure of regulatory fragmentation, using only information from the MD&A section of the 10K instead of the entire document. Results, reported in Internet Appendix Table A2, are qualitatively similar to our main findings.

Fourth, we recognize that our choice of 100 topics is somewhat arbitrary. For robustness, we re-estimate our main regressions based on alternative groupings of topics. First, across our set of 100 topics, we manually group more similar topics together, a process that generates either 57 or 73 topics. Second, we re-estimate our LDA analysis to allow more narrow topic definitions, either 200, 300, or 1,000 topics. Results, as reported in Internet Appendix Table A3, are qualitatively similar across all these groupings.

5.7. Industrial organization of the industry

Classic economic theories argue that regulation can raise barriers to entry (see, for example, Stigler (1971)), and we conjecture that the fragmentation of regulation has a similar effect. Our analysis relies on the product market similarity scores from Hoberg and Phillips (2016). The authors first compute the similarity scores between each pair of companies, based on how they describe their products in the annual 10-K form. The published database (labeled TNIC-3) reports, for each focal firm, the list of peer firms with relatively high similarity scores. We use those scores

to identify changes in the competitive environment surrounding each focal firm, and to see whether those are driven by changes in the focal firm's regulatory fragmentation.[23]

Our analysis is summarized in Table 7. We use the workhorse specification (equation 7) where the main independent variable of interest is regulatory fragmentation, but now the dependent variable captures various aspects of the focal firm's competitive environment. As before, independent variables are measured at time t while the dependent variable is measured at time $t+1$. In columns 1 and 2, we focus on entry: the number of new peers at time $t+1$. We compute separately the number of new peers that went public during year $t+1$ (column 1), and the number of peers that were already public in year t but moved into the focal firm's industry at time $t+1$ (column 2). We find that fragmentation is significantly negatively related to both measures. In economic terms, a one-standard deviation increase in fragmentation is associated with a 0.67 decrease in the number of IPOs in the focal industry.

In column 3 we shift the focus to exits. We compute the percentage of peers at year t that continue to trade at year $t+1$ but are no longer peers. In other words, we measure the exit rate from the focal firm's industry. We find a significantly positive relation with fragmentation: a one-standard-deviation increase in fragmentation is associated with an 8.6% increase in the number of peers that exit the focal firm's industry.

Finally, column 4 examines the net effect of fragmentation on industry size. The dependent variable is the number of peers in year $t+1$. Consistent with the significantly lower entry and higher exit shown in columns 1-3, we find a significant negative effect on industry size: a one-standard-deviation increase in fragmentation is associated with 6.1 fewer peers in the industry. In sum, the results throughout this section demonstrate that the costly nature of fragmentation both

[23] In our sample, the median focal firm has 26 peers, with an interquartile range of 5 to 121.

deters entry and contributes to exit, in ways that negatively affect membership in the industry.

6. Sources of burden arising from regulatory fragmentation

Results to this point show that regulatory fragmentation is costly for firms. In this section, we seek to disentangle two possible sources of burden. One source of burden is duplication, where the multiple agencies who regulate a single topic impose similar regulatory requirements. For example, companies may be required to fill out two different forms that track pollution levels. The duplicate requirement could be helpful if it provides added assurance that the regulatory requirement is fulfilled, but the redundancy entails additional costs on companies. A second source of burden is inconsistency across regulators. Using the above example, while both agencies require the company to keep track of pollution levels, perhaps agency X requires reporting in a metric system and agency Y uses the imperial system. The inconsistency imposes heavier costs on companies. In addition, inconsistency might create uncertainty in more complicated situations, for example if firms are unsure how to resolve discrepancies in requirements.

The two channels are not mutually exclusive. To empirically evaluate their importance, we rely on the fact that some documents in the FR are co-authored by multiple agencies while others are authored by a single agency.[24] When agencies collaborate, it is unlikely that the resultant regulation is riddled with inconsistencies. Thus, co-authored regulations should have weaker adverse effects (in absolute value). To test this idea, we augment our baseline specification with a variable that represents the firm's exposure to co-authored topics. It is constructed in two steps. First, we identify co-authored topics based on the Federal Register, which we define as topics where most of the documents are co-authored by two or more agencies. Second, we identify firms

[24] Nearly 80% of the Federal Register documents are solo-authored.

with high exposure to co-authored topics: $CoAuthored_{f,t}$ equals one if firm f dedicates most of its 10-K filing at time t to co-authored topics and zero otherwise. Our independent variable of interest is $CoAuthored_{f,t}$ interacted with our primary measure of regulatory fragmentation. We use a fully-interacted model, where $CoAuthored_{f,t}$ is interacted with each of the independent variables.

The results are reported in Table 8. Following earlier specifications, dependent variables include measures of costs, productivity, profitability, growth, and employment. Consistent with our predictions, the coefficient on the interaction term ($CoAuthored_{f,t} \cdot RegFragmentation_{f,t}$) has the opposite sign from the coefficient on $RegFragmentation$ in nearly all cases. For example, with SGA as the dependent variable, the average effect of fragmentation is 0.545, but for firms who are more sensitive to "co-authored" topics the effect is only 0.432.

In sum, results indicate that the negative effects of fragmentation are mitigated when agencies collaborate, that is, when the costs of fragmentation reflect duplicative redundancy. In contrast, effects are stronger when agencies independently regulate the same topic, suggesting that resulting rules are more likely to suffer from inconsistency.

7. Firms' efforts to influence regulatory fragmentation

Lobbying represents one of the common tools firms employ to influence government activities, including new rulemaking, proposed future actions, and enforcement issues. When regulatory activity is fragmented across multiple government agencies, it potentially affects firms' lobbying choices. On the one hand, because regulatory fragmentation adversely affects firms, an increase in fragmentation potentially leads firms to increase lobbying expenditures to counteract these effects. At the same time, however, the increased fragmentation arguably decreases the

efficiency of lobbying, as it is less clear where to focus lobbying efforts. When multiple agencies oversee a given regulatory issue, firms face less clarity on where to direct lobbying dollars. Moreover, the impact of lobbying for or against a given regulatory topic is likely lower, when that regulatory activity is spread more widely across multiple agencies.

To examine these issues, in Table 9 we estimate regressions similar to those shown in Tables 4 and 5, with the exception that lobbying is the dependent variable.[25] Specifically, we measure lobbying as the log of lobbying expenditures in columns 1 and 3, and as raw lobbying expenditures in columns 2 and 4 (in USD millions). The independent variable of focus is regulatory fragmentation, and we also include topic dispersion, regulation quantity, and control variables used in prior regressions. Columns 1 and 2 include company and year fixed effects, and columns 3 and 4 additionally include industry×year fixed effects. Across all specifications, we find that greater regulatory fragmentation is associated with a significant decrease in firm lobbying. These results are consistent with firms concluding that the benefits of lobbying are lower, when it is less clear where to direct lobbying efforts.

8. Alternative stages of regulatory activity

As discussed previously, our comprehensive measure of government activity represents the flow of all government activity. While most regulation-related studies focus solely on the effects of newly implemented rules, firm executives regularly complain about multiple facets of regulatory requirements, including for example enforcement actions (as reflected in notices), modifications to previously passed rules, etc. In this section, we examine whether these different stages of government regulatory activity all have significant effects on firms.

[25] We obtain data on lobbying activities from Kim (2018).

8.1 Notices, proposed rules, and rules

Notices include many types of content, including information pertaining to future rule making as well as details on to the implementation and ongoing requirements of laws and regulations that have already passed. Table 10 provides direct insight on the extent to which notices relate to past and future rulemaking. We estimate regressions where the dependent variable is the log number of words within the *Rules* section written by agency *a* on topic *i* during year *t*. The key independent variables include the log number of words within the *Notices* section written by the same agency on the same topic in the past (years *t-1* and *t-2*) and in the future (years *t+1* and *t+2*).

Results in column 1 show the relation between rulemaking and past notices: a one-standard-deviation increase in notice words predicts a 24.0% increase in rules words in the subsequent year.[26] Column 2 indicates that rulemaking is also significantly related to the content of future notices: a one-standard-deviation increase in notices words in year t+1 is associated with an 23.0% increase in rulemaking in the prior year (as defined as words on the same topic by the same agency). Inferences are similar in column 3, where we simultaneously include both lags and leads. Finally, in column 4, we include an even stricter set of fixed effects, thereby estimating whether an agency pays greater attention to a particular topic relative to its average attention for that topic (agency-topic fixed effects), controlling for the overall increase in the agency's activities during the year (agency-year fixed effects), and for the overall increase in the government's attention to this topic during the year (year-topic fixed effects). Not surprisingly, the magnitude of the coefficients decreases, as we are arguably soaking up part of the effect in which we are interested. Nonetheless, the coefficients remain significant at the 1% level.

[26] We calculate economic significance by multiplying the coefficient by the standard deviation of independent variable (#Words (notices, agency, topic, year -1)) and dividing it to the standard variable of the dependent variable (#Words (rules, agency, topic, year)). Economic significance: 0.259*2.30/2.47.

An additional type of notices includes miscellaneous activities such as meetings open to the public, collection of information from the public, and organizing international trade missions. These actions do not necessarily have a lead-lag relation with rules, but they are nonetheless relevant for companies (see, e.g., Chen and Kalmenovitz (2020)).

In sum, there are multiple reasons for firms to pay attention to notices: some notices contain information on the early stages of rulemaking, others contain details regarding the implementation of already-passed rules, and others apply specifically to certain firms and require them to take action. To evaluate the effects of fragmentation across different types of government activity, we separately calculate the fragmentation of notices, of proposed rules, and of final rules.[27]

Panels A and B of Table 11 show regressions similar to those in Tables 4-5, except that we use focus on regulatory fragmentation calculated across notices and across final rules, respectively. Results highlight the significant effects of each stage of regulatory activity. While notices are largely ignored in regulation studies, regulatory fragmentation within this stage predicts higher overhead costs, lower productivity, and lower profitability and growth. In contrast, the effects of regulatory fragmentation on new hiring are concentrated within new rulemaking, consistent with firms hiring more employees to satisfy new regulatory requirements.

8.2. New rulemaking versus modifications to prior rulemaking

We take a unique approach to separating rulemaking on new issues versus modifications. Rules and proposed rules within the FR are filed with a Regulation Identifier Number (RIN). All modifications to previous rulemaking are filed under the same RIN as the original rule (or proposed rule) on the issue. Thus, we classify the first document with a given RIN as a new rule or proposed rule. All follow-on documents filed under a previously used RIN are classified as modifications.

[27] These different stages of government activity capture issues with some overlap but that also have unique aspects: the correlation between the fragmentation of rules and proposed rules is 0.66, and between rules and notices is 0.28.

We separately calculate regulatory fragmentation across New Issues (specifically New RIN documents) and across Modifications (specifically Old RIN documents). The correlation between these measures is 0.54, indicating that there is overlap but they also capture different dynamics.

Panel A of Table 12 examines the relations between firms' exposure to regulatory fragmentation across New Issues and firm outcomes. Panel B is similar, but it focuses on the fragmentation across Modifications. We find that both types of regulatory activity are significantly related to firm outcomes.[28] Moreover, in many cases the economic magnitudes are similar.

9. Conclusion

The federal government is the largest economic agent in the country. As such, the government's activities have a tremendous impact on companies. And yet, studies tend to focus on small subsets of the government's activities and especially on various federal regulations that are already in place. In this paper we choose a different path and develop the first rigorous measure of the federal government's entire actions. We achieve this by analyzing the voluminous official documents published daily by the government in the Federal Register (FR).

We use a machine learning algorithm to categorize all FR activities into 100 topics and label each topic according to its economic focus. We find that topics are often handled simultaneously by multiple federal agencies, and there are substantial shifts that occur around major macroeconomic events. We use a similar machine learning technology to classify the regulatory topics each company faces, based on the content of the annual 10-K filings. We find substantial heterogeneity in regulatory topics within and across firms. Finally, we combine the two parts – FR analysis and 10-K analysis – to create a novel measure of regulatory fragmentation. It

[28] Results are qualitatively similar when we restrict this analysis solely to Rules (instead of including both Rules and Proposed rules).

is based on the intuition that each company is dealing with multiple regulatory topics (calculated based on the 10-K filing), and each topic is handled by multiple agencies (calculated based on the FR documents). It is a firm-specific, time-varying measure, where higher fragmentation indicates that the company's businesses are overseen by a greater number of federal agencies.

We show that regulatory fragmentation is associated with significantly higher SG&A costs, lower productivity (TFP), lower profitability, and slower growth. These results are conditional on other measures of regulatory burden and complexity, which we derive separately, and are identified within firm over time and also within each industry×year. Combined, our findings indicate that companies internalize the costs of having to keep abreast of multiple regulatory bodies. When a firm must answer to a greater number of government agencies, it must divert resources away from value-increasing efforts to satisfy regulatory requirements. Put differently, companies benefit if their businesses are regulated by fewer government agencies: they face less uncertainty and find it easier to capture the relevant regulators.

Overall, our paper is related to the emerging literature that studies how regulation in all its forms affects economic activity. Our empirical approach applies advanced linguistic tools to a long-established but little-used administrative data set, namely, the Federal Register. This approach allows us to study broad trends in the government's activities, and to develop micro-level evidence on how individual firms respond to changes in that activity. Finally, our focus on regulatory dispersion sheds light on a less-known aspect of regulation: the "industrial organization" of the federal government, where multiple agencies regulate similar topics.

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Figure 1: Total number of words in the Federal Register

This figure shows the annual number of words in the Federal Register between 1995 and 2019, based on the three most prevalent types of documents: rules, proposed rules, and notices. The sample consists of 783,950 documents obtained from the Federal Register server. In each document, we count only words from Grady Ward's English dictionary.

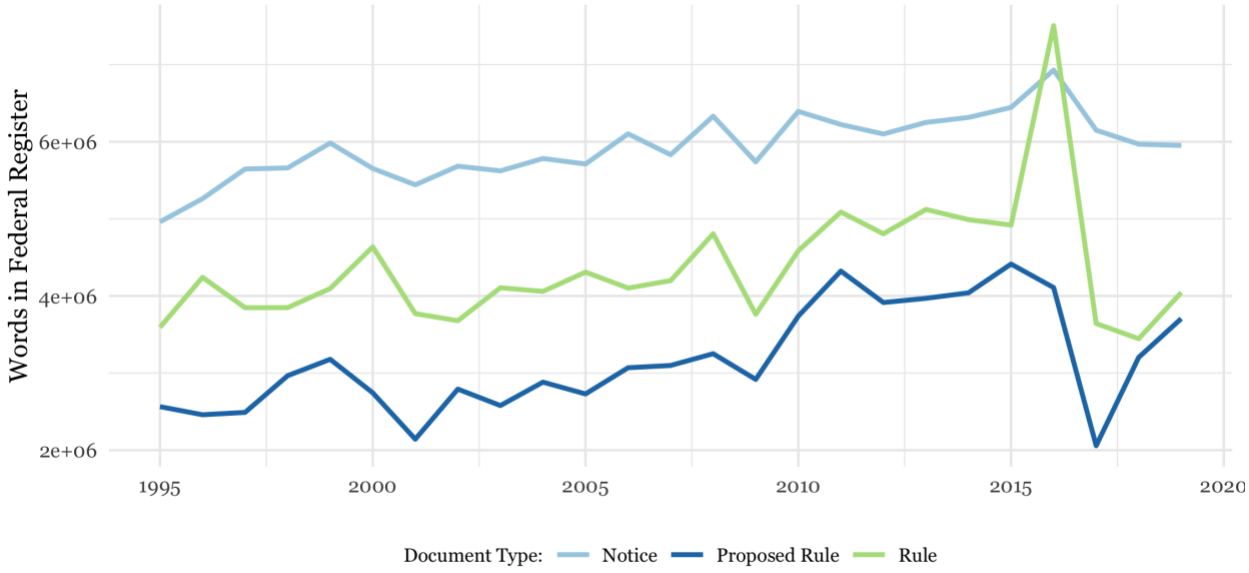


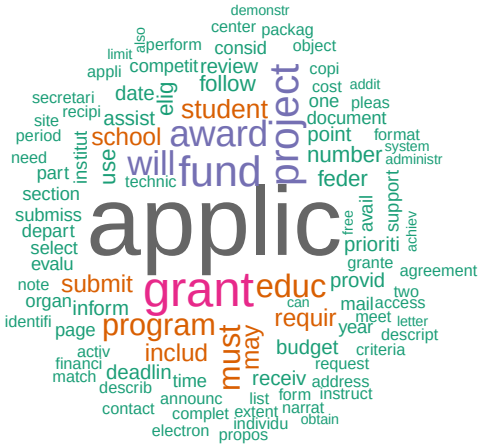
Figure 2: Topic clouds

We categorize the contents of the Federal Register into 100 distinct topics, using LDA analysis. This figure plots word clouds of the most common words within four of these topics.

Panel A: Topic 3 (Endangered Species)

Panel B: Topic 5 (Securities: investment companies)

Panel C: Topic 21 (Grants: education)



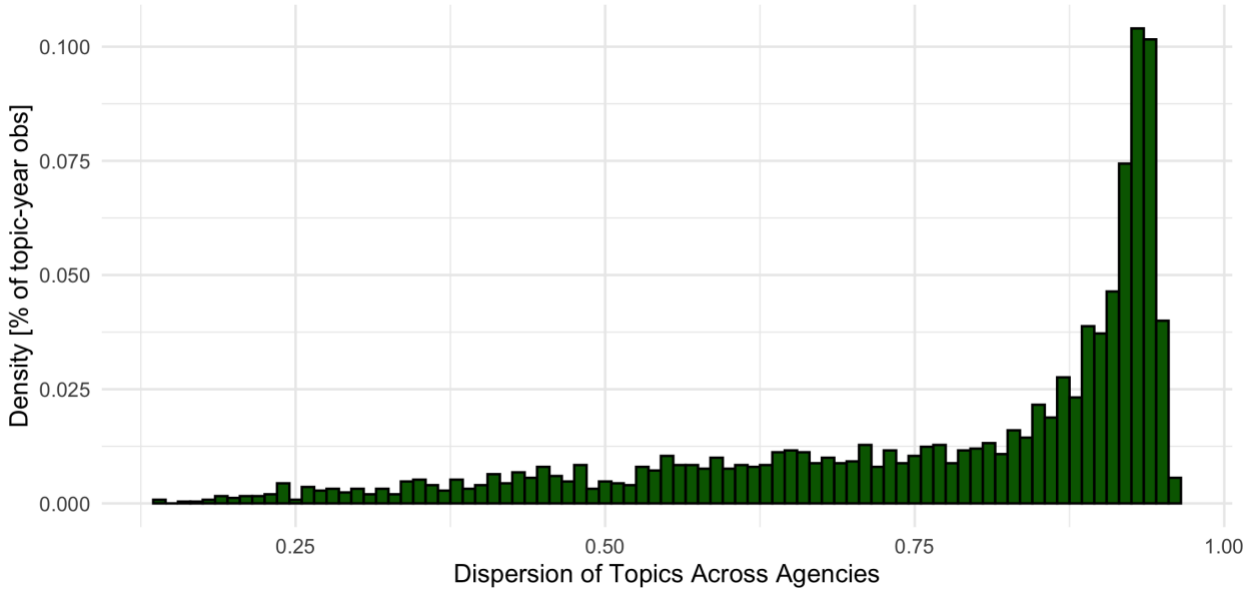
Panel D: Topic 23 (Health: insurance)

Figure 3: Regulatory fragmentation histograms

This figure shows the distribution of topics across agencies (Equation 2), the distribution of topics within firms (Equation 3), and our main measure – regulatory fragmentation (Equation 4). The distribution of topics across agencies (Panel A) is at the topic-year level; it equals 1 minus the sum of squares of the fractions of words in the topic-year observation written by each agency. The distribution of topics within firms (Panel B) is at the firm-year level; it equals 1 minus the sum of squares of the fraction of each topic in the firm's annual report. Regulatory fragmentation (Panel C) is at the firm-year level; it equals the weighted average of the distribution of topics across agencies, where weights correspond to the fraction of the annual report devoted to each topic.

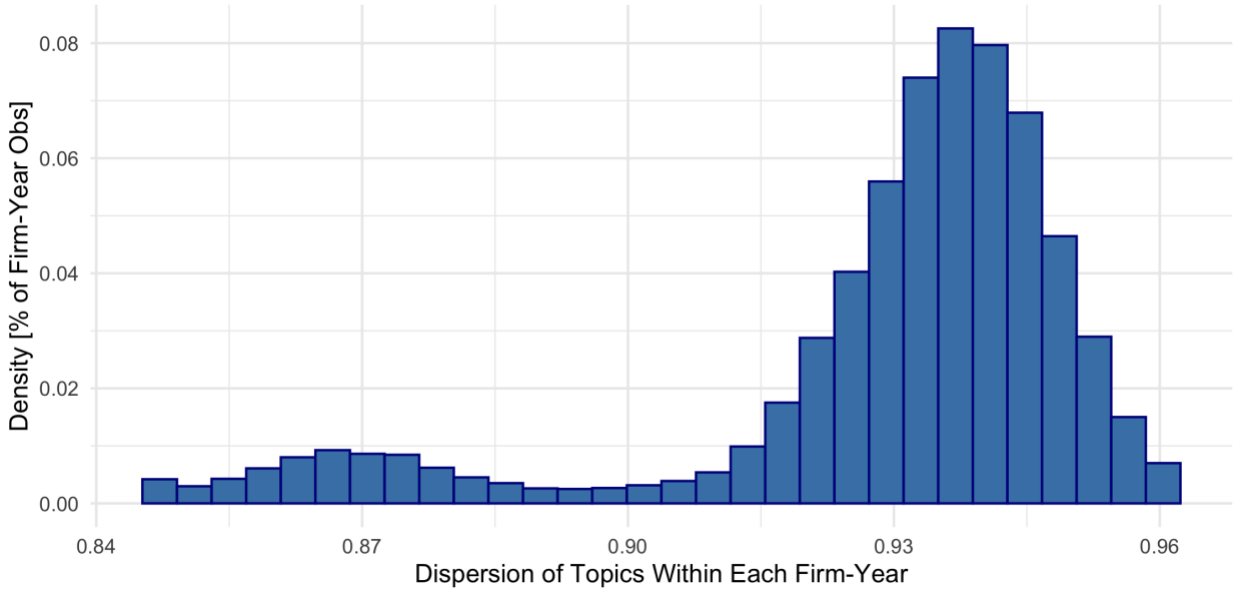
Panel A: Dispersion of topics across agencies

$$Regulatory\ Fragmentation_{i,t} = 1 - \sum_{Agency} \omega_{i,t,a}^2$$



Panel B: Dispersion of topics within each firm-year

$$TopicDispersion_{f,t} = 1 - \sum_{Topic} P_{f,i,t}^2$$



Panel C: Regulatory fragmentation

$$Regulatory\ Fragmentation_{Firm\ f,Year\ t} = \sum_{Topic} P_{f,i,t} \cdot Regulatory\ Fragmentation_{i,t}$$

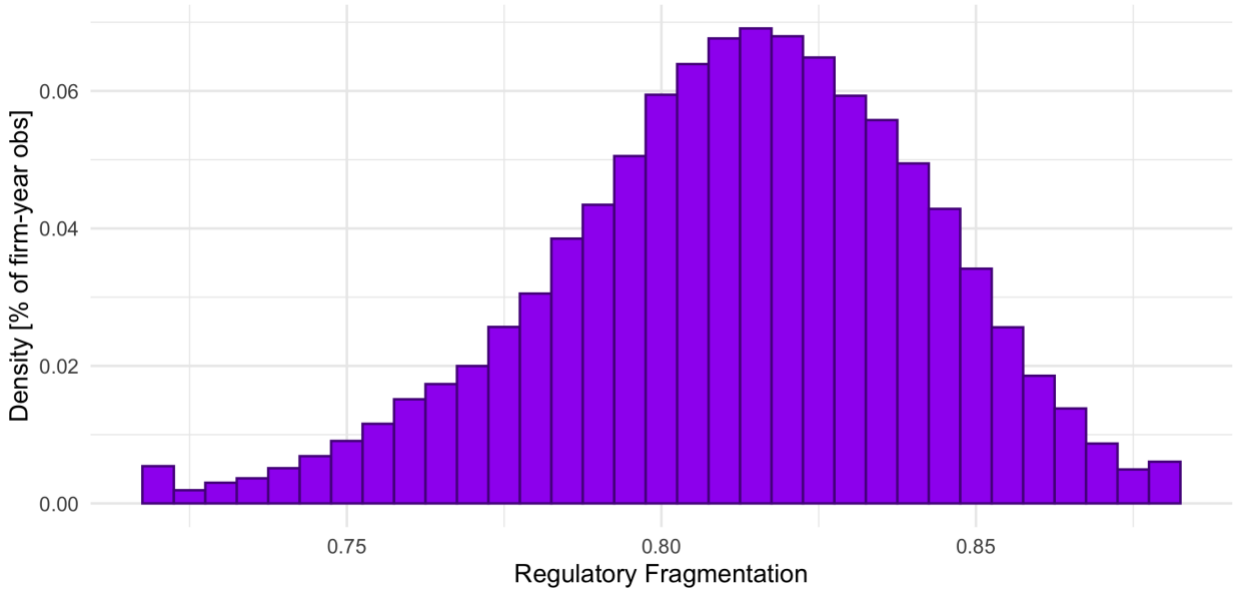
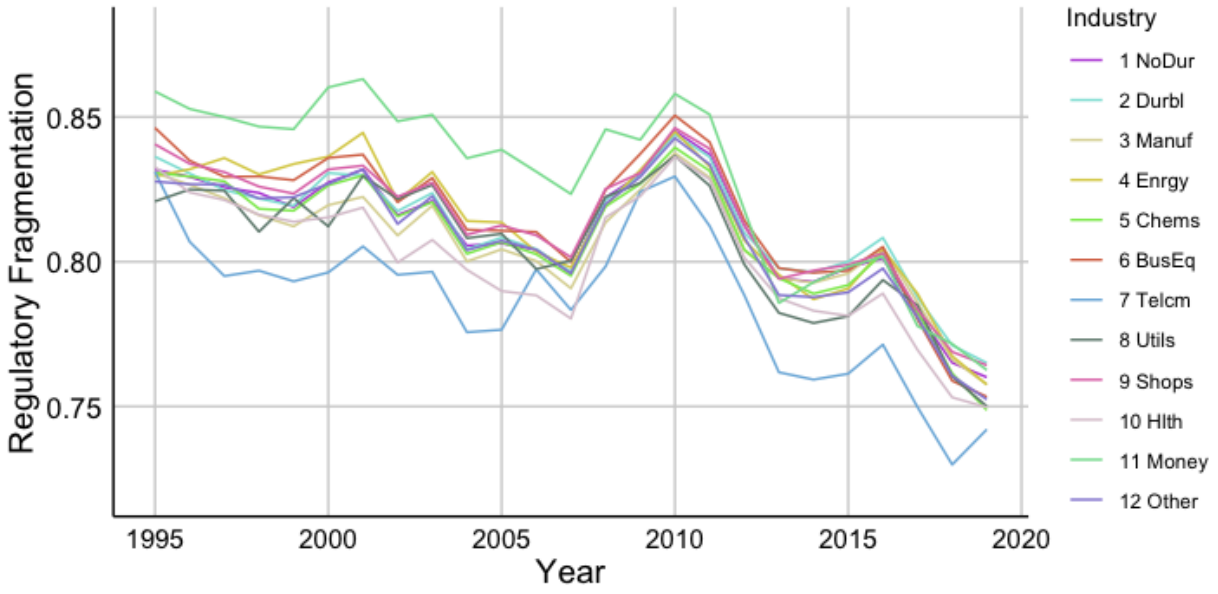


Figure 4: Time trends in regulatory fragmentation

Panel A shows the average annual regulatory fragmentation, for each 12 Fama-French industry. Panel B plots the annual firm-level regulatory fragmentation within the Non-Durables industry.

Panel A: 12 Fama-French Industries



Panel B: Fama-French Industry #1 (Non-Durables)

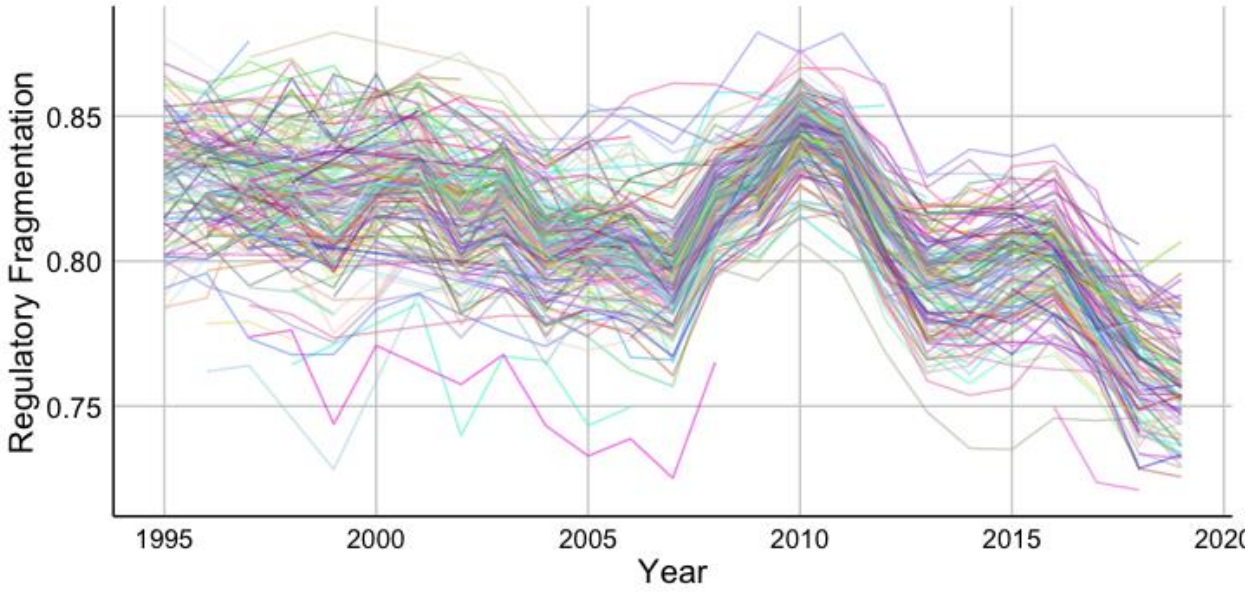
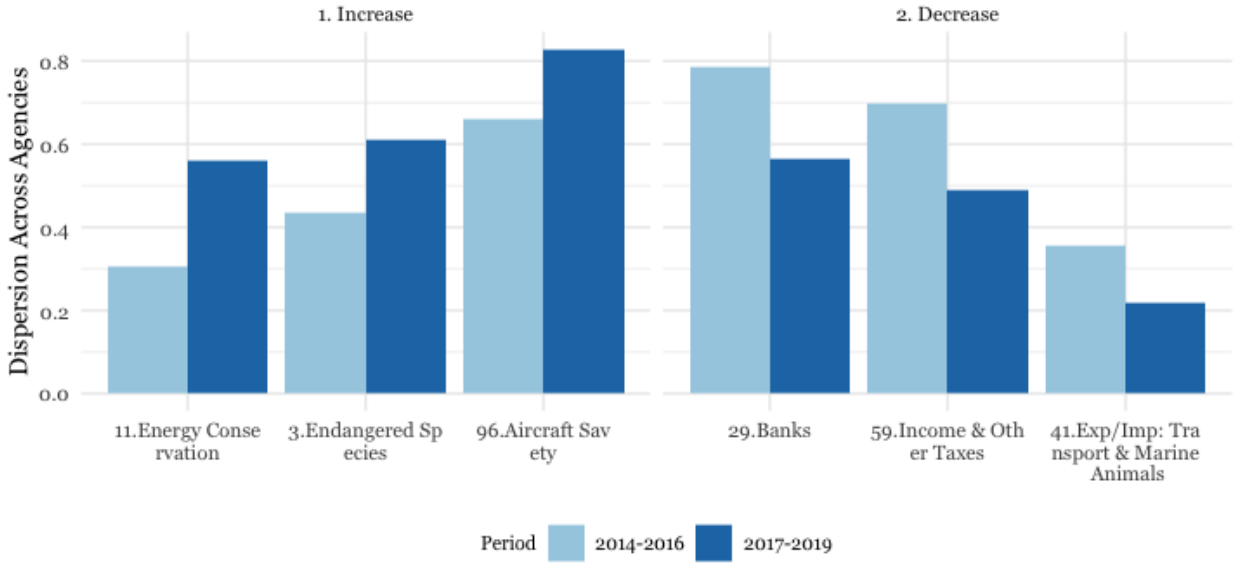


Figure 5: Changes around Trump Election and the Global Financial Crisis

Panel A shows the topics with the highest (lowest) changes in 'Dispersion across Agencies' (Equation 2), that is in the extent to which the topic was regulated across multiple agencies, from the 2014-16 period to the 2017-19 period. Panel B plots the topics with the highest (lowest) changes from the 2006-08 period to the 2009-11 period.

Panel A: Topics with the biggest change around the 2016 presidential election



Panel B: Topics with the biggest change around the 2008-09 financial crisis

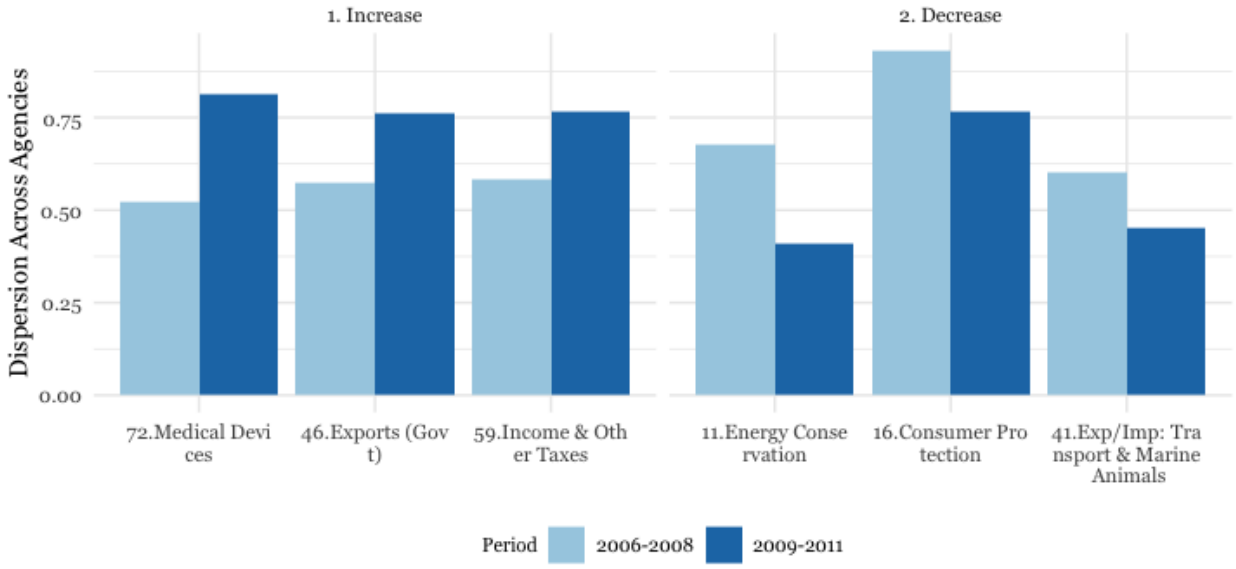


Table 1: Regulatory fragmentation, across topics and firms

Panel A shows the five topics with the highest (lowest) average dispersion across agencies (Equation 2). Dispersion across agencies is measured at the topic-year level and is calculated as 1 minus the sum of squares of the fraction of words written by each agency. Panel B shows the five companies with the highest (lowest) average topic dispersion (Equation 3). We focus on companies that are present in the sample for at least five years. The dispersion of topics within a firm is measured at company-year level and is calculated as 1 minus the sum of squares of each topic in the company's annual report. Panel C shows the five companies with the highest (lowest) average regulatory fragmentation (Equation 4), again focusing on companies that are present in the sample for at least five years. Regulatory fragmentation is the weighted sum of squares of each topic's 'Dispersion across agencies', where weights represent the fraction of the company's annual report devoted to each topic.

Panel A: Average dispersion across agencies, for each Topic

Topics with Lowest Dispersion			**Topics with Highest Dispersion**		
Topic	Label	Agency Dispersion	Topic	Label	Agency Dispersion
36	Nuclear materials	0.3867	20	Freedom of information	0.9501
64	Env: Emissions	0.3849	18	Claims	0.9488
79	Aviation Safety: inspection	0.3589	62	Privacy: Freedom of Information	0.9487
23	Health: insurance	0.3446	26	Govt procurement: Env	0.9474
5	Securities: investment cos	0.3395	66	Govt procurement: Small bus	0.9418

Panel B: Average Dispersion of Topics within Firms

Firms with Lowest Dispersion		**Firms with Highest Dispersion**	
Firm Name	Topic Dispersion	Firm Name	Topic Dispersion
First capital	0.8527	Dexcom	0.9604
Calamos Asset Management	0.8527	Chad Therapeutics	0.9604
Glen Burnie Bancorp	0.8530	CVS Caremark	0.9604
Jeffersonville Bancorp	0.8534	Hansen Medical	0.9600
Carolina Bank Holdings	0.8535	Marinemax	0.9594

Panel C: Average Regulatory Fragmentation of Firms

Firms with Lowest Regulatory Fragmentation		**Firms with Highest Regulatory Fragmentation**	
Firm Name	Regulatory Fragmentation	Firm Name	Regulatory Fragmentation
Select Medical Holdings	0.7278	Comm Bankcorp	0.8716
HCA Holdings	0.7278	Dearborn Bancorp INC	0.8681
Affiliated Managers Group	0.7286	Oneida LTD	0.8666
LHC Group	0.7301	Wells Fargo	0.8665
Healthsouth	0.7334	NASB Financial	0.8665

Table 2: Verification exercise

We compute how many agencies mention the firm in the Federal Register and the dispersion of those mentions (equation 5; data from Kalmenovitz and Chen (2020)). Equivalently, we compute how many agencies does the firm mention in its 10-K and the dispersion of those mentions (equation 6). In Panel A, we report the distribution of the four measures. In Panel B, we report the most-cited firms (in the FR) and the most-cited agencies (in the 10-K). In Panel C, we report the overlap between the two measures. In Panel D, we report the correlation between the two measures and our primary measure of $RegFragmentation$. See section 3.4.

Panel A: Descriptive Statistics on alternative measures of regulatory fragmentation

	Average	Quartile 1	Median	Quartile 3
#Agencies that mention each company (in FR)				
# Mentions	2.3	1.0	2.0	3.0
Dispersion	0.28	0.0	0.11	0.53
#Agencies that each company mentions (in 10-K)				
# Mentions	3.5	2.0	3.0	5.0
Dispersion	0.47	0.28	0.52	0.69

Panel B: Most common cases

Mentions of companies in FR: Companies mentioned by most agencies		Mentions of agencies in 10-Ks: Agencies most frequently mentioned	
Company	# Mentions	Agency	# Mentions
Automatic Data Processing (1995)	12	Securities and Exchange Commission	60,442
Cabot Corp (1995)	12	Department of Treasury	25,592
Caterpillar Inc (2001)	12	Department of Commerce	13,035
Coachman Industries (1996)	12	Environmental Protection Agency	12,047
Digital Equipment Inc (1996)	12	Federal Deposit Insurance Commission	11,269

Panel C: Overlap between Company mentions in FR and Agency mentions in 10-Ks

Mentions of Companies in FR	
# companies that are mentioned by >1 agencies in a year	*14,592*
Subset in which all company mentions all agencies in their 10-K (in year t-1, t, or t+1)	*3,439*
Percent of cases in which company mentions all agencies in their 10-K (in year t-1, t, or t+1)	*23.6%*
Mentions of Agencies in 10Ks	
#companies that mention >1 agencies in 10K	*14,214*
Subset in which all agencies mention the company (in year t-1, t, or t+1)	*714*
Percent of cases in which all agencies mention the company (in year t-1, t, or t+1)	*5.0%*

Panel D: Regressions of alternative measures of regulatory overlap on regulatory fragmentation

	Dependent Variable = 1 – HHI, where HHI is calculated based on:	
Dep. Var.	Agencies that mention company (in FR)	Agencies mentioned by company (in 10K)
Regulatory	0.481**	0.014
Fragmentation	(0.229)	(0.071)
Dispersion of Topics	-0.780**	1.528***
within firm	(0.329)	(0.104)
Regulation Quantity	-0.123*	-0.133***
	(0.070)	(0.023)
Log(Word,10K)	0.013	0.125***
	(0.008)	(0.003)
PPE/AT	-0.031	-0.024**
	(0.038)	(0.010)
EBITDA/AT	-0.123***	-0.005
	(0.035)	(0.007)
Log(Sales)	0.043***	0.009***
	(0.005)	(0.002)
Tobin's Q	0.000	-0.001
	(0.002)	(0.000)
Num. Obs.	14592	60534
R2	0.628	0.772
Company FE	X	X
Year FE	X	X
Industry*Year FE	X	X

Table 3: Descriptive statistics

The sample consists of 60,573 company-year observations between 1995 and 2019 and is based on the CRSP/Compustat database with non-missing annual reports in SEC EDGAR. The left-hand panel divides the sample into five quintiles based on the dispersion of topics within a firm (Equation 3) and reports average firm characteristics in each quintile. The right-hand panel is similar, but it is based on quintiles of our main variable, regulatory fragmentation (Equation 4).

	By dispersion of Topics within a Firm					By Regulatory Fragmentation				
Quintile:	1	2	3	4	5	1	2	3	4	5
Num. Obs.	12,108	12,107	12,107	12,107	12,108	12,108	12,107	12,107	12,107	12,108
Topic Disp.	0.889	0.928	0.935	0.942	0.95	0.93	0.932	0.933	0.932	0.917
Reg. Fragment.	0.821	0.809	0.81	0.811	0.811	0.768	0.798	0.814	0.829	0.852
Sales	2,853	4,082	2,856	2,023	2,252	3,513	2,834	2,618	2,426	2,674
TFP (log)	-0.24	-0.28	-0.314	-0.378	-0.381	-0.313	-0.334	-0.34	-0.344	-0.314
Segments	1.106	1.297	1.233	1.197	1.156	1.222	1.238	1.211	1.184	1.134
PPE/AT	0.109	0.274	0.258	0.238	0.233	0.242	0.238	0.236	0.229	0.168
EBITDA/AT	0.062	0.111	0.1	0.082	0.049	0.068	0.082	0.086	0.086	0.081
MB	2.674	3.245	3.022	3.252	3.849	3.75	3.158	3.204	3.04	2.89
Sales Growth, %	8.4	10.265	11.235	11.845	14.381	12.877	11.814	10.868	11.019	9.548
Assets Growth, %	9.359	10.285	11.618	12.608	13.774	12.864	12.042	11.083	10.526	11.128
Tobin's Q	1.519	2.012	2.082	2.26	2.666	2.351	2.112	2.133	2.096	1.848
SGA/AT	0.091	0.25	0.292	0.334	0.375	0.24	0.265	0.286	0.304	0.245
EMP/AT	0.002	0.007	0.007	0.007	0.007	0.004	0.006	0.007	0.008	0.006
INVT/AT	0.024	0.078	0.089	0.102	0.115	0.076	0.084	0.088	0.09	0.068
ROA, %	182.642	167.544	21.424	-145.755	-434.828	-123.34	-18.32	-51.261	-74.632	58.573

Table 4: The relation between regulatory fragmentation to costs, productivity and profitability

The sample consists of 60,573 company-year observations between 1995 and 2019. The main independent variable is *Regulatory Fragmentation*. *SGA/AT* is the ratio of SG&A costs to total assets, TFP is total factor productivity (measured following İmrohoroglu and Tüzel (2014)), and *ROA* is income before extraordinary items scaled by total assets and multiplied by 100. All variables are defined in Appendix 2, and independent variables are lagged one period. Standard errors are clustered at the 48 Fama-French industry level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Dep. Var.	SGA/AT	TFP	ROA	SGA/AT	TFP	ROA
Regulatory	0.381***	-0.601**	-37.737***	0.487***	-0.537*	-34.195***
Fragmentation	(0.135)	(0.270)	(8.279)	(0.125)	(0.313)	(9.453)
Dispersion of Topics	0.488**	-0.536	-9.530	0.505**	-0.684*	-7.221
within firm	(0.189)	(0.414)	(16.614)	(0.210)	(0.373)	(14.692)
Regulation Quantity	0.036	0.039	3.101	0.058	0.041	4.677*
	(0.035)	(0.062)	(3.480)	(0.044)	(0.067)	(2.336)
Log(Word,10K)	-0.006	-0.014	-3.934***	-0.006	-0.015*	-3.818***
	(0.004)	(0.009)	(0.926)	(0.005)	(0.009)	(0.910)
# Segments	0.000	0.004	-0.295**	0.001	0.001	-0.254**
	(0.002)	(0.004)	(0.111)	(0.002)	(0.004)	(0.121)
PPE/AT	0.083**	-0.551***	-6.792***	0.080**	-0.588***	-6.455***
	(0.033)	(0.092)	(1.707)	(0.036)	(0.083)	(2.193)
EBITDA/AT	-0.036**	1.177***	40.189***	-0.038**	1.224***	39.752***
	(0.016)	(0.079)	(3.563)	(0.016)	(0.081)	(3.708)
Log(Sales)	-0.040***	0.098***	3.209***	-0.042***	0.094***	3.175***
	(0.006)	(0.010)	(0.354)	(0.007)	(0.010)	(0.372)
Tobin's Q	0.013***	0.048***	-0.479***	0.013***	0.049***	-0.467***
	(0.001)	(0.004)	(0.092)	(0.001)	(0.005)	(0.075)
Num. Obs.	60534	38922	60534	60534	38922	60534
R2	0.867	0.729	0.637	0.872	0.740	0.653
Company FE	X	X	X	X	X	X
Year FE	X	X	X	X	X	X
Industry*Year FE				X	X	X

Table 5: The relation between regulatory fragmentation to growth and employment

The sample consists of 60,573 company-year observations between 1995 and 2019. The main independent variable is *Regulatory Fragmentation*. *Sales Growth* is year-on-year change in sales (multiplied by 100), *Asset Growth* is year-on-year change in assets (multiplied by 100), and *Emp/AT* is employment scaled by total assets. All variables are defined in Appendix 2, and independent variables are lagged one period. Standard errors are clustered at 48 Fama-French industry level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Dep. Var.	Sales Growth	Assets Growth	EMP/AT	Sales Growth	Assets Growth	EMP/AT
Regulatory	-146.776***	-199.396***	0.000	-163.559***	-193.763***	0.004**
Fragmentation	(25.826)	(33.550)	(0.005)	(32.850)	(37.912)	(0.002)
Dispersion of Topics	-21.475	39.141	0.006	5.595	53.140	0.002
within Firm	(38.432)	(30.682)	(0.005)	(34.886)	(35.119)	(0.005)
Regulation Quantity	-41.626***	-54.062***	0.002**	-44.347***	-52.508***	0.001
	(12.035)	(9.059)	(0.001)	(10.581)	(9.069)	(0.001)
Log(Word,10K)	5.132***	6.277***	0.000*	4.610***	5.712***	0.000*
	(1.537)	(1.073)	(0.000)	(1.476)	(1.203)	(0.000)
# Segments	0.142	-0.396	0.000	-0.175	-0.603	0.000
	(0.368)	(0.381)	(0.000)	(0.331)	(0.389)	(0.000)
PPE/AT	-17.525***	-38.837***	0.003***	-13.531**	-35.817***	0.003***
	(4.519)	(7.435)	(0.001)	(6.186)	(9.640)	(0.001)
EBITDA/AT	-0.698	13.903***	0.002***	-2.452	12.676***	0.001***
	(8.342)	(3.697)	(0.000)	(7.841)	(3.820)	(0.000)
Log(Sales)	12.389***	9.939***	0.000	12.915***	10.134***	0.000
	(1.119)	(0.892)	(0.000)	(1.172)	(0.939)	(0.000)
Tobin's Q	0.941***	-0.894***	0.000***	0.882***	-0.917***	0.000***
	(0.178)	(0.227)	(0.000)	(0.199)	(0.234)	(0.000)
Num. Obs.	60534	60534	60534	60534	60534	60534
R2	0.363	0.277	0.919	0.399	0.305	0.923
Company FE	X	X	X	X	X	X
Year FE	X	X	X	X	X	X
Industry*Year FE				X	X	X

Table 6: Robustness of findings to firms without big operational changes

We estimate regressions similar to those in columns 1-3 of Table 3. In Panel A, we restrict the sample to firm-years with no year-to-year change in the Hoberg-Philips 500-industry group (cols 1, 4, 7), no change in the number of segments (cols 2, 5, 8), and less than 20% absolute change in assets (cols 3, 6, 9). In Panel B, we estimate similar regressions except that we interact regulatory fragmentation with a dummy equal to one: if the Hoberg-Philips 500-industry changed (cols 1, 4, 7), if the number of firm segments changed (cols 2, 5, 8), or if the absolute value of the change in firm assets is greater than 20%. Coefficients on control variables are suppressed, standard errors are clustered at 48 Fama-French industry level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Subsamples of firms without year-to-year large operational changes

	Dept Var = SGA			*Dept Var = TFP*			*Dept Var = Sales Growth*		
Sample	Does not switch Industry	#segments does not change	Size does not change by >20%	Does not switch Industry	#segments does not change	Size does not change by >20%	Does not switch Industry	#segments does not change	Size does not change by >20%
Regulatory Fragmentation	0.367** (0.147)	0.363** (0.140)	0.303** (0.120)	-0.558* (0.280)	-0.640** (0.274)	-0.541* (0.295)	-149.240*** (27.458)	-148.233*** (24.510)	-82.707*** (21.154)
Num.Obs.	54259	56444	44207	34473	35755	28785	54259	56444	44207
R2	0.874	0.870	0.904	0.735	0.733	0.755	0.383	0.376	0.399
Yr, Comp FE	X	X	X	X	X	X	X	X	X

Panel B: Interacting regulatory fragmentation with measures of firm operational changes

	Dept Var = SGA			*Dept Var = TFP*			*Dept Var = Sales Growth*		
Firm Char	Industry	#segments	Firm Assets	Industry	#segments	Firm Assets	Industry	#segments	Firm Assets
Regulatory Fragmentation	0.374*** (0.137)	0.379*** (0.139)	0.413*** (0.132)	-0.602** (0.271)	-0.597** (0.271)	-0.576* (0.286)	-147.638*** (25.449)	-147.699*** (24.811)	-163.487*** (25.174)
Change in Firm Characteristic	-0.050 (0.049)	-0.036 (0.091)	0.077 (0.047)	0.001 (0.224)	0.065 (0.169)	0.024 (0.139)	-6.766 (21.548)	-13.058 (29.360)	-52.050* (26.366)
Reg Frag × Chg Firm Char	0.065 (0.060)	0.046 (0.112)	-0.080 (0.059)	-0.003 (0.275)	-0.082 (0.206)	0.025 (0.172)	8.331 (26.541)	16.707 (36.562)	68.426** (32.941)
Num.Obs.	60534	60534	60534	38922	38922	38922	60534	60534	60534
R2	0.867	0.867	0.868	0.729	0.729	0.730	0.363	0.363	0.364
Yr, Comp FE	X	X	X	X	X	X	X	X	X

Table 7: Industry composition

We use data from Hoberg and Phillips (2016): number of product market peers for each focal company. In column 1, the outcome is the number of new peers which were private in the previous year. In column 2, the outcome is the number of new peers which were public in the previous year but have now switched into the focal firm's industry. In column 3, the outcome is the exit rate from the focal firm's industry: percentage of peers at year t which are no longer peers at year $t+1$, but are still trading in year $t+1$. In column 4, the outcome is the total number of peers (net effect of entry and exit). All regressions include industry-year and company fixed effects, as well as controls for Regulation Quantity, Dispersion of topics within firm, Log (10K, Words), PPE/AT, Log(Sales) and Tobin's Q. All variables are defined in Appendix 2, and independent variables are lagged one period. Standard errors are clustered at the 48 Fama-French industry level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Model 1	Model 2	Model 3	Model 4
Dep. Var.	# IPOs	#Companies join industry	#Co's that leave industry, but are still trading	# Total Peers
Regulatory	-22.427***	-7.485*	286.688**	-203.961***
Fragmentation	(6.124)	(4.394)	(127.284)	(44.115)
Num. Obs.	60534	60534	56364	60534
R2	0.786	0.607	0.119	0.915
Company FE	X	X	X	X
Industry*Year FE	X	X	X	X

Table 8: Single-authored vs co-authored documents

We re-estimate the regressions from Tables 4 and 5, augmented with the indicator variable $Coauthored$ which is constructed in two steps. First, we identify co-authored topics based on the Federal Register: a topic where most of the documents were written by two or more agencies. Second, we identify firms with high exposure to co-authored topics, $CoAuthored_{f,t}$: it equals one if firm f dedicates most of its 10-K filing at time t to co-authored topics. All regressions include year and company fixed effects, as well as controls for Regulation Quantity, Dispersion of topics within firm, Log (10K, Words), PPE/AT, Log(Sales) and Tobin's Q, and the interaction of each of those controls with $CoAuthored_{f,t}$. All variables are defined in Appendix 2, and independent variables are lagged one period. Standard errors are clustered at the 48 Fama-French industry level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dep. Var:	SGA/AT	TFP	ROA	Sales Growth	Asset Growth	Emp/AT
Regulatory Frag	0.545***	-0.386	-53.229***	-178.220***	-241.443***	0.008***
	(0.132)	(0.352)	(14.295)	(36.294)	(41.225)	(0.003)
Coauthored	0.318	-0.276	8.823	-2.377	-164.219*	0.031***
	(0.222)	(0.705)	(21.107)	(78.975)	(88.238)	(0.010)
Regulatory Frag	-0.113*	-0.139	25.141**	19.934	81.630***	-0.007***
× Coauthored	(0.063)	(0.275)	(11.378)	(28.318)	(25.090)	(0.002)
Num.Obs.	60,534	38,922	60,534	60,534	60,534	60,534
Controls	X	X	X	X	X	X
Full interactions	X	X	X	X	X	X
Yr, Comp FE	X	X	X	X	X	X

Table 9: Regulatory fragmentation and lobbying expenses

The sample consists of 14,986 company-year observations with information on lobbying donations in the LobbyView database (Kim (2018)). The dependent variable is lobbying expenses in USD millions or its log transformation (one plus expenses). The main independent variable is *Regulatory Fragmentation*. All regressions include controls previously used in Tables 3 and 4. All variables are defined in Appendix 2, and independent variables are lagged one period. Standard errors are clustered at 48 Fama-French industry level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Log(Lobbying $)	Lobbying $	Log(Lobbying $)	Lobbying $
Regulatory	−22.280***	−6.657***	−21.606**	−5.811**
Fragmentation	(6.800)	(2.251)	(8.120)	(2.218)
Dispersion of Topics	−8.734	0.621	−14.779	−2.222
within Firm	(13.256)	(2.964)	(13.471)	(2.681)
Regulation Quantity	−1.959	−0.801	−2.706	−1.311*
	(2.499)	(0.838)	(2.681)	(0.771)
Log(Word,10K)	0.680**	0.103	0.436	0.053
	(0.323)	(0.099)	(0.319)	(0.110)
# Segments	0.053	0.040	0.041	0.035
	(0.117)	(0.029)	(0.125)	(0.031)
PPE/AT	0.157	0.010	−0.390	0.036
	(0.957)	(0.229)	(1.056)	(0.288)
EBITDA/AT	−0.999**	−0.413***	−0.453	−0.355***
	(0.475)	(0.094)	(0.570)	(0.124)
Log(Sales)	1.019***	0.244***	1.046***	0.235***
	(0.238)	(0.057)	(0.262)	(0.074)
Tobin's Q	−0.015	−0.002	−0.037	−0.009
	(0.037)	(0.008)	(0.039)	(0.007)
Num.Obs.	14983	14983	14983	14983
R2	0.611	0.874	0.649	0.887
Company FE	X	X	X	X
Year FE	X	X	X	X
Industry*Year FE			X	X

Table 10: Relationship between Rules and Notices

This table shows lead-lag relationships between notices and rules. The sample incudes a panel of 227,600 agency×topic×year observations. $Words_{rules,a,i,t}$ ($Words_{notices,a,i,t}$) is the total number of words written by agency a on topic i at year t, in the Rules section (Notices section) of the FR. Standard errors are clustered as the agency level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent Variable:	$\log(1+Words_{rules,a,i,t})$			
	Model 1	Model 2	Model 3	Model 4
$\log(1+Words_{notices,a,i,t-1})$	0.259***		0.140***	0.135***
	(0.042)		(0.026)	(0.010)
$\log(1+Words_{notices,a,i,t-2})$	0.177***		0.095***	0.114***
	(0.026)		(0.020)	(0.009)
$\log(1+Words_{notices,a,i,t+1})$		0.248***	0.151***	0.141***
		(0.047)	(0.033)	(0.010)
$\log(1+Words_{notices,a,i,t+2})$		0.219***	0.150***	0.155***
		(0.027)	(0.022)	(0.010)
Num. Obs.	227,600	227,600	227,600	227,600
R2	0.822	0.823	0.826	0.890
Agency, Year, Topic FE	X	X	X	
Agency×Year, Agency×Topic, Topic×Year FE				X

Table 11: Regulatory fragmentation across segments of the Federal Register

We re-calculate our measure of regulatory fragmentation for each class of documents in the Federal Register: notices, proposed rules, and rules. In Panels A and B, we re-estimate the regressions from Tables 3 and 4 using the notices and rules measures, respectively. All regressions include industry*year and company fixed effects, as well as controls for Regulation Quantity, Dispersion of topics within firm, Log (10K, Words), PPE/AT, Log(Sales) and Tobin's Q. All variables are defined in Appendix 2, and independent variables are lagged one period. Standard errors are clustered at the 48 Fama-French industry level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Regulatory Fragmentation (Notices) and future performance

Dep. Var:	SGA/AT	TFP	Sales Growth	Asset Growth	ROA	Emp/AT
Regulatory Frag	0.414**	-1.112***	8.512	-164.694***	-180.629***	0.004
(Notices)	(0.186)	(0.362)	(9.949)	(34.901)	(36.785)	(0.003)
Num.Obs.	60,537	38,925	60,537	60,537	60,537	60,537
Controls	X	X	X	X	X	X
Ind* Yr, Comp FE	X	X	X	X	X	X

Panel B. Regulatory Fragmentation (Rules) and future performance

Dep. Var:	SGA/AT	TFP	Sales Growth	Asset Growth	ROA	Emp/AT
Regulatory Frag	0.476***	0.023	-65.721***	-115.362***	-137.377***	0.005**
(Rules)	(0.118)	(0.275)	(10.620)	(29.275)	(31.478)	(0.002)
Num.Obs.	60,537	38,925	60,537	60,537	60,537	60,537
Controls	X	X	X	X	X	X
Ind*Yr, Comp FE	X	X	X	X	X	X

Table 12: Regulatory fragmentation across new versus modified rules

We re-calculate our measure of regulatory fragmentation for two types of documents: those who introduce a new rule (new RIN identifier), and those who modify an existing rule (old RIN identifier). In Panels A and B we re-estimate the regressions from Tables 3-4 using the new RIN and old RIN measures, respectively. Standard errors are clustered at the 48 Fama-French industry level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Regulatory Fragmentation (FR Documents with new RIN) and future performance

	SGA/AT	TFP	Sales Growth	Assets Growth	ROA	Emp/AT
Regulatory Frag	0.487***	-0.183	-62.073***	-104.913***	-139.148***	0.001
(New RIN)	(0.102)	(0.160)	(8.736)	(27.249)	(23.307)	(0.003)
Num.Obs.	60537	38925	60537	60537	60537	60537
R2	0.872	0.740	0.654	0.399	0.305	0.923
Ind*Yr, Comp FE	X	X	X	X	X	X

Panel B. Regulatory Fragmentation (FR Documents with old RIN) and future performance

	SGA/AT	TFP	Sales Growth	Assets Growth	ROA	Emp/AT
Regulatory Frag	0.374***	-0.076	-45.592***	-95.474***	-126.118***	0.005***
(Old RIN)	(0.096)	(0.230)	(10.661)	(27.948)	(29.607)	(0.002)
Num.Obs.	60537	38925	60537	60537	60537	60537
R2	0.872	0.740	0.653	0.399	0.305	0.923
Ind*Yr, Comp FE	X	X	X	X	X	X

Appendix 1

Table A1: Full Agency Names

This table lists the full names and common abbreviations of federal agencies which are frequently mentioned in the paper.

Agency	Abbreviation
Commodity Futures Trading Commission	CFTC
Department of Agriculture	USDA
Department of Commerce	Commerce
Department of Energy	DOE
Department of Health and Human Services	HHS
Department of Housing and Urban Development	HUD
Department of Interior	DOI
Department of Justice	DOJ
Department of Labor	DOL
Department of Transportation	Transportation
Department of Treasury	Treasury
Department of Veteran Affairs	VA
Environmental Protection Agency	EPA
Federal Communications Commission	FCC
Federal Energy Regulatory Commission	FERC
Federal Reserve System	FRS
International Trade Commission	ITC
Nuclear Regulatory Commission	NRC
Securities and Exchange Commission	SEC

Appendix 2

Table A2A: Regulation related variables

Name	Description	Level	Data Source
Regulatory fragmentation	$= 1 - \sum_{Agency} \omega^2_{Topic\ i,Year\ t,Agency}$, where $\omega_{Topic\ i,Year\ t,Agency}$ is the fraction of the words in all Federal Register documents written by each agency in a given topic in a given year. Occasionally, we refer to this variable as the dispersion of topics across agencies.	Topic-year	FR
Dispersion of Topics within Firm	$= 1 - \sum_{Topic} P^2_{Firm\ f,Year\ t,Topic}$, where $P_{firm\ f,Year\ t,Topic}$ is the fraction of the annual report of firm f in year t dedicated to a given topic.	Company-year	FR, SEC EDGAR
Regulatory Fragmentation	$1 - \sum_{Topic} \sum_{Agency} P_{Firm,Topic,Year} \omega^2_{Topic,Agency,Year}$, Equivalently, this can be estimated as a weighted sum across all 100 topics of the dispersion of each topic across agencies ($\omega^2_{Topic\ i,Year\ t,Agency}$), where weights equal the topic probability in the firm's annual report	Company-year	FR, SEC EDGAR
Regulation Quantity	$\sum_{Topic} P_{Firm,Topic,Year} \cdot \log(Topic\ Words, Fedreg)$, where $\log(Topic\ Words, Fecreg)$ is the natural logarithm of the number of words in each topic	Company-year	FR, SEC EDGAR

Note that we use the label "Regulatory fragmentation" twice: once to describe the dispersion of topic i across agencies (denoted with $Regulatory\ Fragmentation_{i,t}$), and second to describe the exposure of firm f to the fragmentation of each topic across agencies (denoted with $Regulatory\ Fragmentation_{f,t}$). We also estimate Regulatory Fragmentation separately for notices, proposed rules, and rules. First, we estimate agency dispersion for notices (proposed rules/rules) only using the formula from the table above and applying it only to notices (proposed rules/rules). Then we use this new measure of agency dispersion and re-estimate Regulatory Fragmentation using the same formula as before.

Table A2B: Other variables

Name	Description	Level	Data Source
Log(Words,10K)	Logarithm of the number of English words in the main file of the company's 10-K report. English words are defined according to Grady Ward dictionary	Company-year	SEC EDGAR
PPE/AT	*ppent*/*at* (Compustat items)	Company-year	Compustat
EBITDA/AT	*ebitda*/*at* (Compustat items)	Company-year	Compustat
Log(Sales)	log(*sale*) (Compustat item)	Company-year	Compustat
Tobin's Q	(*at* - *ceq* + *size*/10^3)/at, where *at* and *ceq* are Compustat items, and *size* is company market capitalization from the end of the previous calendar year (CRSP)	Company-year	Compustat, CRSP
Industry	Fama-French 48 industry	Company-year	CRSP, Fama-French
N segments	Number of business segments	Company-year	Compustat Segment