Analyzing Public Comments

Vladimir Eidelman,[*]Brian Grom [†], Michael A. Livermore[‡*]

[*]To whom correspondence should be addressed.

Abstract

With the increased politicization of agency rulemaking and the reduced cost of participating in the notice-and-comment rulemaking process, administrative agencies have, in recent years, found themselves deluged in a flood of public comments. Scholars of public bureaucracies can use this important new publicly available data along with new tools in computational text analysis to better understand how agencies interact with the public. To illustrate the value of these new tools, we carry out computational text analysis of over three million public comments that were received by administrative agencies over the course of the Obama Administration. Our findings indicate that advances in natural language processing technology show great promise for both researchers and policymakers who are interested in understanding, and improving, regulatory decision-making.

Introduction

The public comment process is one of the hallmarks of the American administrative state. As the informal notice-and-comment rulemaking

[*]FiscalNote

[†]FiscalNote

[‡]University of Virginia School of Law. This chapter draws from "Computationally Assisted Regulatory Participation" *Notre Dame Law* 93(3): 977-1034

procedure has grown into one of the most important national policymaking venues, the public comments process has become a forum for both organized interest groups and ordinary individuals to engage in public deliberation and political debate. In recent years, as both the ease of participation and interest in rulemaking have grown, there has been an explosion of public participation, and agencies now receive millions of comments from the public each year concerning proposed agency actions. These comments are voluntarily generated by individuals and organizations representing a vast diversity of interests—from large industrial trade associations representing businesses with billions of dollars at stake to individual citizens who have an interest in a particular regulatory outcome.

At the same time that agencies find themselves deluged in public comments, recent advances in machine learning and natural language processing have made powerful text analysis tools more broadly available. Both commercial enterprises and academic researchers have recently begun to put these tools to use in a variety of settings, from tracking employee morale based on email communications to testing the relationship between online blogging and political opinions. Computational text analysis of public comments, however, is relatively rare, leaving largely untapped a substantial resource for both scholars and policymakers.

Public comments are a valuable source of data that can be used to empirically examine how bureaucratic institutions interact with the public. As a form of political participation that is unique to the bureaucratic setting, commenting behavior is an interesting and important phenomenon in its own right and provides information on how agencies and their actions shape and are shaped by the publicly expressed views of individuals and groups. In recent years, a small number of political scientists and others interested in bureaucratic behavior have begun to take advantage of public comments to study agencies, work that can be substantially facilitated by leveraging new tools in computational text analysis.

In this chapter, we describe an analysis of over three million public comments received by administrative agencies over the course of the Obama administration. Applying a basic, replicable procedure of sentiment analysis to these comments, and comparing those results to information on agency ideology from the political science literature, we find that agencies with more moderate ideological leanings tend to receive comments that contain more positive language. This analysis indicates, as a threshold matter, that political characteristics of agencies are correlated with comment characteristics. Future work can build on this insight to inform subsequent research into the relationship between agencies' behavior and the public comments that they receive.

Moving from the descriptive to the normative, we examine how agencies and agency oversight institutions can use computational text analysis of public comments to improve agency decision-making and accountability. In the era of mass commenting, agencies face both a "needle-in-the-haystack" problem (i.e., identifying the most substantive comments) and a "forest-for-the-trees" problem (i.e., extracting overall trends or themes in large, unstructured collections of documents). To examine the usefulness of text analysis techniques to address these challenges, we carry out a case study of the comments received by the Environmental Protection Agency (EPA) in response to its proposed rule to limit greenhouse gas emissions from the electricity generating sector, called the Clean Power Plan. We apply two tools: a measure of the "gravitas" of a public comment, and a topic model that we use to identify overall semantic trends in the comments. We find that, although not perfect, these techniques already have value for agencies and can be further refined to improve on their current performance.

The Deluge

Over the past several decades, informal rulemaking has become one of the most important policymaking forums in American politics (DeMuth 2016). Partisan rancor and divided government have often inhibited the

ability of Congress to pass meaningful legislation. Legislative gridlock on the major issues of the day, including immigration and climate change, has led to an ever more active executive branch. Informal rulemaking is perhaps the Executive's preeminent tool for setting domestic policy, and administrations of both political parties have wielded it to great effect (Kagan 2001). This state of affairs has had several consequences for the public comment process. Comments have taken on greater importance as a means to influence major policy decisions and, at least occasionally, serve as a preliminary step in litigation over high stakes rulemakings. In addition, the public comment process is sometimes incorporated into broader advocacy efforts to influence public opinion and politicians. Advocacy campaigns around rulemakings increase public attention, leading to a higher volume of public comments.

At the same time as the stakes of the public comment process grew, information technology lowered the costs of participation. In the past, there were fairly substantial barriers to learning about a rule, engaging in research on the public policy choices involved, and submitting comments. Now, rather than attempting a trip to the local library for a copy of the Federal Register, interested individuals can quickly access a diverse array of information about proposed regulations online. From websites of individual agencies or the comprehensive government-wide regulatory portal at "regulations.gov," interested persons can now easily and inexpensively identify ongoing regulatory proceedings, access relevant documents, and submit comments. In addition to extensive explanatory regulatory preambles, agencies typically include a great deal of additional substantive information on their rulemakings on agency websites, and any official supporting documents are also made available on regulations.gov. Advocacy organizations also publish their own analyses of proposed rules, and journalists and other content authors (i.e., bloggers, opinion writers, academics, etc.) often provide additional information for free. Within the time it once took to drive to the library and find a proposed rule's text, a relatively well-informed and conscientious re-

searcher can amass a substantial amount of information about any rule of interest.

With lower costs and higher stakes, participation in the notice-and-comment process has ballooned. Several recent high profile rulemakings have generated what might be called mega-participation, with comments numbering well over a million. The State Department Keystone XL oil pipeline decision received more than 2.5 million comments; the Federal Communications Commission received over 1.25 million comments on its original net neutrality rules; EPA received over 4 million comments on its proposed Clean Power Plan. Within these voluminous submissions are form comments that have been circulated by advocacy groups; detailed, well-researched submissions by nongovernmental organizations, industry, and academics; and comments from other interested groups and individuals, including local organizations, states and municipalities, and members of the general public.

In terms of simple administrative manageability, opening up the floodgates of participation in the rulemaking process presents clear difficulties. Agencies are obligated to consider and respond to substantive comments; having to review many millions of comments to even determine their substance is an extraordinary burden. Even if many of the comments are repeats of a form submission, agencies must still separate out the unique comments and give at least some cursory examination to them. Given the lower cost of acquiring information, agencies may also face a higher volume of substantively meaningful comments. Even if these comments contain valuable information, processing them can require substantial commitment of agency resources.

From the perspective of expanding citizen involvement in administrative decision-making, recent innovations create obvious opportunities. A large number of comments can mean that agencies collect more information on matters such as the interaction of a rulemaking with technology or business practices or regulatory alternatives. In addition, when more people participate in the comment process, the greater the legitimacy

conferring benefits of the process. Just as a higher voter turnout is often interpreted as a sign of a more robust democracy, a larger number of public comments indicates a more inclusive and participatory administrative process.

But translating the promise of mass participation into a public comment process with enhanced output or input value has proven to be no easy challenge. One approach to addressing mass participation attempts to extract more meaning from comments in their current form. The idea is to use advanced information processing and text analysis techniques to extract as much possible usable information from the public comments that are submitted to agencies. In the subsequent discuss We will focus on how the data that already exists in the form of agency comments can be put to use, first to better understanding how agencies interact with the public, and then to improve those interactions to ultimately increase the value of the public comment process.

Studying Bureaucratic Politics

There is a considerable and methodologically eclectic empirical and theoretical literature on bureaucratic politics (Aberbach and Rockman 2006; Brehm and Gates 1999; Baekgaard, Blom-Hansen, and Serritzlew 2015; Bendor and Meirowitz 2004; Fiorina and Noll 1978). Important contributions include emphasizing the heterogeneous nature of agencies and the importance of institutional design and administrative procedure in affecting relationships between agencies and political institutions (Balla and George 1998; Devins and Lewis 2008; Epstein and O'Halloran 1996; Mccubbins et al. 1987). Even narrowing focus to U.S. federal agencies, there is great variation in agencies' missions, in the interest group environment in which they operate, in their institutional structure and procedures, and in their internal culture. Taken together, the collection of these differences can be thought to contribute to distinct profiles that remain at least somewhat consistent over time, inclining some agencies

toward certain behaviors while inclining other agencies toward other behaviors.

Among the differences that appear to matter for agency decision-making is the makeup of the career personnel and specifically their policy preferences (Baekgaard, Blom-Hansen, and Serritzlew 2015; Brehm and Gates 1999; Gailmard and Patty 2007; Prendergast 2007). Although policy is at least sometimes responsive to the desires of political principals, the substantial policy discretion given to career personnel, and their role in structuring and informing the decisions made by principals, gives them substantial ability to shape outcomes toward their preferred policies (Imbeau, Pétry, and Lamari 2001; Knill, Debus, and Heichel 2010; Wood and Waterman 1991; D. Carpenter 2014; D. P. Carpenter 2001; Livermore 2014). This fact does not imply bad faith on the part of career staff—they may genuinely intend to serve the public interest, as they understand it, and have little at stake, in terms of personal satisfaction, for the policy decision made by agencies. Nevertheless, the values, perspectives, and beliefs of career personnel can (perhaps appropriately) influence the choice that agencies make.

There is a subfield within the bureaucratic politics literature that attempts to estimate the policy tendencies of agency personnel. This work builds on earlier efforts within political science to examine the role of "ideology"—understood as a consistent set of preferences over policy outcomes—in other decision-making contexts, such as Congress and the courts (Poole 2005; Martin and Quinn 2002). These ideal point models enable a data-driven method for estimating preferences via construction of a low dimensional latent space that captures similarity among individuals. This same notion of ideology has been applied to agencies and agency personnel, and a variety of methods have been used to estimate this "latent variable," including prior agency decisions, the opinions of outside experts, the political moment of an agency's formation, and the campaign contributions and survey responses of agency personnel (D. Lewis 2003; Clinton and Lewis 2008; Clinton et al. 2012; D. E. Lewis

2007; Nixon 2004; Bonica, Chen, and Johnson 2012). These studies tend to come to relatively consistent results, confirming that agencies have something like an ideological profile that persists over time.

Agency ideology has been found to have several interesting consequences for the relationship between political and administrative decision-making. For example, Presidents treat agencies differently in their political appointment decision in light of agency ideology: some agencies are targeted for patronage, while other agencies are targeted for more intensive policy supervision, depending on how well agency ideology tends to align with the governing philosophy in the White House (D. E. Lewis 2008).

An important, but understudied, question in the bureaucratic politics literature is how agency ideology affects interactions between agencies and the broader public. In addition to making official decisions—promulgating rules, issuing licenses, initiating enforcement actions—agencies engage in a variety of public engagement activities, which include not only those that are required by law (such as the notice-and-comment process) but also through voluntary initiatives that include public meetings, publications, media relations, and social networking. These actions speak to the importance of managing public perception for agencies, not only for direct reputational benefits, but also as part of a broader effort to influence the oversight activities of actors that are more directly accountable to the public.

One of the difficulties of studying agency-public interactions is that data and methods have not been as fully developed as in other areas of the bureaucratic politics literature. Some studies have focused on the identity of commenters as the primary explanatory variable to test whether interests that commenters have submitted in comments tend to influence the regulatory process(Balla and George 1998). Survey techniques have also been used to examine how participants perceive their role in the regulatory process (Furlong and Kerwin 2005; Yackee 2015). Recently, researchers in political science, public administration, and law have begun

to exploit public comments to study agency-public interactions(Boustead and Stanley 2015; Golden 1998; Krawiec 2013; McKay and Yackee 2007). Susan Webb Yackee, in particular, brought attention to the value of public comments in understanding agency-public interactions with several studies that relied on hand coding a large number of comments (McKay and Yackee 2007; Yackee 2005). Two recent papers published in law journals also engage in human coded analysis of public comments to gain insight into how the public perceives highly salient agency rulemakings (Boustead and Stanley 2015; Krawiec 2013).

One underexplored feature of comments is their sentiment. Similar to consumer reviews on websites such as Amazon.com or Yelp.com, which express satisfaction or dissatisfaction with a product or service, public comments express agreement (satisfaction) or disagreement (dissatisfaction) with a rulemaking or provisions thereof. The sentiment carried within public comments provides a valuable lens into attitudes and perceptions held by the public on agency decisions. Of course, comments are not submitted by a random sample of the population and should not be thought of as replacing public opinion surveys, which are carefully designed to provide insight into the general public. But the self-selection process itself conveys information—public comments express the views of the interested public, a number that can exceed over a million individuals for mass-comment-volume rules. This large group of interested individuals may be more likely to vote, contribute to or volunteer for political campaigns, or act as opinion leaders within local social networks. Whatever their status vis-à-vis these other political activities, the group of public commenters is sufficiently large that it is a useful object of study in its own right, so extracting and analyzing the sentiment in their comments has the potential to provide worthwhile information for the study of how agencies and the public interact.

Ideology and Comment Sentiment

In a simple model of participation in the public comment process, a proposed regulation can be understood as representing a point within a one-dimensional, left-right ideological space. [1] A liberal proposed regulation (for example, one that increases regulation of financial products) would occupy a position to the left of a conservative proposed regulation (for example, deregulating financial products). Both agencies and commenters in this model have "ideal points" within this ideological space that represent their preferred policy outcomes. Agencies will tend to propose regulations that are close to their ideal point. The distance from a commenter's ideal point and the proposed regulation affect the sentiment of the comment. A proposed regulation that is relatively close to a commenter's ideal point will spur positive sentiment, and proposals that are relatively distant will generate more negative sentiment. The likelihood of commenting may also be related to the distance between a potential commenter's ideal points and proposed regulations, as well as other factors, such as the salience of the underlying issues affected by a rulemaking. Individuals are more likely to comment on a proposal they strongly favor or disfavor and on rulemakings that involve high salience issues.

This model of commenting involves strong assumptions about the nature of ideological space and the motivations of commenters. In reality, people's ideological dispositions may vary on multiple dimensions and be poorly represented by a simple left-right spectrum. Even on a single dimension, we are unable to directly observe the distribution of ideal points of potential commenters, which may be relatively normally distributed and clustered toward the center or, alternatively, may be bimodal, with relatively few moderates and separate groupings oriented toward the extremes or even uniformly distributed across the space. We also have little

1. For background on ideal point estimation see (Bateman and Lapinski 2016).

information on how individuals learn about regulatory proposals and decide to comment, and what mix of salience, satisfaction with the policy choices made by an agency, and other factors influence commenting behavior.

What simple models lack in nuance, sophistication, and complexity, they can sometimes offset with parsimony. Despite the limitations in the micro-level account of commenting behavior offered above, it can nonetheless help motivate some macro-level predictions about the relationship of sentiment and the ideological characteristics of agencies. At the aggregate level, certain features of comments may be predictable, even if the behavior of individual commenters is highly stochastic, unchanging, or affected by a wide range of unobserved variables.

The macro-level prediction that we test is that agencies with more moderate ideological tendencies will receive comments with relatively more positive sentiment. This result is consistent with the simplified model in which personnel ideology is correlated with the likely policy choices made by agencies, the desire to comment is relatively uniform across the ideological spectrum, and there is some centralized tendency to the distribution of ideal points within the pool of potential commenters.

Given the number of potential variables in play, there are other, more micro-level accounts that would also be consistent with a positive correlation between ideological moderation and sentiment. For example, under a bimodal distribution, moderate proposals might be distant from all potential commenters' ideal points, but many unhappy potential commenters may be demotivated by milquetoast proposals and decide not to comment at all. There may be other causal stories as well, such as the possibility that negative sentiment in comments causes ideologically moderate individuals to avoid seeking work at an agency. If this is the case, the location of regulatory proposal in ideological space does not cause negative sentiment in comments; rather, some other variable causes negative sentiment (e.g., an unpopular mission), which then affects the type of personnel attracted to an agency, which in turn affects ideology esti-

mates. Or there may be unobserved variables—such as the influence of a special interest group or congressional oversight committee—that affect both agency ideology and comment sentiment. The current analysis will not be able to distinguish between these alternatives. Rather, its value lies in investigating empirical associations in the data and opening the door for additional research to develop and test alternative theories of commenter behavior.

Data

For our analysis, we exploit the extensive dataset of public comments compiled by FiscalNote, a Washington D.C.-based government analytics firm. FiscalNote scraped all publicly available comments for all agencies during the study period from Regulations.gov whenever possible and from the individual agencies' websites otherwise. It is worth noting that not all comments are publicly released; for example, agencies sometimes release only unique comments. Every comment that was available was analyzed. Our study period is the first seven years of the Obama Administration. **SHOULD WE UPDATE THE ANALYSIS HERE – WILL ALSO BE NICE TO DISTINGUISH FROM THE PRIOR WORK** During that time, more than two million public comments were received and released in response to solicitations by U.S. federal administrative agencies concerning pending actions (primarily, but not exclusively, rulemakings). Our analysis is based on 1,461 rules adopted during the study period for which one hundred or more comments were received. The data covers 106 administrative agencies. The three rules with the largest number of comments during the study period were a rule by the Department of Health and Human Services implementing provisions of the Affordable Care Act, an Internal Revenue Service rule concerning candidate-related political activities by tax-exempt organizations, and a State Department permit application concerning the TransCanada Keystone Pipeline.

Our predictor variable of interest is agency ideology. We will test the relationship between ideology and sentiment with the basic hypothesis

that agencies with more 'extreme' ideologies will receive public comments with lower mean sentiment. To construct the ideology variable, we rely on a measure based on responses to a 2007–08 survey conducted as part of the *Survey on the Future of Government Service* project. [2] That survey was sent to over seven thousand senior level officials within the federal government, both career and political appointees. Completed surveys were received from over two thousand respondents (with an overall response rate of 34%). To develop an ideology measure that was commensurable with Congress, the survey included several questions on how the respondent would have voted on fourteen questions that were subject to House and Senate votes in 2006 (including the confirmation of Justice Alito and a bill to increase the minimum wage). Using congressional actions allowed the researchers to compare the hypothetical votes of survey respondents to the actual votes of Senators and Representatives, placing them in common ideological space.

The *Survey on the Future of Government Service* researchers reported separate ideology scores for career official and appointees; for our analysis we will use the ideologies for the careerists only, disregarding the political appointees. Given the relatively low level of turnover within ranks of career civil servants, a greater degree of inter-administration ideological consistency can be expected. Use of only the career respondents may also allow us to examine more persistent agency level effects that are less likely to be subject to variation as the White House changes between Presidents and parties.

The FiscalNote data includes fairly granular level specification of the issuing agency, which is more finely grained than the estimates of agency ideology. In those cases, we identify a parent agency and tag an ideology score accordingly. For example, the Fish and Wildlife Service is a

2. (Clinton et al. 2012) We use data from an earlier working paper version that reported more detail on the survey responses.

bureau within the Department of the Interior—since we have no specific ideology score for the Fish and Wildlife Service, all of its rules are attributed to Interior. This lack of granularity adds a fair amount of noise to our analysis; it is quite possible that the ideology of personnel associated with the Fish and Wildlife Service (which is charged with administering the Endangered Species Act) is different than personnel at the Bureau of Oceans Energy Management (which administers offshore oil drilling), even though both fall within the Department of the Interior. The coarseness of our ideology measure can be expected to attenuate our results, rather than lead to spurious correlations.

Our ideology variable is not simply a location on the left-right spectrum. Rather, we estimate the degree to which an agency departs from the middle of the ideological distribution. To do this, we calculate an ideological midpoint by taking the mean ideology for agencies in our sample and then using the distance between that midpoint and an agency's score as an estimate of the degree of ideological polarity.

We analyzed the sentiment of all of the comments in our dataset using the publicly available sentiment analysis model in the pattern Python library. The text was preprocessed using TextBlob and NLTK to tokenize, stem, and remove stop words. Every comment is given a sentiment score based on the occurrence of lexical items indicating positive and negative polarity within the document; these comment sentiment scores are then categorized by the corresponding rule to create a per rule distribution, and a mean sentiment value is determined for every rule. This mean sentiment is used as the dependent variable in our analysis. For all rules in our data set, the distribution of mean sentiment is roughly normal.

Results

There are eighteen agencies in our dataset for which we have both ideological scores and rules. Many of these agencies have bureaus, departments, or offices that are not represented separately. Figure 1 presents the relationship between agency ideological polarity and mean sentiment.

Recall that each agency's ideology score is not a location in left-right ideological space, but rather a measure of the distance between that agency's ideology and the midpoint in the space. Most of the agencies have a unique score, but several of the agencies share ideological scores with each other (there are thirteen unique scores for eighteen agencies).

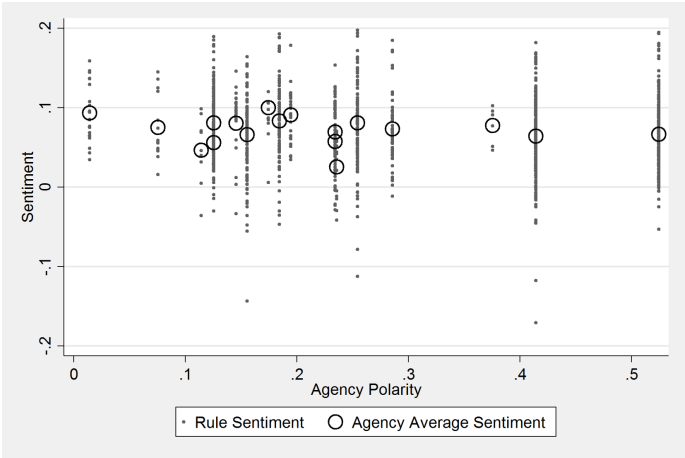

Figure 1. *Agency polarity and comment sentiment*

The horizontal axis presents a measure of agency polarity that is calculated by taking the absolute difference between an agency's ideology and the mean ideology. Sentiment falls on the vertical axis, with the scores representing the percentage positive words minus the percentage negative words. Each dot represents a single rulemaking, circles are the sentiment scores aggregated by agency.

Visually, it is clear from Figure 1 that there is a substantial amount of variation at the agency level; the same agencies issue rules that generate comments with very different levels of positive or negative sentiment. Because ideology is assigned at the agency level, its usefulness in predicting sentiment at the rule level is relatively low and at first glance it is not clear that there is a relationship at all. The large number of rules in our sample, however, allows us to detect even fairly weak signals in this

noisy data. When sentiment is averaged at the agency level, the relationship between ideology and sentiment becomes somewhat more visually apparent.

To examine the size of the relationship and test for significance, we estimate a linear model in which sentiment is treated as a dependent variable and agency ideological polarity is treated as predictor variable, with controls for the number of comments (which may be correlated with both agency ideology and sentiment) and year fixed effects. An ordinary least squares regression shows that agency ideological polarity is significant at the 1% threshold with a coefficient of -0.03 and an adjusted R-squared of 2%. This coefficient can be interpreted to mean that agencies with highly moderate ideologies can expect, other things being equal, comments that include roughly 1.5% more net positive words compared to agencies at the extreme end of our sample. The relatively low R-squared value is consistent with the limited predictive power of ideology for sentiment at the rule level. We also estimate a separate model in which agency average sentiment replaces rule sentiment with the same controls for total comments received and year fixed effects. In that model, ideological polarity is again significant at the 1% threshold and R-squared increases to 21%.

To check whether any specific agency accounts for the relationship, we conducted an additional round of analysis. We first analyzed whether EPA rules were particularly controversial, adding an indicator for whether a rule was issued by EPA; there was no change in the results. We then constructed a new model with the issuing agency as indicator variables and identified seven agencies with significant correlations with mean sentiment (Commerce, Education, Interior, Transportation, Housing and Urban Development, Nuclear Regulatory Commission, and State). We gave each of these agencies the same treatment as the EPA, adding them individually to the third model. In none of these specifications did the significance of agency polarity fall below the 1% level.

The upshot of this analysis is that there is a relationship between agency ideology and the sentiment that is expressed in comments to the

agency. More ideologically moderate agencies tend to receive comments that are, on average, more positive. It is worth emphasizing that these results are detectable even though the measures of both sentiment and agency ideology are quite noisy. The sentiment analysis scores are based on publicly available technology that is not tailored to the regulatory context, and the document level aggregation obscures the content of the sentiment within the comments. Agency ideology is assigned at a very high level up the hierarchal ladder within the executive branch, which misses out on the potentially substantial ideological differences between bureaus and offices within agencies. Nonetheless, in the aggregate, there appears to be an identifiable relationship.

This result is consistent with the simple model of commenting introduced above, but as discussed, there are also other plausible stories that might account for this relationship—a fuller reckoning with the underlying causal mechanisms will require further research. Our limited understanding of how agency ideology interacts with the comment process also reduces our ability to draw normative conclusions. Under a very strong traditionalist understanding of agencies, (Goodnow 1900) in which politics should be kept entirely separate from administration, our result would raise red flags. But on a more nuanced understanding that allows for some interaction of politics and administration, it is at least potentially unproblematic for agencies to occupy different places along the ideological spectrum and, accordingly, generate differing public responses to their rules.

Certainly, it would be overly hasty to conclude from our analysis that the more ideologically distinctive agencies are poorly performing their regulatory tasks. It is not obvious that agencies should seek to avoid negative sentiment and encourage positive sentiment—unlike in the case of consumer products, immediate satisfaction may simply not be the best interpretation of agency performance. Furthermore, there is no reason to think that the comments that are submitted to agencies are representative of the views of the American public in general; they may well better

reflect the interests of organized groups or ideological activists, in which case negative sentiment from commenters may be associated with rules that better protect the public interest.

Further Research

Although both the empirical and normative conclusions that can be drawn from our results are murky at this stage, the potential directions for future research are clearer. We propose three research areas that are raised by the proceeding analysis, that could be addressed by leveraging existing data sources, and that have the potential to generate a richer understanding of the public comment process and interactions between public bureaucracies and the public more generally.

The first research area would be to develop better measures of comment characteristics as well as measures of rule characteristics based on regulatory texts. The basic sentiment measure used in our analysis is very rough and is not tailored to the corpus or question of interest. Better measures could capture more relevant features of comments that are estimated with greater precision. In addition, we do not analyze the content of regulatory texts and relate that content to agency ideology or comment content. Some simple analyses of regulatory texts have been carried out, but more sophisticated measures that reveal the policy content or ideological valence of regulatory text could serve as the basis for more nuanced analysis of the relationship between proposed regulations and the comments that they generate.

The second research area concerns commenter ideology. In the analysis above, identifying information was not used, and commenters were treated as an undifferentiated mass. As with other public filings, however, commenter identity is not hidden, and can, in theory, be extracted from comment texts. Generally speaking, there are two types of commenters: organizations and individuals. Once commenter identity is revealed, that information can be used to categorize comments by the authoring organization or individual and can be linked via that informa-

tion to other sources of data, such as campaign donation information for individuals, or lobbying filings for organizations. This information can provide insight into the distribution of ideological tendencies within the pool of commenters and how commenter ideology relates to agency ideology and comment characteristics.

A third research area would involve interactions of comment characteristics with political oversight. Our analysis is limited to the Obama presidency, and so does not capture variation in the party that occupies the White House. As the Trump Administration unfolds, this new data will become available. Nor do we mine information on congressional oversight activities or the institutional design characteristics of agencies (such as whether they submit rules to OIRA for clearance) to examine how oversight from political bodies might affect regulatory text or the content of comments. Data from media sources might also be used to estimate the public salience of regulatory matters, which may interact with political oversight or affect the propensity of interested individuals to comment.

Overall, the initial exploratory analysis presented in this Section indicates that there is substantial potential to make use of public comments to understand the relationship between agencies and the public. Of course, as with any source of data, public comments do not provide a complete picture, but they nonetheless are a valuable lens into the thoughts, concerns, and reactions of interested parties to the proposed actions of administrative agencies. As new generations of computational text analysis tools become available, they have the potential to provide substantial new insights that challenge existing understandings and create opportunities for new avenues of research that enrich and deepen our understanding of questions at the heart of the social scientific study of government.

Enhancing Participation

The most salient risks posed to agencies when faced with a large number of comments is the failure to identify and respond to substantive comments that are subsequently used as the basis for litigation. Courts enforce the Administrative Procedure Act's requirement for agencies to collect and consider comments, occasionally striking down rules when agencies fail to adequately respond to comments on a proposed rule. Agencies are not under a general obligation to "discuss every item of fact or opinion" offered in a comment, but they are required to include in the record sufficient response to comments to show to a reviewing court that the "major issues of policy were ventilated" during the rule making deliberations. [3]

Regardless of controversies over how to respond to less sophisticated mass comments, (Farina, Newhart, and Heidt 2012; Mendelson 2011) there is broad consensus that highly substantive comments that contain information of obvious output value for agencies ought to be appropriately considered. Courts have emphasized the importance for agencies to respond to comments that raise relevant scientific or technical information, illuminate undesirable consequences of the proposed rule, or offer alternative courses of action for the agency to consider. [4] A judicial reversal imposes major costs. Agencies spend considerable resources on rulemaking, including personnel hours and funds to hire consultants.

The most significant category of rulemaking costs, however, may be political. Each agency's rulemaking agenda is extremely constrained, with the potential to issue only a small number of rulemakings each presidential term. The opportunity cost for any rulemaking includes all of the other policies that could have been pursued. Agencies also expend general political capital during rulemakings, inevitably courting contro-

3. Auto. Parts & Accessories Ass'n v. Boyd, 407 F.2d 330, 338 (D.C. Cir. 1968)
4. See e.g., Pub. Citizen, Inc. v. FAA, 988 F.2d 186, 197 (D.C. Cir. 1993).

versy and opposition even in contexts where regulation is broadly popular. Given the costly investment that a major rulemaking represents, when a rule is struck down it is an enormous disappointment for the agency. When agencies fail to account for highly substantive comments, not only do they undermine their own decision-making process, they also open themselves up to these litigation risks.

Although agencies have both internal reasons and external incentives to identify highly substantive comments, the low cost of submitting comments means that more substantive submissions can be buried under a mountain of less substantive comments. We refer to this challenge as the *haystack problem*—agencies must find the proverbial needle in the haystack. Substantive comments must be unearthed from within a large number of comments that are highly unlikely to pose any litigation risk. Failure means that the agency loses the opportunity to improve its rulemaking or head off a judicial challenge. When there are a large number of unique comments of a less substantive nature, and a relatively small number of sophisticated comments, the task becomes more difficult. Agencies that find themselves inundated with tens of thousands, or even millions of comments, have an especially difficult chore.

The second challenge agencies face is how best to respond to the less sophisticated comments offered on behalf of small stakeholders or interested individuals. These are not the technocratic, jargon-laden comments that are submitted by large law firms on behalf of major industry, but are nonetheless genuine expressions of concern or support. The welfare stakes can be quite real for the small business owner who faces a rule that would cut into already slim profits or the parent commenting on an air quality rule out of concern for a child with asthma. Although there is some disagreement among experts about the information value of these informal comments, the reality is that they are regularly submitted, and they may, if properly analyzed, provide insights that are of use to regulators.

This second challenge is much greater than the haystack problem,

because it is not just a matter of screening out the informal comments. Since the information in these comments is diffused, there has to be some mechanism to distill and aggregate meaning that might be spread over many tens of the thousands of comments. It is relatively easy to sit down and extract the content from a set of well-researched, persuasively written comments that have been prepared by professionals whose expertise is exactly in communicating to agency officials. It is an altogether different task to face perhaps thirty thousand comments submitted by individuals from a huge range of backgrounds, many of whom have no experience communicating to agencies, lack familiarity with the governing jargon, and have little time to devote to researching the relevant issues, and attempt to extract any kind of collective meaning from those.

This difficult task we refer to as the *forest problem*. For a major rulemaking with tens of thousands of unique comments, it is impossible for any person to gain a sufficient vantage point from which to view the entirety. Any single person can read only a small share, and attempt to summarize as best as is possible; others may read the summaries and try to detect broader trends, but as the level of resolution decreases, important details can blur. The limits of human cognition (not to mention hours in the day) require a tradeoff, and the process of communication between the fine-grained level (of individual comments) and higher-order meaning (trends within the group of comments) is highly imperfect.

Gravitas

At the heart of the haystack problem is the need to identify the most useful comments within a large, unstructured corpus of documents. In essence, agencies would like to be able to separate comments that have substantive weight, or gravitas, from the mass of less substantial informal comments. Under Farina's account, agencies can focus exclusively on the comments with greater gravitas, while under Mendelson's, agencies should analyze even the less substantial comments (Farina, Newhart, and

Heidt 2012; Mendelson 2011). Regardless, the treatment given to comments will vary depending on their gravitas—even if informal comments are not ignored altogether, the types of analysis that they will be subject to, and the information that will be extracted, will be very different. When a major law firm, representing a multinational company, submits comments to an agency on a proposed rule, agencies lawyers must comb through the document to identify potential legal lines of attack, and economic, engineering, and policy personnel will examine the comments for data or arguments that inform potential changes in the rule. The information in informal comments will often be of a very different sort, and is more likely to bear on issues such as risk communication, framing, or the political interpretation of the proposal.

There are some obvious approaches to addressing the haystack problem that do not require advanced computational techniques. For example, comments that are filed by major companies or organizations, or their representatives, are likely to receive attention. The comments of established experts may also be more likely to be flagged for special treatment. Other relevant features of comments that can be identified fairly easily using basic computational tools include the length of the submission, the sophistication of the vocabulary, the relevance of the comment to the rule (perhaps based on shared vocabulary or phrases), the amount of citation, and basic identifying information on the author (such as whether the comment was from an institution or an individual, or whether the commenter participated in other rulemakings).

We conduct an initial assessment of the viability of this technique using comments from a recent rulemaking by the Environmental Protection Agency (EPA) to reduce greenhouse gas emissions from existing electricity generating units. This rule is one of the most consequential proposed environmental regulations in the nation's history, and the number of public comments received by the agency reflected this historical status of the rule: EPA received over 4.3 million comments. Given this massive volume of comments, it is pretty clear that the agency cannot give each one

a great deal of individual attention, and so some automated means of directing the agencies focus would be particularly helpful in this context.

A first step is simply to remove duplicate comments. EPA appears to have done so; although the agency reports over four million comments received, less than one percent (34,388) are posted by the agency online. Even with the duplicates removed, however, there are still tens of thousands of comments for the agency to review, and so additional steps to prioritize responses and categorize comments remain helpful.

The following analysis relies on a gravitas measure developed by FiscalNote. This measure ranks comments based on several identifying features including comment length, attachment count, the complexity (or coarseness) of the language that is used, whether the author is an organization, key person, or ordinary individual, the number of cogent arguments expressed, and other cues that together serve as a proxy for sophistication. According to the FiscalNote gravitas measure, the single most sophisticated comment was submitted by the environmental organizations Sierra Club and Earthjustice. This comment was truly behemoth, clocking in at 274 pages with an additional seventy-three exhibits (an example, "The History of Energy Efficiency") and thirteen appendices (including "Literature Survey, Efficiency Improvements through Upgrades of Existing Plants"). Other gravitas leaders include the environmental group Center for Biological Diversity and the Ameren Corporation (an energy holding company).

Some other points on the gravitas spectrum give a sense of the wide diversity of comments received by the agency. At the top of the bottom quintile of the FiscalNote measure are two short comments sent by individuals, one of which appears to be a form comment:

- Please reduce carbon pollution from existing power plants to protect public health. Set strict limits on carbon pollution from power plants. (forwarded via the American Lung Association)
- Thank you, thank you for your courage and foresight. Change must happen immediately to save the planet.

At the top of the second quintile there are two short comments from individuals that remain fairly unsophisticated:

- This sounds good. Up front at least. It's been a while since this country has passed any major environmental movements, and I definitely agree with one like this.
- Support american energy & not the marxist agenda.

The comment with the median gravitas score was submitted by an individual and reads as though it might be a mixture of a form comment along with some additional personalized commentary:

- I strongly support the EPA's effort to limit industrial carbon pollution from existing power plants. These new clean air standards will protect public health, fight climate change, and create jobs through innovation in cleaner, safer energy technology. It's our obligation to protect our children and future generations from the effects of climate change – and that means moving forward with these clean air protections now. I have been screaming about this for 50 years! What the hell are you waiting for, the end of life on earth?

At the top of the third quintile is the following:

- It is absolutely imperative that this plan be enacted. As an American citizen, I am ashamed by the near-total lack of action on climate change in this country. Climate change is a very real threat to the health and well-being of my children and their future children. If we do not take decisive action now, there will be no world for my grandchildren to inherit. This plan makes economic sense and promotes public health and national security. It would be a complete disgrace if this plan was not enacted because of the short-sighted special interests of a small group of industry executives and politicians that are beholden to the coal industry. It is time for the United States to begin taking actions to reduce our disproportionate share of global greenhouse gas emissions.

At the top of the fourth quintile is a comment that may be or have elements drawn from a form comment:

- Please keep in mind all of us who support clean renewable energy, which is very do-able in the USA. We vote and we spread information. Along with all 2.4 million Sierra Club members and supporters, I want to see strong positive climate action. I'm encouraged with the framework put forward by EPA's proposed safeguards against carbon pollution from existing power plants but want to see the standard strengthened. We need states to be encouraged to choose clean energy and energy efficiency. It's not the appropriate time to build more dangerous nuclear power plants and invade our fragile water supplies with fracking. We must dedicate resources to create more productive jobs in an industry that doesn't pollute our air and water or disrupt the climate. (forwarded via the Sierra Club)

It is, of course, the most sophisticated comments that are likely to receive the most agency attention. Even focusing at the top, there are still a fairly large number to consider. For example, the comment with the one hundredth highest gravitas score was from a group called the Small Business & Entrepreneurship Council, a northern Virginia based "nonpartisan advocacy and research organization." These comments are fairly long, at 2300 words and include comparatively sophisticated arguments in support of the three criticisms of the rule summarized by the group as:

- After a thorough review of the CPP, [we] believe the wisest course of action is for EPA to withdraw the proposed rule and abandon its costly agenda to regulate carbon dioxide under the Clean Air Act. The reasons for our position are straightforward. EPA's proposed rule: Is illegal, stretching far beyond the narrow boundaries of Section 111(d) of the Clean Air Act; Imposes high costs for no meaningful benefits; and Threatens the reliability of the nation's bulk electric power system, which raises the prospect of blackouts

and brownouts, which can in turn increase operating expenses and uncertainty, as well as reduce output and revenues.

The one thousandth most sophisticated comment was submitted by the West Virginia Community Action Partnership, a "statewide membership association" of local community groups that serve over 40,000 "low-income families annually in all of our state's disadvantaged communities, providing [them] with multiple services to promote their economic security." These comments clocked in at 1,600 words and offered support as well as detailed criticism for the rule. The group summarized its view follows:

- We are in strong support of the general goal and ultimate result of the 111[d] rule. We are enthusiastic about a framework that allows a building block of efficiency and clean energy policies as part of the solution. However, we believe EPA has failed to establish:The needed framework for participatory planning; The criteria for establishing that each state's plan is equitable with respect to access to clean energy; Protection from environmental degradation; and, Protection of human health.

Any automated measure will sometime fail, and one form comment broke the top five most sophisticated because it was delivered in bulk as a set of images (rather than individually as text) creating a very large file. The comment, which appears to have been individually hand signed by over 30,000 electricity customers in South Carolina, urged that agency to give "equitable treatment for [South Carolina's] nuclear units under construction." But even if imperfect, the ability to conduct a rough triage using automated tools can have substantial savings. Assuming that it would take an employee ten second per comment to group the comments into rough categories, the human resource cost to conduct this simple operation on all of the comments received on the Clean Power Plan would be over ten thousand person hours—a considerable return.

Agencies also have access to information that could build on the simple approach used above. FiscalNote's gravitas measure is based on a handful of very easily identifiable characteristics that are used to generate an intuitive measure, such as comment length and the sophistication of the language used. These factors make sense, but they are not independently verified. Agencies, on the other hand, have access to metadata that could be used to validate a constructed measure, or perhaps even more promising, to train a supervised model for classification. Specifically, agencies have data from past rulemakings on which comments were considered serious enough to warrant a substantive response—either in terms of revision to a proposed rule, a response in a preamble, or response-to-comments document. In essence, the agencies have tagged certain documents as worthy of a deeper consideration. This information could be used to generate a training set for a supervised machine learning experiment. It is possible that a properly constructed and trained algorithm could predict, with a fair degree of accuracy, those comments that are most likely to warrant additional attention. At the very least, such an approach could take a first cut to identify high-substance comments, with the remainder subjected to the existing human evaluation procedure.

Identifying Emergent Meaning

At the heart of the forest problem is the potential for emergent meaning that arises at the level of the corpus (i.e., the collection of comments) that is not apparent when the component documents (i.e., the comments) are analyzed in isolation. This emergent meaning exists at the aggregate level in the form of patterns and regularities that are determined, at least in part, through the relationship of documents to each other, as well as the internal relationships between concepts, arguments, and ideas within documents. Addressing the forest problem requires aggregated representations of a large number of comments that can be interpreted by agencies and released to the public.

As it stands, in major rulemakings, agencies release comments in an entirely unstructured fashion. In response-to-comments documents or in regulatory preambles, agencies will detail how they have considered substantive issues that were raised during the public comment process. Sometimes, agencies will include some sweeping language concerning informal comments, characterizing the grounds for general support or opposition for the rule. When they identify common themes that are the subject of many comments, or when they flag some comments as duplicates that have been generated by mass email campaigns, agencies already engage in some rudimentary efforts to identify emergent meaning. Both of these observations require agencies to compare comments to each other, in addition to taking each on its own terms. But frequently, the response-to-comments document is not indexed at all to the pool of comments, so it is impossible to track which comments match which revisions or responses (other than, theoretically, reading all of the comments themselves). Ultimately, although these rudimentary efforts are useful, there is very little nuance, and the diversity of the individual voices that participated in the commenting process and their relationship to each other is lost.

The volume of comments, their low information density, and the relative resource scarcity of agencies make more sophisticated attempts to develop higher order meaning difficult without the aid of computational tools. Topic modeling is one possible approach (Blei 2012). A major advantage of topic models is their ability to radically reduce the number of dimensions for analysis, from a vocabulary of tens of thousands of words down to a small number of topics (set by the user, typically to between 10–100). With this information, researchers can examine how documents relate to each other and how semantic content varies over time.

Topic models also create a representation of a textual corpus that is highly amenable to additional analysis that can provide further insight into a corpus. For example, topics can be used to construct a network that is based on the document in a corpus that illustrates how topics relate to

each other, showing, in essence, how often subject matter categories are mixed within a document. Topics can also be used as a way to estimate the semantic distinctiveness between documents or groups of documents, which allows a way for analysts to determine, for example, the degree of relatedness between authoring institutions.

From the perspective of an agency, topic modeling comments and carrying out associated analyses could help identify relationships between portions of the rule that are not obviously apparent from the face of the regulation. These emergent relations could provide the agency with insights into how revisions could be made that mitigate a shared concern through a pathway that the agency did not anticipate. This type of representation might also help the agency target its revisions toward areas of the rule that are of concern to many diverse stakeholders by addressing issues that tend to be central within a topical network (i.e., are linked with many different clusters of issues) rather than dealing with concerns that are on the outskirts of the network (and therefore have few relations with other issues).

To illustrate the usefulness of this tool, we applied a standard topic model to the nearly 40,000 publicly released comments received by the EPA in regards to the Clean Power Plan. We use the Latent Dirichlet Allocation implementation provided by Genism for building the topic model. The text was tokenized, stemmed, stop words removed, and the top 10k unigrams (single word expressions) and 5k bigrams (two word expressions) were retained.

As discussed in detail above, there was a broad diversity in terms of the sophistication of comment, with many simply offering words of support or opposition, and others that engaged in detailed analysis. Because topic models are based, at a very general level, on word co-occurrence, sophisticated and unsophisticated comments are given the same weight. That said, if more sophisticated comments tend to use similar language that may be reflected in the topics that are generated by the model. This actually seems to be the case. In a twenty-topic model of the Clean Power

Plan comments, one of the topics includes a number of two-level phrases that are very specific to the regulatory context at issues and seem quite likely to be associated with fairly sophisticated players. The top words (or words indicated by word stems) for this topic include "stationary source," "electric utility," "generating unit," and "emissions guidelines." All of these are terms of art specific to the Clean Air Act context, and so are likely a flag for sophisticated comments.

In that same twenty-topic model, there is a fair amount of overlap in the vocabulary, with words like "EPA," "energy," "carbon," "clean," and "rule" showing up across multiple topics. Looking at the top words that are not common across topics, some interesting results emerge. For example, one of the topics includes "carbon tax" as a top unit when bigrams were included. That same topic included relatively high in the distribution the words "fee," "dividend," and "citizen." To an observer of climate policy, this topic conforms to arguments forwarded by those who favor an approach to greenhouse gas reductions that favors a revenue neutral price on carbon that is accompanied by a per capita "dividend" of the collected funds.

Other topics in the same model include a topic that appears oriented toward the gravity of the threat from climate change, which includes several bigrams within the topic words; these include "children enact," "today threaten," "problem greatest," "challenge face," and "undeniable problem." Two topics appear to focus on the question of how nuclear power should fit into climate change policy: one with top words like "nuclear power," "waste," "reactor," "sustain," and "radioactive"; the other with top words such as "nuclear," "clean," "current," "construct," "calculate," "credit," and "baseline." The role of environmental groups in organizing commentators also shows up, with one comment substantially devoted to words associated with the Sierra Club and another with words associated with the Environmental Defense Fund.

On the Horizon

From a content perspective, the analysis of the Clean Power Plan comments provide some interesting insights, but its the primary utility is in illustrating the ability to extract emergent content from a large unstructured corpus of comments. At the same time, there are even more ambitious possibilities for a new kind of public deliberation that is created when agencies provide a feedback mechanism within the group of commenters, rather than a closed one-way flow of information from commenters to agency.

One can imagine a technologically enhanced notice-and-comment process that is superior to the current approach in many ways. Natural language processing tools could be embedded directly into the public comment interface and allow commenters easier access to information on a rulemaking that could include automated summaries of rulemaking text or links to relevant background documents, which themselves could be automatically summarized and distilled for ease of consumption. Prompts could be used to help commenters understand the types of information that they might want to include, and automated argument analysis could help facilitate more persuasive and well supported comments.

These tools could help improve the baseline quality of comments, but it is in facilitating interaction between commenters that there is even greater potential value. For example, an agency could engage in a two-step public comment process that allowed for an initial round of comments that closed by a certain date, followed by a pause and a second public comment window. During the pause, a specifically designed content analysis engine that combined elements of topic modeling, sentiment analysis, and perhaps other computational text analysis tools, could work on the first round of comments to develop an interactive representation of their content. During the second round comment period, automated tools could guide participants through the first-round comments and flag areas of interest and points of agreement or disagreement—even,

perhaps, facilitating up-voting or down-voting particular comments or ideas. An automated approach could be used to identify higher quality comments that could be presented to commenters to inform their own understanding of the rule, or could be integrated into an annotation engine that would allow commenters to voice agreement or disagreement with the arguments presented by others.

Once the final set of comments were collected, the agency (or a third-party agency that might have a more neutral attitude) could analyze the digital traces of the conversation, examining points of agreement and disagreement, collating opinions or sentiment with commenter characteristics (such as industry affiliation or region), scraping through for new bits of technical information, and developing a final aggregate representation that captures the state of deliberation on the rulemaking. Because it would be designed to be highly automated, this more interactive notice-and-comment process could be used for rulemaking at many different levels of broader public salience, from highly charged rulemakings that generate millions of comments, to the more run-of-the-mill rulemakings in which only several hundred comments are submitted.

This technologically enhanced public comment process would likely have substantial value, as participants would be given a much richer environment in which to engage in public deliberation, with the associated legitimacy-enhancing effects. There would also be greater information value, as higher quality comments are generated and more of the information that is embedded within them is extracted. The final aggregated representation of the comments could then serve as the foundation for revisions to the proposed rule. The agency could also use the comments as a starting place for a final substantive discussion that grapples with both the technical decisions and value-laden choices that it made.

Conclusion

We hope to have illustrated how new tools in natural language processing, combined with the massive (and publicly available) corpus that is

generated by the notice-and-comment rulemaking process, creates opportunities for both researchers as well as government officials. Scholars of public bureaucracies can use the information embedded within public comments to test theories on the interaction of agencies and the public that they serve. Agencies can use advanced computational techniques to respond to the challenges of the era of mass commenting, specifically by identifying the most substantive comments that require more sustained attention and by aggregating and analyzing comments to identify emergent content that is only apparent when comments are understood in relationship to each other and not simply read as individual, atomized responses to a regulatory proposal. Although computational text analysis is certainly not a panacea for all that ails the regulatory process, or American democracy more generally, these tools can be usefully put to use both to enhance understanding and ultimately improve public deliberation over pressing and highly contested policy decisions.

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