Sentiment and Uncertainty about Regulation*

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Abstract

Businesses regularly cite the regulatory environment as a factor impacting their production and hiring decisions, but there is little research on quantifying the sentiment and uncertainty around regulation. We present measures of sentiment and uncertainty about the U.S. regulatory environment using natural language processing of an original news corpus from seven leading U.S. newspapers. We build monthly indexes of regulatory sentiment and regulatory uncertainty and categorical indexes for 14 regulatory policy areas from 1985 through 2021. Impulse response functions indicate that a negative shock to regulatory sentiment is associated with large, persistent drops in future output and employment, while increased regulatory uncertainty overall has a nonsignificant or transitory impact on output and employment. Economic outcomes are particularly sensitive to sentiment and uncertainty around certain regulatory areas including transportation, consumer safety and health, general business and trade, and energy regulations.

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1 Introduction

The U.S. government issues thousands of regulations a year. Some of these are in response to crises, such as the COVID-19 pandemic, while others have evolved over time to address longer term goals. Regulations can address market failures to reduce or eliminate negative externalities and improve efficiency of resource allocation. However, poorly designed or excessive regulations may impose "regulatory burden" on the economy, which can potentially generate substantial adverse effects on economic outcomes. How regulation affects the economy is thus an important question for both researchers and policymakers and particularly relevant today.

Efforts to answer this question are often hindered by the difficulty of measuring regulation. The existing research has mostly focused on measuring the quantity of regulation. However, the regulatory environment for economic activities depends not only on how many regulations there are but also on the types of regulations, the enforcement of specific regulatory requirements, the particular policy instrument used to achieve regulatory goals, and the subjective perception of regulation. To study the effects of regulation through a holistic lens, we construct news-based, time-series measures of sentiment and uncertainty about the U.S. regulatory environment using natural language processing (NLP) of newspaper articles from 1985 through 2021.

We show a simple economic application of the measures by examining the impacts of regulatory sentiment and regulatory uncertainty on macroeconomic performance. We find that a negative shock to regulatory sentiment is associated with large, persistent drops in future output and employment, while an increase in regulatory uncertainty overall has a nonsignificant or at most transitory impact on output and employment. These findings contribute to the understanding of economic effects of regulation by discovering that changes in the regulatory environment that induce negative perception or higher uncertainty may have an impact on aggregate economic activity. Moreover, regulatory sentiment, as defined in our study, may be a more appropriate measure reflecting the connection between regulation and macroeconomic outcomes than regulatory uncertainty.

Our text analysis covers 608,172 news articles related to regulation from seven leading U.S. newspapers from January 1985 through December 2021. The normalized volume of these articles suggests increasing news attention to regulatory policy in the U.S. over time, stressing the need to investigate the content of regulation-related news. We then use a NLP technique, lexicon-based sentiment analysis, to evaluate two dimensions of the news corpus: the average sentiment (i.e., positive and negative tone) and the degree of uncertainty expressed in the news about regulation. Based on the estimated sentiment and uncertainty, we build monthly indexes of regulatory sentiment and regulatory uncertainty, respectively, from 1985 through 2021.

We interpret a decrease in the regulatory sentiment measure as a change in the overall regulatory environment that is perceived negatively by stakeholders and reflected in the media, while an increase as a positively perceived change. Similarly, an increase in the regulatory uncertainty measure represents a change in the regulatory environment that imposes greater uncertainty, and a decrease indicates lower uncertainty. When firms perceive negatively or become uncertain about a change in the regulatory environment, they may withdraw or postpone their hiring and investment activities, thereby affecting aggregate economic outcomes.

To examine this economic impact, we estimate impulse responses of key macroeconomic variables to shocks in regulatory sentiment and regulatory uncertainty. The impulse response functions suggest that a negative shock to regulatory sentiment is associated with large, persistent drops in future output and employment. This effect remains after various model modifications and upon controlling for existing measures of general economic sentiment or policy uncertainty, implying that our regulatory sentiment measure contains some unique information that is not captured by other related measures. Nevertheless, we do not observe similar effects of a regulatory uncertainty shock. The output and employment responses to an increase in regulatory uncertainty are not statistically significant in the baseline analysis and at most transitory using an alternative model. This result suggests that uncertainty specifically around regulatory policy is likely to affect firm behavior and thus the macroeconomy in different ways than other types of policy uncertainty studied in the literature.

In addition to the aggregate measures, we categorize relevant news articles into 14 regulatory policy areas and construct categorical indexes that measure regulatory sentiment and uncertainty around specific policy areas. We find that finance and banking is the regulatory area that has drawn the most news attention. Economic outcomes are particularly sensitive to sentiment and uncertainty around certain regulatory policy areas. Specifically, negative regulatory sentiment shocks related to transportation and consumer safety and health have negative, long-lasting effects on future output. Increased uncertainty about business and trade regulation and energy regulation also appears to have a stronger linkage with output compared to the other areas.

Economic theory suggests that regulation can have negative or positive impact on the economy. On one hand, regulation generally imposes restrictions on firm behavior and thus diverts resources that otherwise might be used for production and innovation (Eads, 1980; Coffey et al., 2020). Regulation may also change the firm's ability to calculate the payoffs to investments (Eads, 1980). Uncertainty can exacerbate this effect, since it hampers firms' ability to form a probability distribution of payoffs, making firms more cautious about their investment and hiring decisions (Bloom, 2009, 2014). On the other hand, regulation can generate positive economic impacts by changing the nature and the optional institutional patterns of research the firm undertakes Eads (1980). A well-known example is the "Porter hypothesis," which argues that properly designed environmental regulations can stimulate innovation that may partially offset or even exceed their compliance costs Porter and Van der Linde (1995).

How regulation affects the economy in aggregate thus becomes an empirical question. Existing approaches to measuring regulation at an aggregate level primarily focus on the quantity of regulation, such as the number of rules published by federal agencies, and the number of pages, total words, and command words in the regulatory code (e.g., the *Code of Federal Regulations*) (Dawson and Seater, 2013; Mulligan and Shleifer, 2005; Coffey et al., 2020). Others use government spending and staffing devoted to regulatory activity as a proxy of regulation (Beard et al., 2011; Sinclair and Vesey, 2012). These studies generally find a negative or nonsignificant relationship between regulation and macroeconomic outcomes.

However, the existing empirical measures do not provide complete information about the aggregate effects of regulation. The quantity of regulation or regulators' spending is far from a perfect measure of regulation itself (Calomiris et al., 2020; Simkovic and Zhang, 2019). Moreover, these measures typically track a single aspect of regulation on a relatively low frequency (mostly annually) due to the prolonged rulemaking or budget process. Our news-based measures of regulatory sentiment and regulatory uncertainty fills this gap. The measures capture real-time fluctuations in the outlook for the overall regulatory environment on a much higher frequency. These fluctuations can be caused by various types of regulatory events, such as the promulgation of a new regulation, a company's regulatory compliance or violation, a regulatory investigation, or a lawsuit challenging agency regulatory actions. Therefore, our study presents a more holistic view about the economic impact of regulation.

Sentiment and uncertainty around the regulatory environment are important because firm decisions are subject to these subjective perceptions. Firms' anticipation of payoffs may depend on whether they hold a positive or negative view about the current and future regulatory environment, which captures the idea of "animal spirits" that influence household and business behavior (Keynes, 1936; Shiller, 2017). An analogy is consumer sentiment measuring subject attitudes toward current and future economic conditions. Survey-based measures, such as the Michigan Consumer Sentiment Index, have been widely examined in economic studies and found to have incremental predictive power for consumption expenditures and other economic activity (Bram and Ludvigson, 1998; Carroll et al., 1994; Benhabib and Spiegel, 2019). Closely related to sentiment, uncertainty can postpone firm actions like investment and hiring (Bloom, 2014; Bachmann and Bayer, 2013). For example, a pharmaceutical company may have the option to invest in the development of a new drug; however, if the company is uncertain about whether the drug would be approved to enter the market by regulators, it may prefer to wait until some certainty is achieved.

Recent developments in NLP have introduced economists to use unstructured text as data and build novel measures of sentiment and uncertainty (Gentzkow et al., 2019). Newspapers are a popular source of text data, as they provide high-frequency information and can work as "information intermediaries" with an effect of influencing and shaping public opinions (Ter Ellen et al., 2021). Examples include news-based economic sentiment measures, which are found to be strongly correlated with survey-based consumer sentiment measures and help explain aggregate economic fluctuations (Shapiro et al., 2020; Fraiberger, 2016). Another seminal contribution is made by the news-based economic policy uncertainty (EPU) index developed by Baker et al. (2016). Numerous studies have been published subsequently to develop similar uncertainty measures for other countries (Arbatli et al., 2017; Cerda et al., 2016) and specific policy areas such as trade policy and monetary policy (Caldara et al., 2020; Husted et al., 2019). This research generally finds that increased policy uncertainty reduces business investment and employment growth, raises precautionary savings, and increases stock price volatility (Baker et al., 2016; Bloom et al., 2018; Gulen and Ion, 2016; Caldara et al., 2020; Julio and Yook, 2016).

We contribute to this literature by developing sentiment and uncertainty measures specifically related to regulation as well as studying both for different regulatory areas. Few studies have examined sentiment or uncertainty around regulation. An exception is Baker et al. (2016)'s categorical EPU index on regulation, which measures economic uncertainty around regulatory policy. They use a pre-defined set of terms related to regulation, in addition to their economic, uncertainty, and policy terms, to identify news articles that reflect regulatory policy uncertainty and construct the index based on the volume of those articles. Our regulatory uncertainty measure differs from theirs in at least three ways. First, we identify news content related to regulation by defining a computer-generated dictionary of "regulatory noun chunks" based on titles of rules published by federal agencies. This approach covers a comprehensive set of linguistic terms related to regulatory issues and involves minimal human judgment. Thus our measures reflect a broader definition of regulation and a wider range of regulatory issues. Second, we quantify the degree of uncertainty using a NLP sentiment analysis method, instead of quantifying it based on whether the article contains the word "uncertain" or "uncertainty." The sentiment analysis method can potentially capture different types of uncertainty such as that derived from vagueness or imprecision. Third, we use regressions to construct the time-series measure following Shapiro et al. (2020) instead of relying on the volume of relevant articles, which controls for ideological differences across newspapers.

Our study has several practical implications. First, the dynamic relationships we show in this paper suggest that an improvement in the regulatory system that improves public perceptions of government interventions may help minimize unnecessary regulatory burden on the economy. Second, news sentiment and uncertainty around certain regulatory policy areas appear to have particularly strong links with macroeconomic performance. Policymakers in those areas should take into account the indirect macroeconomic effects that their regulations may incur and increase transparency and clarity of the regulations. Third, up-to-date measures of regulatory sentiment and uncertainty can provide forward-looking information about economic conditions. This information may help firms better anticipate payoffs and make optimal hiring and investment decisions.

In the next section, we describe the data we use in this study, including text data of news articles and economic data used in the estimation of impulse response functions. In Section 3, we describe our approach to identifying the news content related to regulation and the evidence of increasing media attention to regulation over time. Section 4 presents the regulatory sentiment and regulatory uncertainty indexes, including the sentiment analysis method we use to construct the indexes, some descriptive analysis of the indexes, and the validation of the indexes. Section 5 shows the impulse responses of macroeconomic variables to regulatory sentiment and uncertainty shocks. In Section 6, we describe the categorical indexes that measure regulatory sentiment and regulatory uncertainty in 14 policy areas and their varied roles in the impulse responses of macroeconomic outcomes. Section 7 concludes the study.

2 Data

Our initial news corpus includes over one million news articles that contain the keywords starting with "regulat" or "deregulat"[1] (e.g., "regulation," "regulator," "deregulation") from seven U.S. newspapers published between January 1985 and December 2021. The seven newspapers are Boston Globe, Chicago Tribune, Los Angeles Times, New York Times, USA Today, Wall Street Journal, and the Washington Post.[2] We access to the full texts and metadata of the news articles through ProQuest's TDM Studio, which provides a comprehensive collection of historical and current newspapers in a machine readable format (ProQuest, 2022). We remove articles with identical full text to a previous article, leaving 990,262 articles in the corpus.

Since the keyword "regulation" and its variants can be used in many contexts other than referring to government regulatory policy,[3] we conduct further analysis to refine the corpus by defining a dictionary of regulatory noun chunks (i.e., certain noun phrases extracted from the text) from the titles of all rules considered by federal agencies from 1995 to 2019. The data of rule titles are obtained from the federal government's semiannual Unified Agenda of Regulatory and Deregulatory Actions reports (Office of Information and Regulatory Affairs,

[1]These keywords are only used to generate an initial corpus of news articles that are likely to discuss regulatory issues. A possible concern is that perceptions about regulation and deregulation are different. In a robustness check, we remove the articles containing the keywords starting with "deregulat" and our measures and main results remain unchanged. See discussions in Section 5.2.4.

[2]Data for USA Today and the Washington Post are only available from January 1987.

[3]For example, the term "regulation" and its variants are often used in the context of sports. A February 7, 2019 article in USA Today says: "As you watch the NFL or any baseball game and see every replay tortured and analyzed from every angle, have you ever asked yourself, 'You know, we could really use more regulations in sports.'"

2020). The reports provide uniform data on regulatory and deregulatory actions that agencies plan to issue in the near and long-term future. The Unified Agenda reports published over 190,000 actions between 1995 and 2019, which are associated with 38,868 unique rules (as identified by Regulation Identifier Numbers (RINs)). Section 3 details our approach to define the dictionary and identify the news content related to regulatory policy. As a result, our final news corpus includes 608,172 regulation-related news articles. Table 1 shows the number of articles from each newspaper.

For estimating impulse responses, we use monthly data on employment (Bureau of Labor Statistics, 2022), effective federal funds rate, and industrial production (Board of Governors of the Federal Reserve System, 2022a,b), and monthly averages of the S&P 500 index (S&P Dow Jones Indices LLC, 2022). In robustness checks, we also use the Michigan Consumer Sentiment Index (University of Michigan, 2022), the economic sentiment index (Shapiro et al., 2020), VIX (Cboe Exchange, Inc., 2022), and the EPU index (Baker et al., 2016). The economic data cover the period from January 1985 through December 2021 to match our regulatory measures.

3 News Attention to Regulation

In this section, we describe the approach we use to identify regulation-related news articles from the initial news corpus. Controlling for the total number of news articles published in each newspaper, we first show evidence that news attention to regulation has been increasing over time.

3.1 Identifying Regulation-Related News

Identifying regulation-related news is challenging for several reasons. While some newspaper databases label news articles by subject categories such as finance, politics, and health care, news articles are rarely labeled as regulatory policy. Also, while regulation may be the main theme of an article, it may also be mentioned only in certain sections of an article that mainly discusses economic or political issues. This makes a standard article-level analysis inappropriate to identify news content related to regulation. A simple search of a limited set of keywords like "regulation" or "regulator" would also return inaccurate results, because those words could be used in various contexts.

To identify the specific news content related to regulation, we define a dictionary of regulatory noun chunks to assess the context in which the keyword "regulation" or its variants are mentioned in an article. Specifically, we examine the sentence that mentions "regulat*" or "deregulat*" and its neighbor sentences (i.e., a sentence before and after the regulatory sentence). If any of the three sentences contain one or more regulatory noun chunks defined in our dictionary, then we consider these sentences as regulation-related news. An article can have multiple regulatory sentences, depending on the extent to which regulation is the focus of the article, and all these sentences and their neighbor sentences compose the regulatory section of the article. Specifically, we conduct this assessment in a three-step process.

First, we obtain noun chunks from the titles of all unique rules published in the Unified Agenda reports from 1985 to 2019. Noun chunks are "base noun phrases" identified using the NLP library spaCy. For example, the rule title "Test Procedures for the Analysis of Trace Metals Under the Clean Water Act" contains four noun chunks: ["Test Procedures," "the Analysis," "Trace Metals," "the Clean Water Act"]. We then clean the noun chunks by eliminating special characters, removing leading articles (i.e., "the," "a," and "an" at the beginning of a noun chunk), and lemmatizing the tokens of the noun chunks. The above example thus becomes ["test procedure," "analysis," "trace metal," "clean water act"]. We only keep the cleaned noun chunks with two or more tokens, because a single-token noun chunk such as "analysis" has too broad meaning to suggest any information specific to regulation. We iterate this process over all unique rule titles and eventually generate a list of unique n-token noun chunks ($n \geq 2$). This list includes over 37,000 noun chunks and serves as the base for our dictionary.

Next, we preprocess the texts of all news articles in our initial data set. This includes segmenting sentences of an article, extracting the sentence that mentions "regulat*" or "deregulat*" (indexed i) and its neighbor sentences (indexed $i-1$ and $i+1$), and lemmatizing the tokens in the sentences. We then search each of the n-token noun chunks from the first step in the extracted sentences using regular expression operations. If the three consecutive sentences ($i-1$ to $i+1$) contain one or more of the noun chunks, then these sentences are included in the regulatory section of the article.

As the third step, we conduct human checking and correction of the noun chunks that occur in the articles. Because the list of the n-token noun chunks automatically generated from the rule titles still includes some general terms that are mentioned frequently in the news articles but not specifically related to government regulation (e.g., "same time," "first quarter," and "other country"), we read through the noun chunks that occurred in all the news articles and manually filter out those general terms.[4] After removing the general terms from the results, there remain 10,458 unique noun chunks that occur in 608,172 news articles, meaning that each of these articles contains a regulatory section. These noun chunks form our dictionary of regulatory noun chunks, which are also used for building our categorical indexes as discussed in Section 6. Appendix A lists 100 regulatory noun chunks with most occurrences in the news articles.

Our sentiment analyses in the remainder of the paper are based on the corpus of the regulatory sections in the 608,172 news articles.

3.2 Increasing News Attention to Regulation

Tracking the relative frequency of articles discussing regulatory issues over time can suggest trends in news attention to regulation. We investigate that by building a monthly index of news attention to regulation using an approach similar to Baker et al. (2016)'s approach to building their EPU index. That is, we scale the monthly count of news articles that

[4]For filtering out the general terms, two coders went through the list of noun chunks and marked general terms independently, compared their results, and the discussed to solve the discrepancies.

contain regulatory sections by dividing it by the total number of news articles published in the newspaper in the month, and then standardize the scaled monthly counts and normalize the time series to a mean of 100 from 1985 to 2009. Specifically, the monthly news attention index NA_t is calculated as:

$$NA_t = z_t \frac{100}{\frac{1}{\widetilde{T}} \sum_{t=1}^{\widetilde{T}} z_t}, \tag{1}$$

where z_t is the mean of standardized monthly counts over newspapers:

$$z_t = \frac{1}{K} \sum_{i=1}^{K} \frac{x_{it}}{N_{it} \delta_{i,\widetilde{T}}}, \tag{2}$$

where $i = \{1, 2, ..., K\}$ denotes the newspaper, $t = \{1, 2, ..., T\}$ denotes the month, x_{it} is the raw count of articles related to regulation in newspaper i in month t, N_{it} is the total number of news articles published in newspaper i in month t, $\delta_{i,\widetilde{T}}$ is the standard deviation of the scaled count $\frac{x_{it}}{N_{it}}$ over the time interval $\widetilde{T}$ for standardization and normalization (i.e., January 1985 – December 2009).

Figure 1 plots the monthly index of news attention to regulation. The overall trend suggests that regulation has been drawing increasing attention from the media, especially since the financial crisis. News attention to regulation raised during months of important regulatory developments or historical events that triggered massive regulatory responses. For example, the index shows spikes around the Lehman Brothers bankruptcy in 2008, the passage of Obamacare and the Dodd-Frank Act in 2010, and the 2016 and 2020 presidential elections, and a substantial drop during the month of the 9/11 attack in 2001. Beside the overall increasing trend, December 2020 marks particularly elevated news attention to regulation, presumably because of discussions about the regulatory agenda of the incoming Biden administration and potential regulatory approvals of COVID-19 vaccines.

The trend in news focus on regulation not only suggests that regulatory policy has become an increasingly popular topic among journalists, but also implies that regulation has become more relevant to their readers, potentially including consumers, workers, and business leaders. This also motivated our study to investigate the news content and their implications for the macroeconomy.

4 Measuring Regulatory Sentiment and Regulatory Uncertainty

This section starts with a description of the sentiment analysis method we use to estimate the sentiment and uncertainty scores of the regulation-related news articles in our corpus. Using the estimated scores, we compute the monthly indexes of regulatory sentiment and regulatory uncertainty from 1985 through 2021. We also present some evidence supporting the validity of these indexes.

4.1 Sentiment Analysis

As a popular field of NLP, sentiment analysis is used to extract, quantify, and analyze the semantic orientation of a document, such as customer reviews, social media, survey responses, and news articles. In addition to a mere polar view of sentiment (i.e., positive or negative), sentiment analysis methods can be applied to broader sentiment classifications to extract other subjective information in source material, such as emotional states (e.g., happiness, fear, and anger), subjectivity, confidence, and uncertainty. We use a lexicon-based approach for sentiment analysis. This approach assesses the semantic orientation of a document based on the frequency of words or phrases with a particular semantic orientation that occur in the document. It relies on pre-defined dictionaries of opinionated words, such as a list of positive or negative words. There are many available sentiment dictionaries designed for general purposes and some for specific domains.

We use the 2018 Loughran and McDonald (LM) dictionary (originally developed in Loughran and McDonald (2011)) to assess the sentiment and uncertainty in the regulatory sections of the relevant news articles in the baseline analysis. The LM dictionary was constructed specifically for the domain of finance, using a corpus of corporate 10-K reports (Loughran and McDonald, 2011). Because of its domain relevance, the LM dictionary has been frequently used in economic research (for example, Fraiberger (2016); Calomiris et al. (2020); Ostapenko (2020)). The 2018 version of the dictionary comprises sentiment word lists in several categories, including 2,355 words in the negative category, 354 words in the positive category, and 297 words in the uncertainty category.

However, we also notice that the LM positive and negative word lists are strongly unbalanced, with substantially more negative words than positive words. One reason is that Loughran and McDonald (2011) has a clear focus on the proportion of negative words in 10-Ks for detecting the association between tone and excess returns. They note that finance and accounting research generally finds little incremental information in positive words, and the LM positive word list was created more for completeness than "discerning an impact on tone identification" (Loughran and McDonald, 2011, p.45). While an unbalanced dictionary may not affect our interpretation of changes in sentiment over time, it will bias our sentiment assessment toward a disproportionately negative tone. For this reason, we also use two other dictionaries to construct the sentiment measure for comparison: the Harvard General Inquirer (GI) dictionary and the Lexicoder Sentiment Dictionary (LSD). The GI dictionary is a general-purpose lexicon originally developed in the 1960s and has been widely used in various disciplines. It covers several broad valence categories, including lists of 2,005 negative words and 1,637 positive words. The LSD is a comprehensive sentiment lexicon combining three pre-existing dictionaries and tailored primarily to political news (Young and Soroka, 2012).[5] The LSD comprises 2,857 negative words and 1,709 positive words.

Similar to our search of regulatory noun chunks, we use regular expression to count occurrences of each sentiment word in the preprocessed regulatory section of an article. We incorporate a negation rule to take into account negated positive and negative words. That is, if an English negation word, such as "not," "don't," or "cannot," occurs within three

[5] The three pre-existing dictionaries combined in the LSD are the GI, the Regressive Imagery Dictionary (Martindale, 1975), and the Roget's Thesaurus (Roget, 1911).

tokens before the opinionated word, then the opinionated word would be considered as the opposite orientation. For example, the following regulatory section contains two occurrences of negative words as defined by the LM dictionary: “hazard” and “violation,” and three occurrences of positive words: “boost,” “fear” (with the negation word “without”), and “boost.”

> So, the department’s Occupational Safety and Health Administration in recent years has **boosted** spending on its consultation program, which allows little companies to ask for an OSHA visit to look for workplace **hazards** **without fear** of being cited for **violations** as a result of that visit. The idea is to **boost** voluntary compliance with safety regulations. The program’s funding rose 50% between fiscal 1996 and fiscal 2001, to $48.8 million, equal to about 11% of OSHA’s total budget.[6]

We use a standard formula to calculate sentiment scores. The regulatory sentiment score of an article is the difference between the proportion of positive words and the proportion of negative words in the regulatory section of the article. Therefore, a positive sentiment score indicates an overall positive tone in the news about regulation, and a negative score means an overall negative tone. The above example has a sentiment score of 1.22, suggesting a slightly positive tone toward OSHA’s regulatory consultation program.

We use a similar approach to assess uncertainty in regulation-related news content. The uncertainty category of the LM dictionary covers a broad range of terms in addition to “uncertainty” and “uncertain,” such as “ambiguity,” “confusion,” “doubt,” and “vague.” The regulatory uncertainty score of an article is the proportion of uncertainty words in the regulatory section of the article. A higher uncertainty score suggests a higher level of uncertainty expressed in the regulation-related news. Below is an example of a regulatory section with a relatively high uncertainty score (7.02). The uncertainty words “confusion,”

[6] The quote is from “GAO Criticizes OSHA’s Program for Small Businesses–Report Questions Effectiveness of Consultations as Visits and Hazards Decline” published by the Wall Street Journal on October 30, 2001.

"preliminary," "vagueness," and "confusing" all indicate a great degree of uncertainty around a regulation banning smoking in restaurants in New York City.

> Still, the law has clearly produced **confusion**. Dr. Hamburg, whose staff has so far issued only **preliminary** regulations for enforcing the smoking ban, said that final regulations would be published within two weeks, to "clarify some areas of **vagueness**." Many restaurant owners said the most **confusing** part of the law governs smoking in bar areas and gardens.[7]

4.2 Regulatory Sentiment and Uncertainty Indexes

Table 2 shows the descriptive statistics of the sentiment scores estimated using the LM, GI, and LSD dictionaries and the uncertainty scores using the LM dictionary. The absolute sentiment score that measures the polarity of a document is clearly dependent on the scope of opiniated words defined in the dictionary. Unsurprisingly, the sentiment measured using the LM dictionary is generally more negative compared with the GI and LSD. The LSD generates the most balanced result, with an approximately same number of articles estimated negative and positive. To illustrate how the three dictionaries assess a document differently, Appendix B shows examples of regulatory sections with negative and positive words identified from each dictionary. As shown in Table 2, the uncertainty scores indicate that approximately half of the articles expressed a degree of uncertainty in the sections that discuss regulation. Appendix B also includes the uncertainty words and estimated uncertainty scores for the examples.

To construct the monthly sentiment and uncertainty indexes, we use fixed effects regressions following Shapiro et al. (2020). The specification is:

$$s_j = u_{t(j)} + v_{i(j)} + \epsilon_j, \tag{3}$$

[7]The quote is from "Restaurants Complying On Smoking" published by the New York Times on May 21, 1995.

where s_j is the estimated regulatory sentiment or uncertainty score for article j, $u_{t(j)}$ is a year-month fixed effect, and $v_{i(j)}$ is a newspaper fixed effect. The estimated coefficients on the year-month fixed effects u_t from Eq. (3) are the monthly sentiment or uncertainty index, depending on the dependent variable. One advantage of this approach is that the newspaper fixed effects control for time-invariant heterogeneities across newspapers, which can potentially address the concern of ideological differences among news sources. This is particularly important for our measures, because news sentiment toward government regulation could be largely affected by the political stance of the newspaper.

Figure 2 plots the regulatory sentiment indexes estimated using different dictionaries between January 1985 and December 2021. To focus on changes over time rather than relative polarity between indexes, we normalize the indexes by their means and standard deviations. The three time series demonstrate similar patterns over time and are strongly correlated with each other. The correlation between the LM and LSD indexes is 0.81; the correlation between the LM and GI indexes is 0.58; and the correlation between the LSD and GI indexes is 0.73. We also show the first principal component of the three standardized sentiment indexes in Figure 2, which explains 81 percent of the variance. All the three indexes and the principal component suggest that regulatory sentiment has changed over time. For example, the newspapers in the period of late 1980s and early 1990s appear to express a relatively negative tone when discussing regulation, while the sentiment largely improved around the mid-1990s and maintained at a stable and higher level until the early 2000s. In the following impulse response estimates, we present the results using the LM sentiment index but include the results using the GI and LSD indexes and the principal component to show robustness.

Figure 3 plots the regulatory uncertainty index. In particular, we see more spikes in regulatory uncertainty during recent years. Regulatory uncertainty reached a historical peak in 2010, a year that marks many important events in the regulatory history, including the enactment of Obamacare (March 2010), the Deepwater Horizon oil spill (April 2010), and the passage of the Dodd-Frank Act (July 2010). Other large spikes occurred around the Lehman Brothers bankruptcy in September 2008, the Trump election in November 2016, and the coronavirus outbreak in the U.S. in April 2020.

4.3 Validation

Since there are no established measures that capture regulatory sentiment or uncertainty in the way defined in our study, it is not feasible to validate our measures based on any "gold standard." However, we check the validity of our measures indirectly in several ways.

First, we examine the news articles with extreme sentiment or uncertainty estimates. Appendix C shows ten articles with the lowest sentiment scores, ten articles with the highest sentiment scores, and ten articles with the highest uncertainty scores. Many articles with negative sentiment discuss firms' violations of certain regulations, while articles with positive sentiment praise the effectiveness of some regulation or reflect positive prospect for regulatory changes. Articles with great uncertainty generally comment on confusion about existing regulations or uncertainty about future regulatory actions. Although not reflecting the whole picture, human reading of those articles suggests that the measures are consistent with our interpretation of regulatory sentiment and uncertainty. That is, the measures capture shifts in sentiment or uncertainty around the regulatory environment, which could be driven by a broad range of regulation-related events such as the promulgation of a new regulation, a company's regulatory compliance or violation, a regulatory investigation, and a lawsuit challenging agency regulatory actions.

Second, to verify that our measures indeed capture relevant regulatory events, we study the word clouds of articles published in the months associated with regulatory sentiment or uncertainty shocks. As shown in Appendix D, the word cloud for each month provides common noun chunks contained in the regulatory sections published in the month, which can be used to extrapolate the major events that caused the regulatory sentiment or uncertainty shock. For example, the increase in regulatory sentiment in November 2016 largely reflected positive prospects for the incoming Trump administration's movements on financial regulation; the controversy around the London Inter-bank Offered Rate (LIBOR) in July 2012 caused a substantial decrease in regulatory sentiment; in September 2008, it was announced that Fannie Mae and Freddie Mac were being placed under the direct supervision of the federal government, which triggered an increase in regulatory uncertainty; in April 2020, the coronavirus outbreak was associated with another regulatory uncertainty spike. The word clouds illustrate terms that are consistent with the possible events associated with large regulatory sentiment or uncertainty fluctuations highlighted in Figures 2 and 3.

Third, we compare our measures with several related sentiment and uncertainty measures. Appendix E.1 plots our regulatory sentiment index with the economic sentiment index of Shapiro et al. (2020). The correlation between the regulatory sentiment index and economic sentiment index is 0.29 and statistically significant. While the two time series comove in some time periods, they do not always coincide with each other. For example, during the early 1990s recession, both economic sentiment and regulatory sentiment had substantial decreases. During the 2007-2008 financial crisis, however, regulatory sentiment did not experience a significant drop like economic sentiment. Also, regulatory sentiment seems to react more strongly to political events such as the Clinton health care reform and 2016 presidential election.

Appendixes E.2 and E.3 plot our regulatory uncertainty index with the aggregate EPU index and categorical EPU index on regulation from Baker et al. (2016). The regulatory uncertainty index has a statistically significant correlation of 0.34 with the aggregate EPU index and 0.43 with the regulatory EPU index. Although the correlations between regulatory uncertainty and EPU measures are only moderate, the measures demonstrate several spikes around the same time periods, such as those around Black Monday, the Lehman Brothers bankruptcy, the 2016 presidential election, and the coronavirus outbreak. Nevertheless, these measures also capture some different historical events. For example, EPU surged around the first and second Gulf wars, the 9/11 attacks, and the debt ceiling dispute in 2011, while regulatory uncertainty was relatively undisturbed around those time periods. Instead, a large increase in regulatory uncertainty occurred during January-April 2010, coinciding with the enactment of Obamacare and the Deepwater Horizon oil spill.

We also examine whether our regulatory sentiment or regulatory uncertainty measure Granger causes any of the other sentiment or uncertainty metrics and vice versa. The results are reported in Appendix E.4. Regulatory sentiment tends to Granger cause general economic sentiment, while the opposite does not hold. Both the aggregate EPU index and regulatory EPU index Granger cause the regulatory uncertainty index, and regulatory uncertainty Granger causes regulatory EPU but not aggregate EPU.

The correlation and Granger causality tests suggest both similarities and differences between our regulatory measures and other sentiment or uncertainty metrics. The differences can be attributed to the fact that they are capturing different types of perceptions. The economic sentiment measure tracks news sentiment about economic conditions which may or may not concern government regulation. The aggregate EPU index measures economic uncertainty induced by broader policy issues, including regulatory, trade, fiscal, and monetary policies. The regulatory EPU index is more closely linked to our regulatory uncertainty measure because of their shared focus on regulation. Still, the regulatory EPU index puts a particular emphasis on financial regulation given how the regulation-specific text is identified. It is not surprising that our regulatory measures did not surge around the historical events that are less relevant to regulation, such as the Gulf wars, but rather captures more regulatory developments on healthcare and the environment. These comparisons suggest that our regulatory sentiment and uncertainty measures, while sharing some overlapping information with other economic sentiment or policy uncertainty measures, contain unique information about regulation and potentially different economic implications.

5 Macroeconomic Implications of Regulatory Sentiment and Uncertainty

The new measures of regulatory sentiment and regulatory uncertainty can be used in various economic analyses. In this section, we apply the measures to studying macroeconomic implications of regulatory sentiment and uncertainty by examining impulse responses of macroeconomic variables. We discuss a baseline analysis and a series of robustness checks.

5.1 Impulse Responses

For the baseline analysis, we use the local projection method of Jordà (2005) to estimate the impulse responses of aggregate output and employment to a regulatory sentiment or uncertainty shock.[8] Local projections impose less restrictive assumptions on data dynamics compared to the standard vector autoregression (VAR). This method has been widely used for estimating impulse response functions in the context of text-based sentiment and uncertainty measures (Shapiro et al., 2020; Caldara et al., 2020; Ahir et al., 2022).

The estimation entails a distinct linear regression for each forecast horizon h with the following specification:

$$y_{i,t+h} = \alpha_i^h + \beta_i^h reg_t + \sum_{\tau=1}^{3} \gamma_{i,\tau}^h reg_{t-\tau} + A_i^h \sum_{\tau=0}^{3} Y_{t-\tau} + \varepsilon_{i,t+h}, \tag{4}$$

where y_i is log industrial production or log employment, reg is the regulatory sentiment or regulatory uncertainty index, and the matrix Y includes contemporaneous and lagged values of economic variables including log S&P 500, federal funds rate, log employment, and log industrial production.[9] Based on multiple information criteria, we choose three lags of the

[8]We also implemented local projections using quarterly data to examine how GDP and gross investment respond to regulatory sentiment or uncertainty shocks. Neither a negative regulatory sentiment shock or an increase in regulatory uncertainty is associated with statistically significant responses of GDP or investment. Appendix H plots the impulse response functions. Therefore, our discussion focuses on the monthly model for industrial production and employment.

[9]We tested for stationarity of our regulatory sentiment and uncertainty indexes. The Phillips-Perron

variables.[10] The impulse response from a shock to regulatory sentiment or uncertainty on economic variable y_i is given by the estimates of β_i^h. We consider horizons up to 12 months after the shock ($h = \{0, 1, ..., 12\}$).

Figure 4 shows the impulse responses estimated from local projections. Panel (a) plots the impulse responses of industrial production and employment to a one-standard-deviation negative shock to the regulatory sentiment index, with point estimates and 90 and 95 percent confidence bands. The estimates show that a negative sentiment shock reduces industrial production and employment. The effects on industrial production are statistically significant at the 5 percent level starting 6 months after the shock and gradually rise up to a 0.61 percent drop at the 12$^{\text{th}}$ month post the shock. The shock also leads to a statistically significant reduction in employment starting 8 months after the shock, and the maximum estimated drop is 0.28 percent. These baseline results are based on the LM-based regulatory sentiment index. When using the alternative sentiment indexes (i.e., the GI-based index, the LSD-based index, and the first principal component), we get similar impulse response, as shown in Appendix G.

Panel (b) of Figure 4 shows the impulse responses to an upward regulatory uncertainty shock. The effects of a one-standard-deviation increase in regulatory uncertainty are not statistically significant at the 5 or 10 percent level. This result is different from Baker et al. (2016)'s findings on their EPU index, which suggest that an upward EPU shock leads to statistically significant drops in industrial production and employment. This difference confirms that our regulatory uncertainty measure captures a different type of uncertainty than EPU, as discussed in Section 4.3. Uncertainty specifically around regulatory policy is likely to affect firm behavior and thus the macroeconomy in different ways than other types of policy. One possibility is that, since regulations typically go through prolonged

test rejects unit root for all the indexes, while the ADF and KPSS tests suggest more mixed results. See test statistics in Appendix F.

[10] Different information criteria suggest different numbers of lags: the AIC criterion chooses 4 lags, HQIC chooses 3 lags, and SBIC chooses 2 lags. To balance the need to include enough lags and the relatively short time sample, we select 3 lags of the economic variables.

notice-and-comment processes before being finalized, regulatory uncertainty may reflect less unanticipated changes in future policies but more confusion, ambiguity, and imprecision in the interpretation and implementation of promulgated regulations. To further compare regulatory uncertainty with EPU as well as check the robustness of the baseline results, we re-estimate impulse response functions using the VAR model of Baker et al. (2016) in Section 5.2.1.[11]

To sum up the baseline results, the impulse response estimates indicate that regulatory sentiment has a larger and more robust link with aggregate economic activity than regulatory uncertainty. A decline in regulatory sentiment has a significant, persistent effect on future output and employment, while an increase in regulatory uncertainty is not associated with statistically significant effects on output or employment.

5.2 Robustness

5.2.1 VAR-estimated Impulse Responses

We use the monthly VAR model of Baker et al. (2016) to re-estimate the impulse responses to a regulatory sentiment or uncertainty shock. Following their approach, we orthogonalize the shock by using the Cholesky decomposition with the following ordering of variables: the regulatory sentiment or uncertainty index, log S&P 500 index, federal funds rate, log employment, and log industrial production. The VAR includes three lags of all variables. We show impulse responses up to 36 months after the shock.

Appendix I.1 plots the VAR-estimated impulse response functions. Similar to the results from local projections, a regulatory sentiment shock leads to statistically significant, persistent reductions in both industrial production and employment. There are also statistically significant drops in industrial production and employment following an increase in regulatory uncertainty, but this effect wanes quickly after one period post the shock, suggesting an at

[11]While not reported in this paper, we also considered the smooth local projection model of Barnichon and Brownlees (2019) for estimating impulse response functions. The results are similar for regulatory sentiment but suggest perhaps more persistent impacts of regulatory uncertainty.

most transitory effect. Therefore, the impulse responses estimated from VAR are largely consistent with those from the baseline local projections.

Results are unchanged when we make several modifications to the VAR specification following Baker et al. (2016). Those include the VAR with reverse ordering, a bivariate VAR, a bivariate VAR with reverse ordering, dropping the S&P index, including the VIX, and including time trends. As shown in Appendix I.2, the results suggest very similar impulse response patterns to the baseline estimates, particularly for regulatory sentiment shocks.

5.2.2 General Economic Sentiment and Policy Uncertainty

While we show in Section 4.3 that there are variations between our regulatory measures and general economic sentiment or policy uncertainty measures, it is still possible that the economic effects of regulatory sentiment or uncertainty shocks are picking up information about effects of general economic sentiment or policy uncertainty embedded in the news. To investigate this issue further, we add measures of economic sentiment and uncertainty to the matrix Y in Eq. (4), including the Michigan Consumer Sentiment Index, the news-based economic sentiment index of Shapiro et al. (2020), VIX, and the EPU index of Baker et al. (2016). As shown in Appendix J, the impulse response estimates are nearly unaffected after controlling for any of these measures. In particular, the robust impulse response functions bolster our findings about the economic effects of regulatory sentiment, which suggests that our measure of regulatory sentiment reflects at least some unique information about economic activity that is not captured by general economic sentiment or policy uncertainty.

5.2.3 Interactions between Regulatory Sentiment and Uncertainty

Given that sentiment and uncertainty are sometimes viewed as related concepts, it is possible that the effects of regulatory sentiment and uncertainty shocks are conditional on each other. Leveraging the flexibility of the local projection method, we extend the linear model to account for the interaction of regulatory sentiment and regulatory uncertainty. We estimate impulse response functions to see whether the impact of a regulatory sentiment (uncertainty) shock is different when regulatory uncertainty (sentiment) is particularly high or low. For each forecast horizon h, we run the following regression:

$$y_{i,t+h} = a_i^h + B_i^h \sum_{\tau=0}^{3} X_{t-\tau} + C_i^h \sum_{\tau=0}^{3} (sent_{t-\tau} \times unc_{t-\tau}) + u_{i,t+h}, \tag{5}$$

where $(sent_t \times unc_t)$ is an interaction term of regulatory sentiment and regulatory uncertainty, and the matrix X includes the contemporaneous and lagged values of regulatory sentiment, regulatory uncertainty, and the same economic variables in the baseline Eq. (4).

Panel (a) of Appendix K plots the impulse responses to a regulatory sentiment shock conditional on different levels of regulatory uncertainty. In particular, we compare impulses responses originating from levels of regulatory uncertainty at one standard deviation above and below its mean. There are some signals suggesting that high regulatory uncertainty may exacerbate the negative effects of regulatory sentiment shocks: the estimated reductions in industrial production and employment after a regulatory sentiment shock are generally larger when regulatory uncertainty is high. However, the impulse response functions under high and low uncertainty generally follow similar trajectories, and their differences are not statistically significant. Therefore, the results suggest no clear evidence that the effects of a regulatory sentiment shock are conditional on the level of regulatory uncertainty. Similar results are observed for impulse responses to regulatory uncertainty shocks under high and low regulatory sentiment (Panel (b) of Appendix K).

5.2.4 Regulation or Deregulation

When we generate our initial news corpus, we search for articles that contain terms starting with "regulat" or "deregulat." One may concern that the economic impact of sentiment or uncertainty about regulation that imposes restrictions may be different from that about deregulation (i.e., the reduction or elimination of regulations). To investigate whether that influences our results, we remove articles that contain "deregulat" and re-run the analyses. Among the 608,172 articles covered in the baseline analysis, 31,265 articles contain terms starting with "deregulat." The revised regulatory sentiment and uncertainty indexes based on the remaining 576,907 articles are highly correlated with the baseline indexes, with both correlations over 0.97.

Appendix L shows the impulse responses to a regulatory sentiment or uncertainty shock using the revised indexes. Compared to the baseline estimates, the output and employment responses to a regulatory sentiment or uncertainty shock are nearly unchanged. This robustness check is only to show that removing news content that is possibly related to deregulation does not change our results substantially. More analysis is required to further examine whether and how the effects of perceptions about regulation and deregulation differ, but it is out of the scope of this paper.

6 Sentiment and Uncertainty by Regulatory Policy Area

While the application of our regulatory sentiment and uncertainty indexes suggests some interesting macroeconomic implications, these measures capture information in the news about regulation in general. However, regulation is diverse, involving various policy areas and segments of the economy. To discover how regulatory sentiment and uncertainty differ by policy area and how they connect to economic activity, we build categorical indexes of regulatory sentiment and uncertainty for 14 policy areas. We present the indexes and impulse response estimates in this section.

6.1 Categorizing News Articles

To categorize relevant news content by regulatory area, we use the dictionary of regulatory noun chunks described in Section 3.1. Specifically, we rely on the fact that the regulatory noun chunks are extracted from rule titles and that rules are issued by agencies with specific regulatory authorities. For example, the Environmental Protection Agency generally issues environmental regulations, the Food and Drug Administration issues regulations to protect food safety and health, and the Commodity Futures Trading Commission regulates part of the financial market. Therefore, we categorize agencies by regulatory area according to their authorities and assume that the noun chunks extracted from the rules issued by a given agency are associated with the regulatory area of the agency.

We specify 14 regulatory areas for the agencies in our sample, including: consumer safety and health; national and homeland security; transportation; labor and workplace; environment and natural resources; energy; finance and banking; general business and trade; agriculture and rural development; education and culture; communications; criminal justice; housing, urban development, and social security; and international relations. Appendix M lists examples of the agencies, their designated areas, and rule titles. After linking regulatory noun chunks back to agencies, the vast majority of the noun chunks (8,750 out of 10,458) in our dictionary are designated with one regulatory area, while a small proportion of the noun chunks appear in rules issued by multiple agencies and thus are associated with multiple regulatory areas (e.g., "final rule," "administrative requirement," and "technical amendment"). We use only the area-specific noun chunks (i.e., the regulatory noun chunks associated with only one area) for categorizing the news articles.

To verify the relevance of the noun chunks, we conduct human auditing of the area-specific noun chunks. Among the regulatory noun chunks that are associated with each regulatory area, we manually go through the top 100 noun chunks with the most occurrences in our regulation-related corpus to remove or correct their associated areas. For example, the terms "federal law," "public hearing," and "government agency" are linked to the area of consumer safety and health before human auditing, since they happen to appear only in the rule titles related to consumer safety and health; however, they do not contain information specific to this area and thus are removed from the classification. As a result, the dictionary is refined to include 8,293 area-specific noun chunks after the human auditing.

Since the regulatory section of a news article in our corpus contains one or more of the noun chunks, the article can potentially be classified into regulatory areas based on the area-specific noun chunks mentioned. The following is an example of regulatory section:

> Automobile manufacturers are financing a multimillion dollar lobbying campaign aimed at persuading state legislatures to require motorists to buckle up their **seat belts**, a move designed to kill a **federal regulation** requiring the industry to equip vehicles with more expensive **air bags** by 1989. Last year, legislatures in New York, New Jersey and Illinois adopted mandatory **seat belt** laws and legislation already has been filed on Beacon Hill to bring about the same end.[12]

This regulatory section contains four regulatory noun chunks: "seat belt," "federal regulation," "air bag," and "seat belt" (with "seat belt" occurring twice). Among these terms, "federal regulation" is a common term used in rule titles and thus not an area-specific noun chunk, whereas "seat belt" and "air bag" are noun chunks unique to the area of transportation in our dictionary. Therefore, we classify this article into the transportation category, based on the area associated with "seat belt" and "air bag."

In longer regulatory sections, it is common that there are many regulatory noun chunks that are linked to multiple unique areas. In that case, we define the dominant area of an article as the most common area across all the area-specific noun chunks in the regulatory section. This approach intends to capture the primary regulatory areas discussed in the relevant text of a news article. Mathematically, suppose there are n occurrences of area-specific noun chunks in the regulatory section (duplicated noun chunks are counted multiple times), $\mathbf{a}^p_{m\times 1}$ denotes a $m \times 1$ vector for the pth occurrence of noun chunks, where the qth element of the vector $a^p_q = 1$ if the pth noun chunk is associated with the qth area

[12] The quote is from "Automakers' Millions Back Seat-Belt Laws" published by Boston Globe on January 30, 1985.

($q = \{1, 2, \ldots, m\}$), and otherwise $a_q^p = 0$. We add the vectors for all noun chunks:

$$\sum_{p=1}^{n} \mathbf{a}_{m\times 1}^{p} = \mathbf{b}_{m\times 1}. \tag{6}$$

Then the dominant area is q_{max} such that $b_{q_{max}} = \max_{1\leq q\leq m} b_q$. In some instances, there are multiple dominant areas for an article.

As a result, 305,367 articles are classified into one or more regulatory areas. Appendix N shows word clouds of the top 50 area-specific noun chunks for each area. Appendix O plots article counts by area, showing that finance and banking is the regulatory area that has drawn the most news attention, followed by environment and natural resources, consumer safety and health, and general business and trade.

6.2 Categorical Indexes

We use the same approach to construct the categorical indexes as the aggregate regulatory sentiment and uncertainty indexes. Namely, for a given regulatory area, we create the indexes by fitting the fixed effects regression to the estimated sentiment or uncertainty scores of the articles classified into the area. The specification is:

$$s_{j,q} = u_{t(j,q)} + v_{i(j,q)} + \epsilon_{j,q}, \tag{7}$$

where $s_{j,q}$ is the estimated sentiment or uncertainty score for article j in area q, $u_{t(j,q)}$ is a year-month fixed effect, and $v_{i(j,q)}$ is a newspaper fixed effect. The estimated coefficients on the year-month fixed effects $u_{t(j,q)}$ from the regression compose the monthly sentiment or uncertainty index for regulatory area q.

Appendix P plots the categorical sentiment and uncertainty indexes over time, including 12-month rolling means highlighting general patterns over time. There are substantial variations in the measured sentiment and uncertainty for different regulatory areas. For example, the sentiment about environment and natural resources regulation largely improved from the late 1980s to 1990s, a decade with many significant changes in environmental regulations such as the passage of the 1990 Clean Air Act amendments.

Taking finance and banking as a case study, Figure 5 shows how sentiment and uncertainty around finance and banking regulation evolved over time and fluctuated around relevant financial and economic events. Several dips in sentiment around finance and banking regulation are notable during this time period. The biggest dip occurred in the late 80s and early 90s, coinciding with the savings and loan crisis. Sentiment also declined during the periods associated with Fannie Mae's violation of accounting rules in 2004, the bankruptcy of MF Global in 2011, the LIBOR scandal in 2012, and the coronavirus outbreak in 2020. Interestingly, regulatory sentiment related to finance and banking did not experience significant reductions during the 2007-08 financial crisis. In contrast, regulatory uncertainty increased substantially starting the financial crisis and reached a peak in 2010 as the Dodd-Frank Act was passed in response to the crisis. These contrasting patterns suggests that our measures do not capture perceptions of the market but of the regulatory environment concerning the market.

Although uncertainty is usually perceived negatively, comparing the two measures indicates that higher uncertainty is not always accompanied by more negative sentiment. This is also manifested in our aggregate measures. A prominent example is the 2016 presidential election, which is associated with a spike in both regulatory sentiment and uncertainty. Those changes are likely to reflect positive yet uncertain prospects for curbs on Dodd-Frank financial regulations as asserted during Trump's presidential campaign.

6.3 Impulse Responses

We estimate impulse responses to a regulatory sentiment or uncertainty shock for each regulatory area by replacing the aggregate index with a categorical index in Eq. (4). The analysis suggests particularly strong linkage between sentiment and uncertainty around certain regulatory areas and economic activity.

Figure 6 shows the impulse responses for selected regulatory areas, and the full figures for all areas are available in Appendix Q. Negative regulatory sentiment shocks concerning consumer safety and health and transportation are associated with statistically significant reductions in future output. The effect of a transportation-related regulatory sentiment shock is particularly large and persistent, with an estimated drop of 0.6 percent in output at the 12$^{\text{th}}$ months after a one-standard-deviation shock. As illustrated in the word clouds in Appendix N, major regulatory issued covered by the news content related to transportation regulation include traffic speeds, airbag requirements, interstate commerce, electric vehicles, and traffic safety. The news content concerning consumer safety and health regulation discusses issues like public health, Food and Drug Administration, child care, and new drugs. The effects on employment of sentiment shocks in those areas are relatively nuanced: the effect of a sentiment shock around consumer safety and health regulation is only significant for a transitory period, and the effect of a shock around transportation regulation is not statistically significant. A sentiment shock around finance and banking regulation does not have significant effects on output and has only marginally significant effects on employment.

While we do not observe statistically significant effects of an aggregate regulatory uncertainty shock (as discussed in Section 5.1), uncertainty shocks about energy regulation and business and trade regulation appear to have a stronger linkage with economic outcomes. As shown in Panel (c) of Figure 6, increased regulatory uncertainty around general business and trade is associated with a statistically significant reduction in future output, and this effect is large and persistent. Regulatory issues related to general business and trade in the news focus on initial public offerings, self regulations, and startups. A relatively transitory drop in output follows an uncertainty shock around energy regulation. Energy-related regulatory issues are relatively dispersed, with nuclear power and crude oil drawing a substantial amount of news attention. Similar to regulatory sentiment, the employment effects of regulatory uncertainty shocks in those areas are less prominent (Panel (d)).

Similar to the analysis for aggregate measures, we test the robustness of the impulse response functions using an alternative VAR model of Baker et al. (2016). Although we also observe some significant effects of regulatory sentiment shocks around national and homeland security, environmental and natural resources, and criminal justice using local projections, those effects are not robust when we employ the VAR model for estimation. It may be partially due to a limited number of articles in some of those areas. Therefore, we do not draw conclusions about those areas.

Overall, we find that economic outcomes, in particular aggregate output, are more sensitive to changes in sentiment around consumer safety and health regulation and transportation regulation as well as uncertainty around energy regulation and business and trade regulation, compared with other regulatory areas.

7 Conclusion

In this study, we measure how regulatory sentiment and regulatory uncertainty expressed in the news changed over time and examine how they affect aggregate economic activity. We identify an original corpus of regulation-related news from seven leading U.S. newspapers, which shows that news attention to regulation has been increasing since the financial crisis. We then employ lexicon-based sentiment analysis of the relevant news text to construct monthly indexes of regulatory sentiment and regulatory uncertainty from 1985 through 2021.

Our regulatory measures capture public perceptions of the current and future regulatory environment. Text analysis suggests that the perceptions are affected not only by an addition or reduction of regulations but also by a broad range of regulation-related events at both macro and micro levels, such as a presidential transition, the passage of an influential bill, a large company's regulatory compliance or violation, and an important regulatory investigation. Shifts in regulatory sentiment or uncertainty, like shocks to the regulatory environment that induce negative perception or higher uncertainty, can affect aggregate economic outcomes.

We apply the news-based measures of regulatory sentiment and regulatory uncertainty to studying their macroeconomic implications. Using local projections, we estimate how aggregate output and employment in the economy respond to regulatory sentiment and uncertainty shocks. The impulse response functions suggest that a negative regulatory sentiment shock is associated with large, persistent drops in future output and employment, while a regulatory uncertainty shock overall only has a nonsignificant or transitory impact. The impulse response estimates are robust to various modifications to the empirical model and data. In particular, the effects of regulatory sentiment shocks largely remain after controlling for existing measures of general economic sentiment and policy uncertainty, which suggests that our measure of regulatory sentiment captures some unique information about the economy. Also, these effects do not depend on the degree of regulatory uncertainty present in the economy.

To further explore what types of regulatory policy drive the connection between regulation and macroeconomic outcomes, we construct categorical indexes of sentiment and uncertainty for 14 regulatory policy areas. The impulse response estimates suggest that negative regulatory sentiment shocks related to consumer safety and health and transportation lead to particularly persistent, large drops in future output. Regardless of the lack of findings on persistent effects of aggregate regulatory uncertainty shocks in our analysis, aggregate output appears to be more sensitive to increased uncertainty around business and trade regulation and energy regulation compared to the other areas.

As our analysis suggests, regulatory sentiment plays a more important role in the aggregate economy than regulatory uncertainty. Future research could further explore the mechanisms through which regulatory sentiment affects macroeconomic outcomes. We only show an example of applications of our regulatory indexes, and there are many other ways to use these new measures such as studying their relationship with industry- or firm-level economic outcomes. The text-based approaches used in our study could be applied to constructing industry-specific or topic-specific regulatory measures.

Tables

Table 1: Article Counts by Newspaper

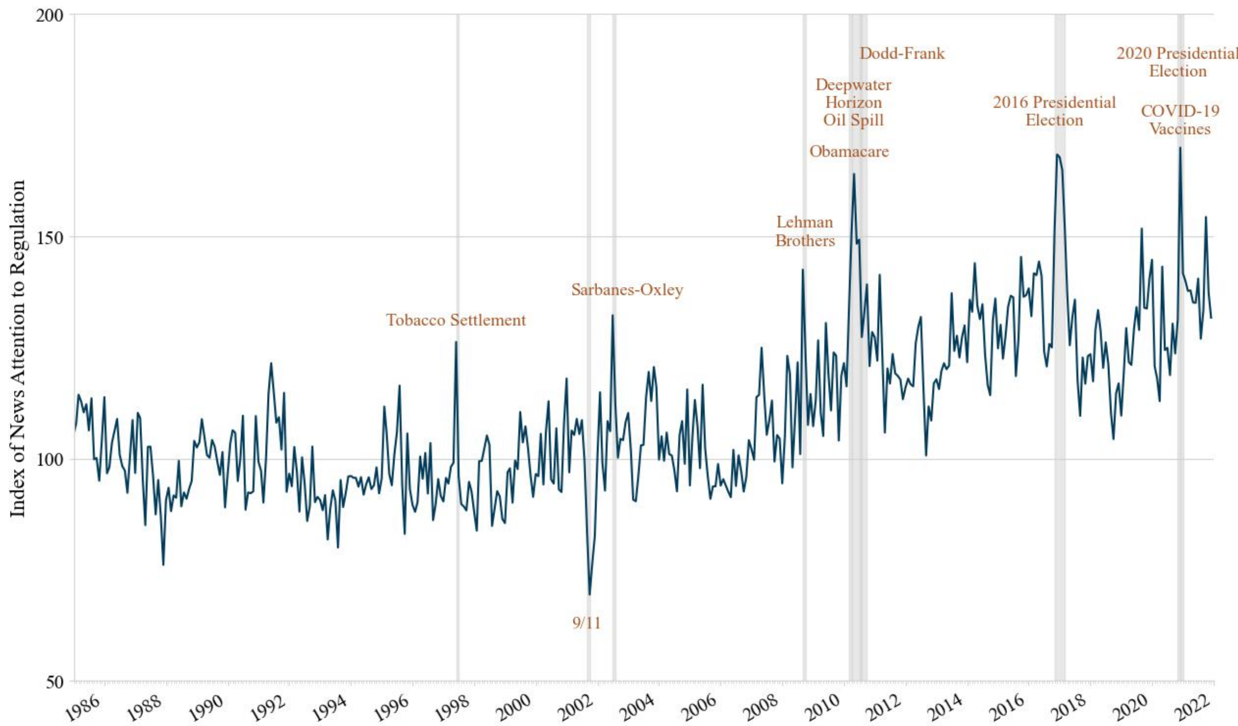
	All articles	Unique articles	Regulatory articles	First regulatory article	Last regulatory article
Wall Street Journal	259,714	253,862	168,874	1985-01-02	2021-12-31
New York Times	283,773	273,223	164,626	1985-01-01	2021-12-31
Los Angeles Times	130,697	129,998	78,438	1985-01-01	2021-12-31
The Washington Post	120,506	117,519	72,705	1987-01-01	2021-12-31
Chicago Tribune	100,049	99,327	56,154	1985-01-01	2021-12-31
Boston Globe	77,358	75,946	44,862	1985-01-01	2021-12-31
USA Today	40,951	40,387	22,513	1987-04-01	2021-12-30
Total	1,013,048	990,262	608,172	-	-

Table 2: Descriptive Statistics of Estimated Sentiment and Uncertainty Scores

	Sentiment Score			**Uncertainty Score**
	LM	**GI**	**LSD**	**LM**
Mean	-2.06	1.06	-0.05	0.75
Std. Dev.	2.56	3.97	3.41	0.95
Minimum	-37.50	-30.77	-35.71	0
Maximum	13.33	30.77	24.56	20.45
Articles with negative scores	443,875	205,877	268,560	N/A
Articles with positive scores	72,946	344,282	266,713	334,834
N	608,172	608,172	608,172	608,172

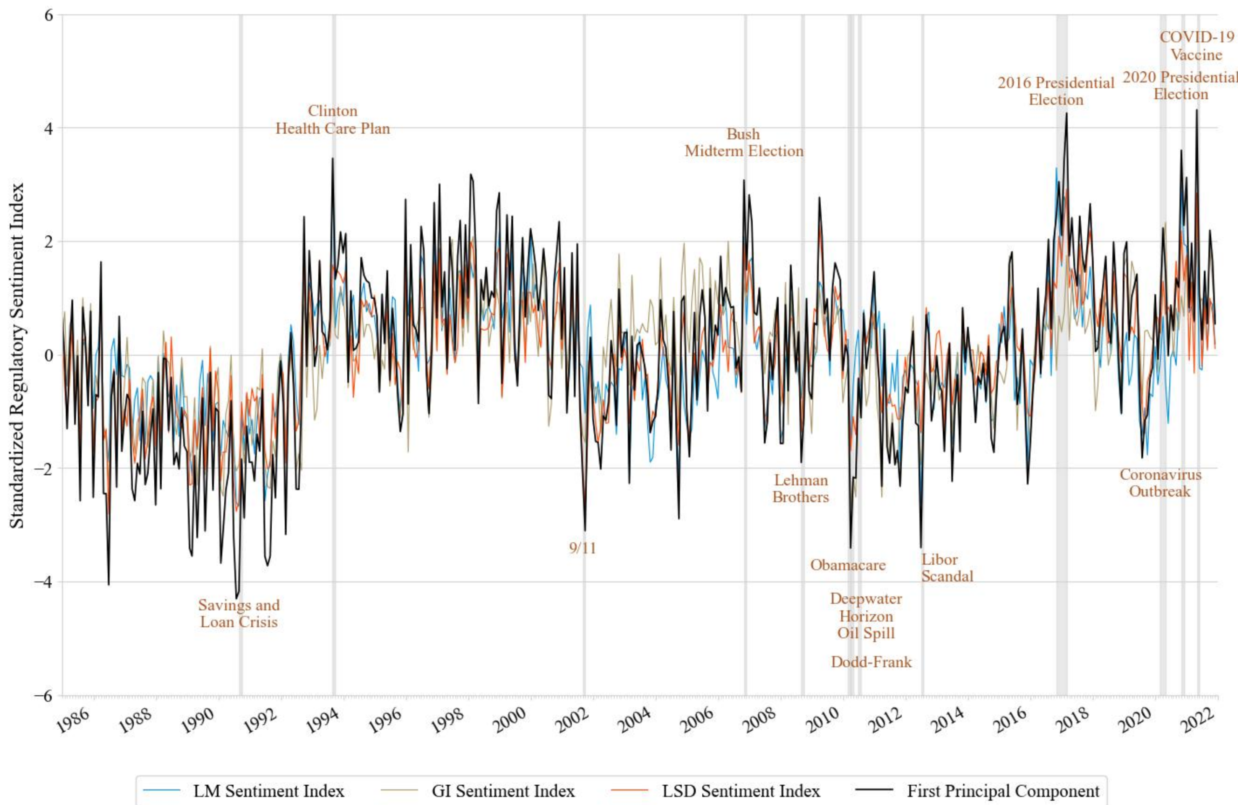
Figures

Figure 1: Monthly Index of News Attention to Regulation
(January 1985 – December 2021)



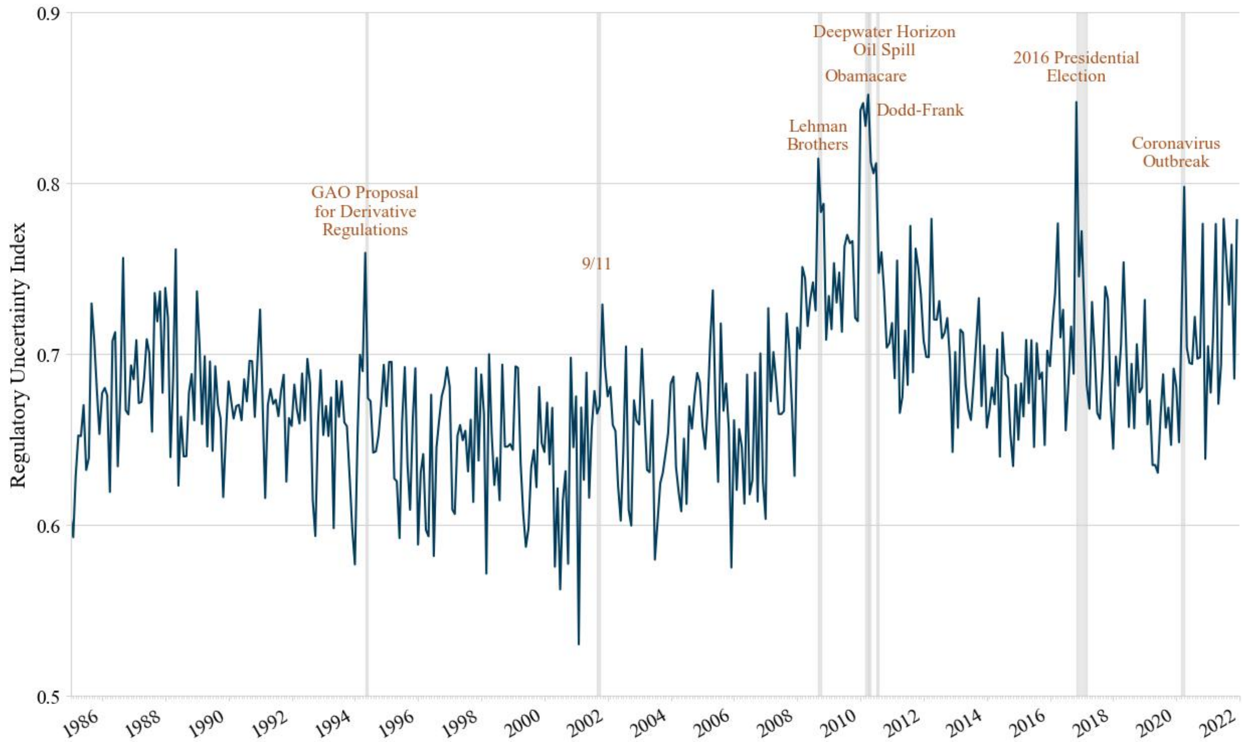
Notes: The index is constructed by standardizing the monthly counts of regulation-related news articles scaled by the monthly counts of all news articles in each newspaper and normalizing the time series to a mean of 100 from January 1985 to December 2009. The index is calculated using data from seven U.S. newspapers including Boston Globe, Chicago Tribune, Los Angeles Times, New York Times, USA Today, Wall Street Journal, and the Washington Post. Data for the Washington Post are available from January 1987, and data for USA Today are available from April 1987.

Figure 2: Monthly Index of Regulatory Sentiment
(January 1985 – December 2021)



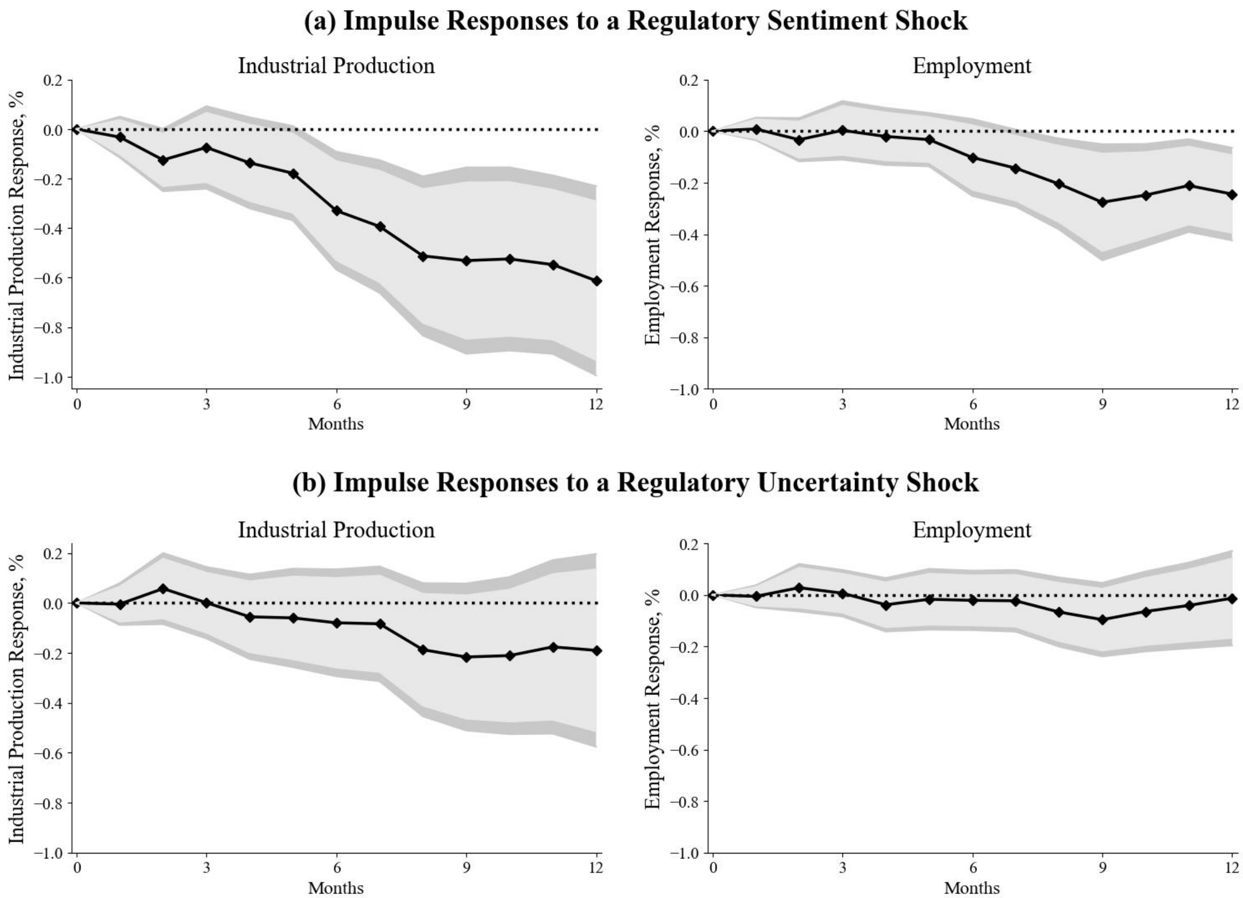
Notes: The figure plots three regulatory sentiment indexes estimated using the Loughran and McDonald (LM) dictionary, the General Inquirer (GI) dictionary, and the Lexicoder Sentiment Dictionary (LSD), respectively, and the first principal component of the three indexes. All indexes are normalized to have mean equal to zero and standard deviation equal to one.

Figure 3: Monthly Index of Regulatory Uncertainty
(January 1985 – December 2021)



Notes: The figure plots the regulatory uncertainty index estimated using the uncertainty category of the Loughran and McDonald (LM) dictionary.

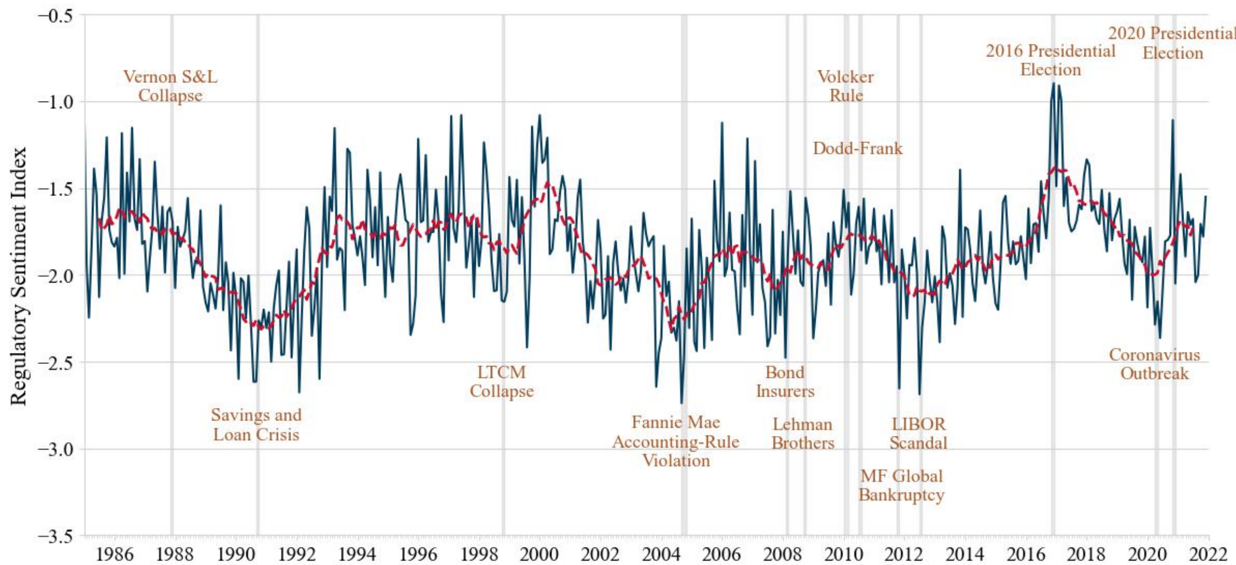
Figure 4: Impulse Responses (Local Projections, Baseline)



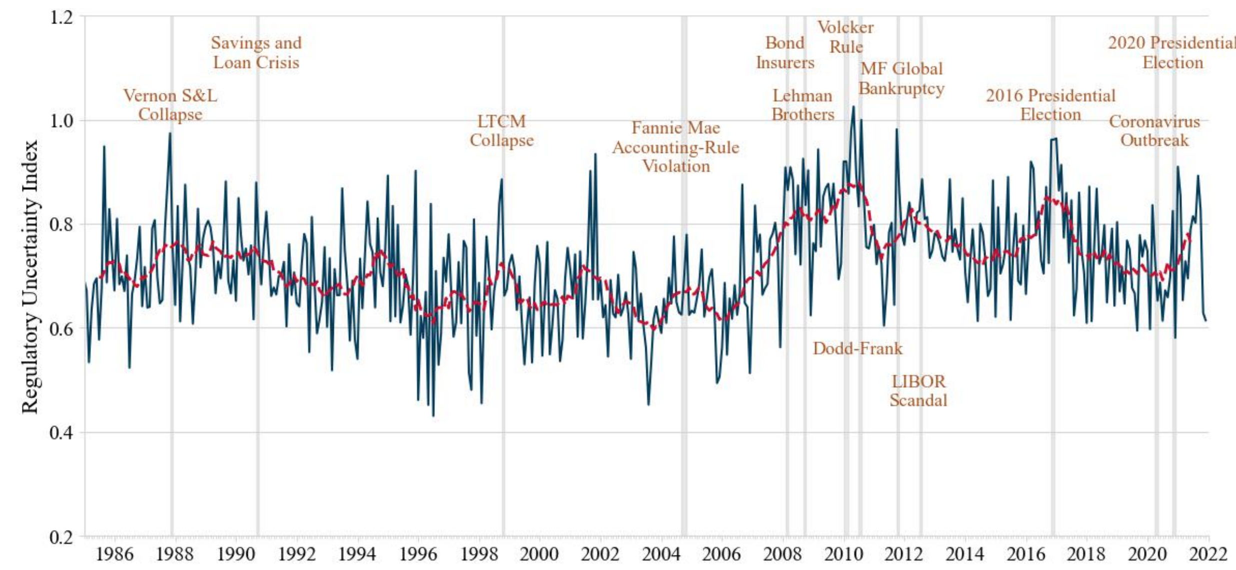
Notes: The figures plot impulse response functions for industrial production and employment to: (a) a one-standard-deviation negative shock to regulatory sentiment, and (b) a one-standard-deviation upward shock to regulatory uncertainty. The regulatory sentiment index is estimated using the Loughran and McDonald (LM) dictionary. The impulse response functions are estimated from local projections using monthly data from January 1985 through December 2021. Shaded areas show 90 percent (light gray) and 95 percent (dark gray) confidence bands.

Figure 5: Regulatory Sentiment and Uncertainty around Finance and Banking Regulation

(a) Regulatory Sentiment around Finance and Banking Regulation

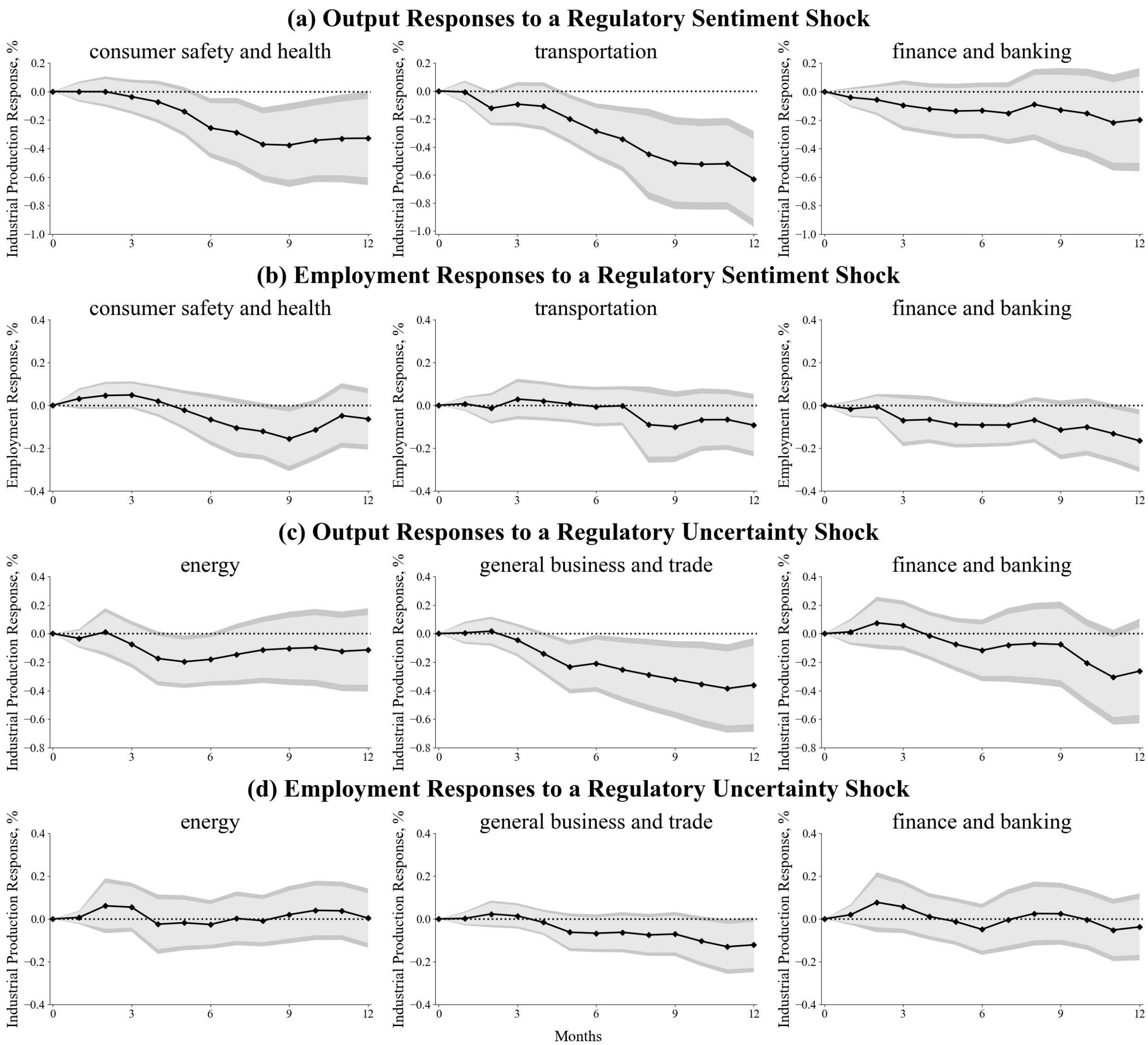


(b) Regulatory Uncertainty around Finance and Banking Regulation



Notes: The figures plot the LM-based regulatory sentiment index (panel (a)) and regulatory uncertainty index (panel (b)) for finance and banking regulation. Dashed red lines show 12-month rolling means.

Figure 6: Impulse Responses for Selected Regulatory Areas



Notes: The figures plot impulse responses for selected regulatory areas. For all areas, refer to Appendix Q. The regulatory sentiment indexes are estimated using the Loughran and McDonald (LM) dictionary. The impulse response functions are estimated from local projections using monthly data from January 1985 through December 2021. Shaded areas show 90 percent (light gray) and 95 percent (dark gray) confidence bands.

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"Sentiment and Uncertainty about Regulation"
Tara M. Sinclair and Zhoudan Xie

Appendices

(For Online Publication)

A The Most Common Regulatory Noun Chunks in News Articles

{new regulation: 36661, federal regulation: 26358, health care: 22508, federal reserve: 21068, real estate: 20205, new rule: 20131, federal government: 19617, attorney general: 19049, hedge fund: 18437, government regulation: 16675, food and drug administration: 15520, interest rate: 14016, nuclear regulatory commission: 13977, state regulation: 13916, natural gas: 13853, financial institution: 12692, environmental protection agency: 12680, mutual fund: 12242, public health: 12136, small business: 11087, federal law: 10835, state law: 10800, insurance company: 9531, executive director: 9305, federal agency: 8729, propose regulation: 8320, clean air: 8207, greenhouse gas: 8154, fannie mae: 8061, financial service: 7995, federal energy regulatory commission: 7940, federal deposit: 7798, state department: 7613, state official: 7369, credit card: 7070, freddie mac: 6635, safety regulation: 6454, law enforcement: 6408, task force: 6379, brokerage firm: 6374, health insurance: 6128, commodity futures trading commission: 6063, regulatory change: 5912, consumer protection: 5782, nursing home: 5704, hold company: 5581, regulatory body: 5343, regulatory system: 5331, air quality: 5286, economic growth: 5269, propose rule: 5007, local government: 4991, general counsel: 4914, carbon dioxide: 4908, air pollution: 4883, life insurance: 4872, insider trading: 4797, nuclear power plant: 4779, rate increase: 4729, public comment: 4661, regulatory requirement: 4660, government agency: 4520, social medium: 4515, national bank: 4467, tax cut: 4446, joint venture: 4376, public hearing: 4359, executive order: 4227, capital requirement: 4144, initial public offering: 4115, regulatory reform: 3954, high speed: 3949, self regulation: 3833, start up: 3803, credit union: 3767, enforcement action: 3735, national security: 3716, state agency: 3715, fuel economy: 3614, market share: 3614, security firm: 3562, commercial bank: 3515, inspector general: 3492, air bag: 3472, money laundering: 3451, executive officer: 3412, health plan: 3408, drinking water: 3400, regulatory review: 3380, land use: 3357, court decision: 3347, third party: 3292, consumer financial protection bureau: 3191, electric utility: 3186, high cost: 3138, accounting firm: 3113, chinese company: 3084, medical device: 3033, banking regulation: 3025, new technology: 3014}

Notes: The above shows 100 most common regulatory noun chunks that occur in all the regulation-related news articles (N=608,172). The number indicates the number of occurrences of the noun chunk across all the articles. The noun chunks are lemmatized, so, for example, "hold company" is a lemmatized version of "holding company."

B Examples of Regulatory Sections

Example 1 (Wall Street Journal, 1993-06-22):

Property and casualty insurers would have to meet stringent capital requirements under a proposal likely to be adopted by insurance regulators. The standards, similar to those now in place for life and health insurers, would require property and casualty insurers to have sufficient capital to meet the riskiness of their investments and operations. Failure to meet the requirements would mean regulators could either seize a troubled insurer or order operational changes. The property and casualty market, alone, involves annual premiums totaling $500 billion. Under the proposal, each insurer must report to what extent it exceeds or falls below its minimum-capital threshold. Insurance regulators released a draft of the rules at a conference for state insurance commissioners here. "We are entering the home stretch of one of the most important improvements in insurance regulation," said Virginia Insurance Commissioner Stephen Foster, chairman of the National Association of Insurance Commissioners. Regulators will vote on whether to adopt the proposal in December. The rules, if passed, would go into effect next year and the results would be available to the public in the spring of 1995. Insurance experts say it's unlikely that regulators will make major changes in the proposal before voting on it. The effort comes at a time when Congress is concerned about whether states are up to the job of overseeing insurance companies. The company wants to prove that the idea is administratively possible, said Roger Joslin, State Farm's treasurer. Under the plan, State Farm can still trade securities but cannot withdraw from the account or convert safe assets into riskier ones without approval of the trustee and state insurance regulators.

Regulatory noun chunks: [capital requirement, minimum capital, insurance regulation, major change, insurance company]

Sentiment:

LM negative words: [stringent, concerned, risky, seize, troubled]

LM positive words: [improvement]

LM sentiment score: -1.4085

GI negative words: [casualty, capital, pass, casualty, stringent, capital, fall, capital, casualty, involve, make, risky, approval (with negation), mean, seize, order]

GI positive words: [health, sufficient, meet, pass, meet, home, important, improvement, company, premium, expert, make, major, company, security, safe, asset, credit, meet, order]

GI sentiment score: 1.4085

LSD negative words: [casualty, riskiness, casualty, casualty, unlikely, concerned, riskier, approval (with negation), failure, seize, troubled]

LSD positive words: [sufficient, adopted, improvements, foster, adopt, experts, effort, safe, assets, credit]

LSD sentiment score: -0.3521

Uncertainty:

LM uncertainty words: [riskiness, possible, risky, could]

LM uncertainty score: 1.4085

Example 2 (Wall Street Journal, 2010-06-22):

House and Senate Democrats are under pressure to complete their overhaul of financial regulations before President Barack Obama meets with world leaders this weekend, setting up a scramble to iron out differences on a range of complicated provisions. The discussions cover issues from bank regulation to consumer protection. They seek to find a balance that may appease the few centrist Republicans willing to support the bill, while also keeping liberal Democrats happy. Lawmakers are also close to a deal that would place a new consumer-financial protection bureau within the Federal Reserve, scrapping an original White House proposal to create a standalone agency. The change, which closely follows language adopted by the Senate in May, would likely not appease business groups, which oppose the creation of any new consumer-protection regulator with broad powers. Lawmakers are divided over whether it would have power over auto dealerships. Lawmakers on Monday did reach a deal that would limit the amount of fees banks are allowed to charge retailers for processing debit cards. The conference committee of congressional negotiators seeking to resolve differences between the House and Senate versions of the bill plans to work through the consumer-protection issues on Tuesday, the Volcker Rule on Wednesday, and derivatives regulation on Thursday. The timing could slip if lawmakers need more time to resolve disputes.

Regulatory noun chunks: [consumer protection, consumer protection, volcker rule, consumer protection, debit card, consumer financial protection bureau, federal reserve]

Sentiment:

LM negative words: [oppose, dispute, complicated, close]

LM positive words: [happy, resolve, resolve]

LM sentiment score: -0.4444

GI negative words: [divide, appease (with negation), oppose, deal, limit, charge, need, dispute, iron, close, deal]

GI positive words: [protection, appease, willing, support, liberal, happy, resolve, protection, protection, deal, allow, resolve, complete, meet, deal, protection, create]

GI sentiment score: 2.6667

LSD negative words: [divided, appease (with negation), oppose, limit, charge, disputes, complicated, scrapping]

LSD positive words: [protection, balance, appease, support, keeping, happy, resolve, protection, adopted, creation, protection, allowed, resolve, protection, create]

LSD sentiment score: 3.1111

Uncertainty:

LM uncertainty words: [may, could]

LM uncertainty score: 0.8889

Example 3 (New York Times, 2016-11-10):

Republican control of Washington sets the stage for a sweeping shift in economic policy. Mr. Trump has proposed a fairly standard set of conservative prescriptions, such as lower taxes and less regulation, with one notable departure: a promise to reduce trade with other nations. The centerpiece of Mr. Trump's plans is a major overhaul of the federal tax code. An analysis by the nonpartisan Committee for a Responsible Federal Budget estimated that Mr. Trump's plans would increase the federal debt by $5.3 trillion over the next decade, and raise the ratio of debt to gross domestic product to 105 percent. Mr. Trump also has promised to reduce federal regulation. Business groups argue that the Obama administration has impeded economic growth by significantly expanding regulation in areas including environmental and worker protections. He has specifically promised to reverse some new environmental rules, such as the climate change regulations on power plants. Earlier this year, he also proposed the "dismantling" of the Dodd-Frank Act, which overhauled federal regulation of the financial industry in the aftermath of the 2008 financial crisis. The act created the Consumer Financial Protection Bureau, a likely target for Republican legislators. He also has threatened a variety of sanctions against American companies that move manufacturing jobs overseas, although the legality of such measures is unclear. Republicans who broadly agree with Mr. Trump on taxes and regulation may have greater reservations about his views on trade. The party has long supported increased trade among nations.

Regulatory noun chunks: [economic growth, consumer financial protection bureau, change regulation, federal regulation, dodd frank act, federal regulation]

Sentiment:

LM negative words: [argue, impede, threaten, against, aftermath, crisis]

LM positive words: [great]

LM sentiment score: -2

GI negative words: [argue, impede, threaten, against, unclear, crisis, tax, low, raise]

GI positive words: [protection, support, create, company, promise, great, promise, major, notable, promise]

GI sentiment score: 0.4

LSD negative words: [argue, impeded, threatened, against, unclear, crisis, debt, debt, gross]

LSD positive words: [protections, supported, created, protection, agree, frank, notable, responsible]

LSD sentiment score: -0.4

Uncertainty:

LM uncertainty words: [unclear, may]

LM uncertainty score: 0.8

Example 4 (Boston Globe, 1998-10-25):

"We don't know whether it will be feasible to lower emissions 75 percent by 2005, but we will participate in the effort." On sludge, or the muck left over when wastewater is drained, Shaheen's plan builds on the ongoing efforts at the Department of Environmental Services to more tightly regulate mercury in the waste, some 18,600 tons of which are spread on farmland annually as fertilizer. The department is moving to adopt a new standard for how much mercury may be in the sludge, and is considering – as per Shaheen's plan – an even tighter standard.

Regulatory noun chunks: [environmental service, new standard]

Sentiment:

LM negative words: [waste]

LM positive words: []
LM sentiment score: -1.0204
GI negative words: [know (with negation), lower, waste, even]
GI positive words: [feasible, consider, even]
GI sentiment score: -1.0204
LSD negative words: [wastewater, drained, waste]
LSD positive words: [feasible, effort, efforts, adopt]
LSD sentiment score: 1.0204

Uncertainty:
LM uncertainty words: [may]
LM uncertainty score: 1.0204

Example 5 (The Washington Post, 2001-04-05):

All recreational boats will be limited to one bushel of hard crabs and three dozen soft or peeler crabs per day. The new limits were implemented after the Chesapeake Bay Commission's Bi-State Blue Crab Advisory Committee decided last year that fishing regulators should reduce crab harvests by 15 percent over three years to increase spawning stock. In recent years, crab harvests have dipped near all-time lows throughout the region. They pointed out that other factors – including recreational crabbers, environmental damage and predatory fish – also contribute to diminishing crab populations. Those factors, the watermen said, should also be addressed when local regulators devised new limits. The commercial crabbers' reaction to the new limits varied from disappointment to relief. He suggested that the panel's new limits are too tough on the commercial crab industry. "These regulations are just getting piled on us one after the other," said Conway, of Crisfield. "If society wants to eliminate the waterman, then these regulations are a very efficient way of doing it." The shortening of the crabbing season drew more complaints from watermen than did the lowering of pot limits.

Regulatory noun chunks: [recreational boat, chesapeake bay, advisory committee, environmental damage]

Sentiment:
LM negative words: [complaint, disappointment, damage, predatory, diminish]
LM positive words: [efficient]
LM sentiment score: -2.1277
GI negative words: [eliminate, limit, hard, limit, low, limit, get, limit, too, complaint, limit, limit, disappointment, point, damage]
GI positive words: [efficient, just, relief, contribute]
GI sentiment score: -5.8511
LSD negative words: [eliminate, limited, hard, limits, limits, limits, too, tough, complaints, limits, limits, disappointment, damage, predatory]
LSD positive words: [efficient, recreational, relief, recreational]
LSD sentiment score: -5.3191

Uncertainty:
LM uncertainty words: [suggest, vary]
LM uncertainty score: 1.0638

C Articles with Highest or Lowest Regulatory Sentiment or Uncertainty Estimates

Articles with Highest Sentiment Estimates:

Title	*Newspaper*	*Publication Date*	*Regulatory Section*
Going for the gators // 189 in Florida take part in annual hunt	USA Today	9/24/1991	Despite the danger, there have been no serious injuries in four years of hunts. Officials cite safety precautions and strict laws regulating hunters. Across the dark lake, hunters' lights flicker.
Business and Finance	Wall Street Journal	8/19/1993	Other firms will be pitching competitive services, and in some cases possibly better technology, for making calls and sending data. Regulators and lawmakers aren't expected to stop AT&T's plans to buy McCaw, despite Baby Bells' concerns. The Bells plan to use the AT&T-McCaw alliance to win greater freedom to enter new businesses.
The Nation; It's Reaganomics, Alive and Irresistible	New York Times	2/11/1996	Government spending was not cut. Neither were Government regulations. The Federal Reserve kept interest rates high.
Japanese Competition Is No Threat	Los Angeles Times	10/15/1989	We gain from the growth and improvement of the Japanese economy. If we remove regulations and reduce burdensome taxes, competition will push us toward greater efficiency. Both we and the Japanese will gain.
The Next California–The State's Economy in the Year 2000; The Next California / Diversity and Small Business; Action File; 10 Steps to a Better Future	Los Angeles Times	9/12/1995	Make government more user-friendly by streamlining regulatory and permitting processes without sacrificing environmental quality.
Crystal Ball Realty Consolidation, Web Expansion On Tap For The New Year	Chicago Tribune	1/4/1998	Their back end is efficient, their front end is friendly and their good name airlifts them. Regulators squeeze. The government will get more involved in e-commerce.

Greetings From the New Africa	Wall Street Journal	4/20/2012	Yet we can easily find real success stories. Ghana and Mozambique have both turned their economies around by taking advantage of the resource boom and creating regulatory frameworks that attract local and outside investment. Ghana has achieved a consistent 5% growth rate since the turn of the century, when political stability encouraged the rising middle classes to create a domestic market for goods and services.
High Number of Lead Poison Cases Found Health: State studies show many workers exposed in Los Angeles County. Monitoring practices in industry are criticized.	Los Angeles Times	8/30/1990	It is difficult to know if California residents have any greater risk to lead exposure than other states because the California studies used the more sensitive levels for lead exposure, Kizer said. But, he said, lead exposure can be easily reduced by enforcement of OSHA regulations. Among children, most lead exposure comes from living near industries using lead or from lead-based paint in homes.
Cool Idea: $30-Million Prize for Efficient Fridge Energy: Utility companies are offering manufacturers the reward for a 'nontoxic' appliance.	Los Angeles Times	7/8/1992	The prize represents a new strategy, offering what the consortium calls a "golden carrot" to improve efficiency. Fernstrom said he believes that such a "golden carrot" approach will be more effective than new regulations to boost efficiency standards. More utilities are expected to join the group later on, increasing the reward to perhaps $40 million.
10 people profit a tidy $8.9B from Trump rally	USA Today	1/11/2017	Buffett's exposure to the financial industry has fueled much of the gains, since the sector has been the biggest winner from Trump's victory. Investors are hopeful higher interest rates and lighter regulations could boost financials' profits. Berkshire's $37 billion market value gain has been impressive, but several banks have performed even better.

Articles with Lowest Sentiment Estimates:

Title	*Newspaper*	*Publication Date*	*Regulatory Section*
Accusations Against 93 Vary Widely	New York Times	11/28/2001	Fraudulently obtaining a firearm. Knowingly violating firearms regulations.

Alpha Discusses Suit	Boston Globe	6/12/1985	The suit alleges that the company failed to fully disclose in a timely manner that a vice president had been accused of violations of the anti-kickback statutes. Alpha denies all material allegations in the complaint, denies that it violated Securities and Exchange Commission regulations, and denies all liability to the plaintiff and the purported class.
Business Digest	New York Times	3/20/2003	Federal regulators accused Household International of violating securities laws by making false and misleading statements.
Michael who? An unlikely site for Milken	Chicago Tribune	1/7/1993	A number of companies became overextended and fell into bankruptcy. Milken pled guilty to conspiracy, fraud, violating public disclosure rules, misleading regulators and aiding the filing of a false tax return. As part of his plea bargain, prosecutors dropped charges against his brother, Lowell, who also worked at Drexel.
Decision '92 Voting In The Valley / An Election Guide Assembly / 40th District Friedman Favored On New Political Turf	Los Angeles Times	10/25/1992	Heidt opposes it. Heidt supports easing air quality regulations to reduce financial burdens on businesses. Friedman opposes it.
EPA Sues Operators Of 30 Sites That Burn Hazardous Waste	Wall Street Journal	9/29/1993	The Environmental Protection Agency filed lawsuits against operators of 30 incinerators, boilers and industrial furnaces, alleging violations of federal regulations on burning hazardous waste. The agency is seeking penalties of $19.8 million for the alleged violations, which mainly involve a regulation requiring businesses that burn hazardous waste to monitor emissions. The lawsuits are the latest in a series of EPA actions to stiffen oversight of hazardous-waste burning.
Today In Congress	The Washington Post	8/11/1988	Hazardous wastes and toxic substances subc. Hearings on PCB toxic waste regulation. 406 DOB.
The Navy Won't Stand for It	Los Angeles Times	10/3/1987	Kenneth D. Harvey, guilty of assault, sexual harassment, conduct unbecoming an officer, dereliction of duty, disobedience of naval regulations and inappropriate social fraternization. And the penalty for his behavior was appropriately severe.

Business & Finance	Wall Street Journal	11/8/2014	Abercrombie warned that its sales dropped 12% in the third quarter because of slowing mall traffic. Regulators faulted Wall Street banks for "serious deficiencies" in loans backing buyouts. Lawmakers stepped up pressure on Takata following allegations employees concealed evidence of air-bag defects.
For The Record	Los Angeles Times	2/13/2010	That is incorrect. Mercury was fined $300,000 for seven violations of state insurance regulations. The state dropped an eighth allegation of wrongdoing involving the use of lapses in coverage to calculate insurance rates, a subject addressed in Prop. 17.

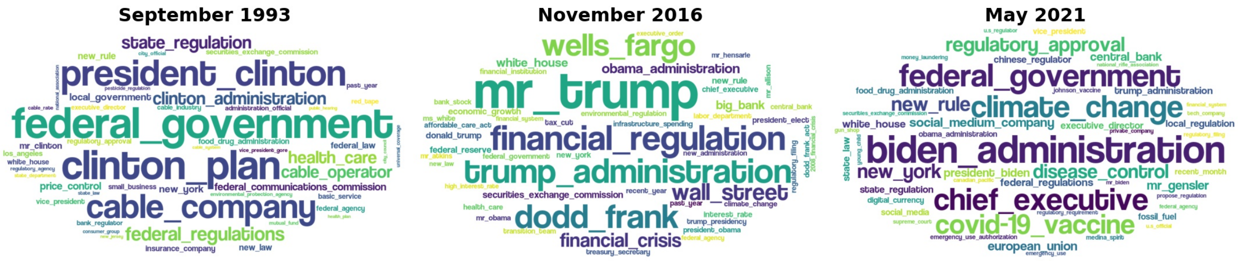
Articles with Highest Uncertainty Estimates:

Title	*Newspaper*	*Publication Date*	*Regulatory Section*
When it comes to annuities, there are pros, cons and certain levels of risk	The Washington Post	7/7/2019	"Retirement is a risky business," Graves said. "There's market risk, withdrawal rate risk, inflation risk, deflation risk, long-term care need risk, change in tax-code risk, regulatory risk and, of course, longevity risk. That's a lot of stuff to worry about."
Verizon: Keep your number; Cellphone carrier reverses position	USA Today	6/25/2003	Companies with lower ratings could suffer, he says. The new regulation could even make it possible for consumers to switch their landline phone number to a cellphone, but how that might work is unclear. Almost 17% of users surveyed in June by consulting firm The Management Network Group said they would do so if they could.
Could insecurity be the secret to CEOs' success?; Some execs say paranoia keeps them on their toes	USA Today	2/1/2007	"Your supplier today could be your competitor tomorrow. An acquisition could eliminate a competitor, while a government regulation could create five. In a changing environment like business, I believe insecurity may be more of a driver than in sports," Pritchett says.
No Subpoena For Tyson At Hearing	New York Times	7/4/1997	But the length of any ban depends on the five-person commission. If the commission revoked his license, Tyson, under state regulations, could apply yearly to have it reinstated. The commission could reinstate the license, or it could deny his applications indefinitely.

Alternate Plan as Health Option Muddies Debate	New York Times	8/17/2009	Ms. Ignagni asked. “What are the regulatory requirements? It may sound benign, but it may use administered prices.
Say 'Aaah'; Booster Shots; What Gets Doctors' Goat? Well...We Do	Los Angeles Times	5/21/2001	But not all agree. “Compliance seems too authoritarian, adherence seems too sticky, fidelity has too many connotations, maintenance suggests a repair crew, and self-regulation or self-management seems too liberal,” wrote one Dutch doctor. Recalcitrant?
Capitol Journal; Munger ready to protect voters	Los Angeles Times	3/30/2015	Additional words in the Elections Clause allow for a possible good government solution, reformers believe. It reads: “...but the Congress may at any time by law make or alter such regulations...” That means Congress perhaps could permit legislatures to assign the redistricting chore to independent panels.
Roche dismisses idea that it may abandon its offer for Syntex	Wall Street Journal	8/15/1994	Roche Holding Ltd. dismissed speculation that it might scrap a pending $5.3 billion bid for Syntex Corp. of Palo Alto, Calif., but balked at predicting when the regulatory review of the huge transaction might be completed. Syntex stock fell in early New York trading Friday amid rumors that the big Swiss drug maker might pull out of the agreed Syntex takeover.
Pop quiz	The Washington Post	9/12/2011	That states could not force children to attend public schools and that they could attend private schools instead. c) That state and federal governments could not regulate what religious schools could teach. d) That state governments could not set qualifications for teachers at religious schools.
Consumers Power's Walter Boris To Take Early Retirement in '86	Wall Street Journal	3/28/1985	The case is pending. State regulators have suggested that a change in the utility's top management might be the price necessary to win a substantial rate increase.

D Word Clouds of Articles Published in Selected Months

(a) Months with Positive Regulatory Sentiment Shocks

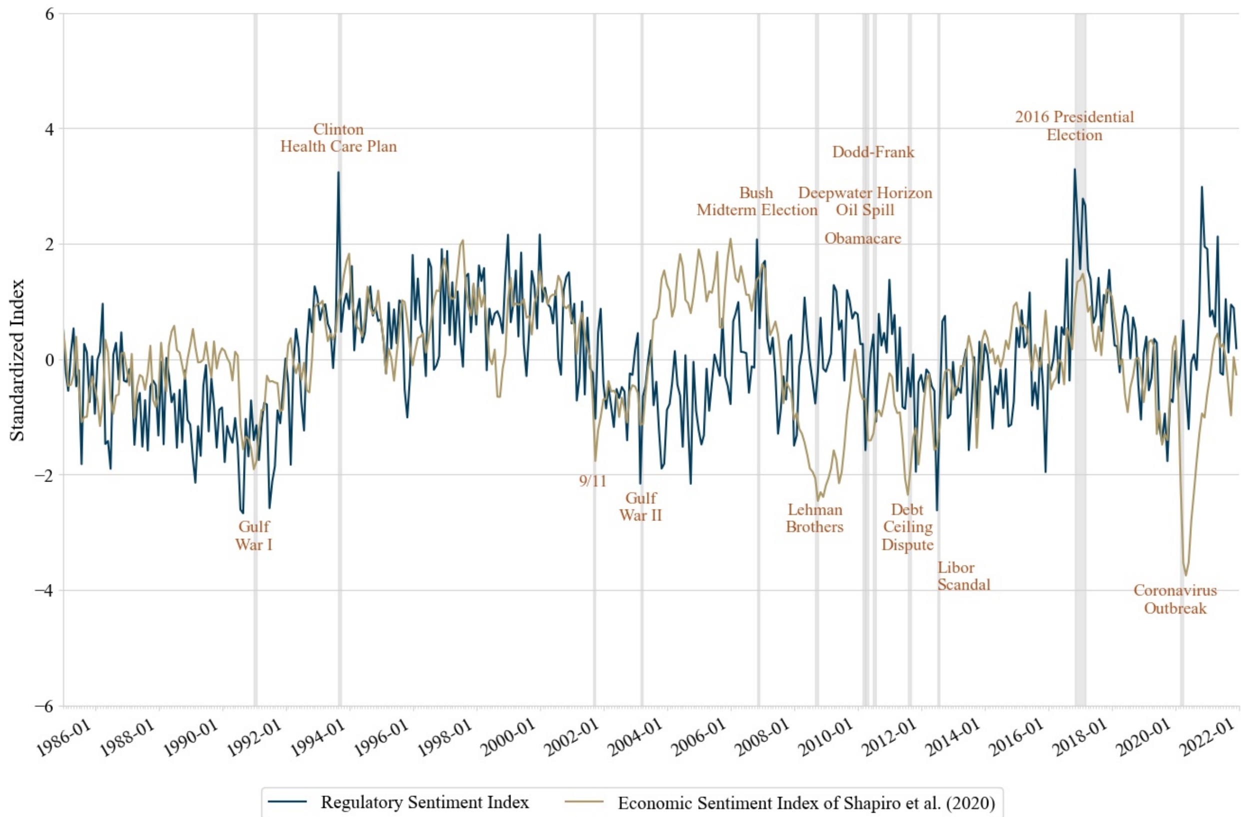


(b) Months with Negative Regulatory Sentiment Shocks

(c) Months with Upward Regulatory Uncertainty Shocks

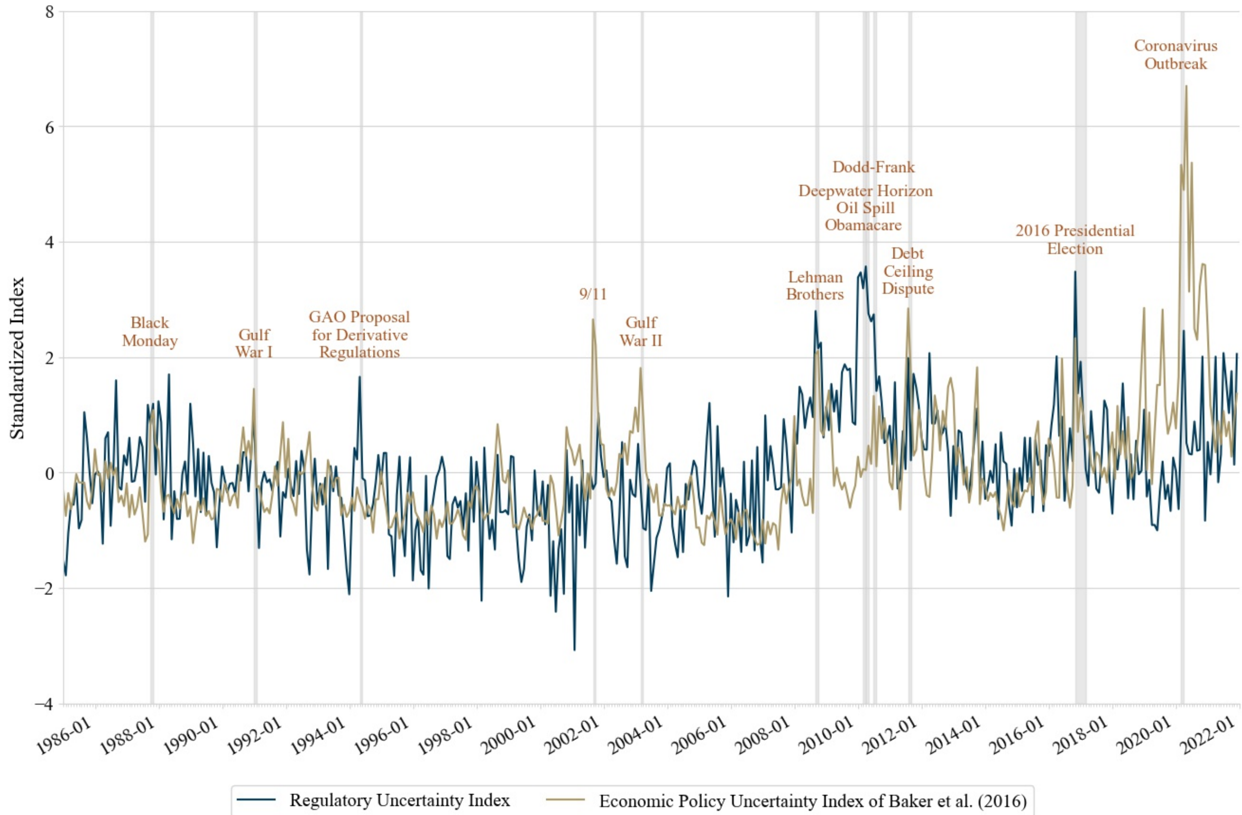
E Comparing Sentiment and Uncertainty Indexes

E.1 Comparing Regulatory Sentiment Index and Economic Sentiment Index



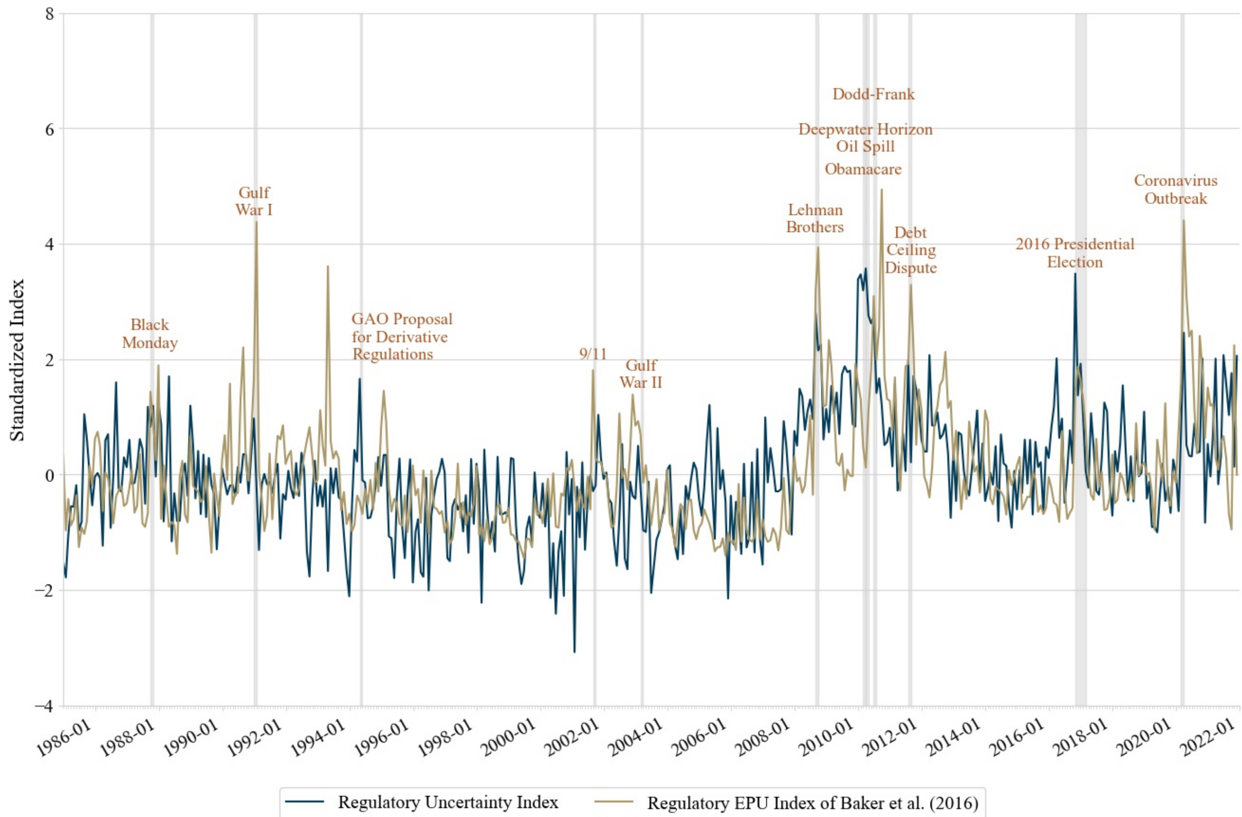
Notes: The figure plots the regulatory sentiment index estimated using the Loughran and McDonald (LM) dictionary and the economic sentiment index of Shapiro et al. (2020). Both indexes are normalized to have mean equal to zero and standard deviation equal to one.

E.2 Comparing Regulatory Uncertainty Index and Economic Policy Uncertainty Index



Notes: The figure plots the regulatory uncertainty index estimated using the Loughran and McDonald (LM) dictionary and the economic policy uncertainty index of Baker et al. (2016). Both indexes are normalized to have mean equal to zero and standard deviation equal to one.

E.3 Comparing Regulatory Uncertainty Index and Regulatory EPU Index



Notes: The figure plots the regulatory uncertainty index estimated using the Loughran and McDonald (LM) dictionary and the categorical EPU index on regulation of Baker et al. (2016). Both indexes are normalized to have mean equal to zero and standard deviation equal to one.

E.4 Granger Causality Tests

Lag Length	**1**	**2**	**3**	**4**
Null Hypothesis (H_0)	**F-Statistic**	**F-Statistic**	**F-Statistic**	**F-Statistic**
Regulatory sentiment does not Granger cause economic sentiment	6.0446 (p=0.0143)	2.4501 (p=0.0875)	1.5893 (p=0.1913)	1.8424 (p=0.1197)
Economic sentiment does not Granger cause regulatory sentiment	3.1810 (p=0.0752)	2.1330 (p=0.1197)	1.0192 (p=0.3839)	0.5974 (p=0.6647)
Regulatory uncertainty does not Granger cause EPU	1.2940 (p=0.2559)	0.7630 (p=0.4669)	0.5953 (p=0.6184)	0.4428 (p=0.7776)
EPU does not Granger cause regulatory uncertainty	9.4066 (p=0.0023)	3.2637 (p=0.0392)	2.1219 (p=0.0968)	1.9306 (p=0.1044)
Regulatory uncertainty does not Granger cause regulatory EPU	18.0025 (p<0.0001)	9.3712 (p=0.0001)	5.7912 (p=0.0007)	4.8780 (p=0.0007)
Regulatory EPU does not Granger cause regulatory uncertainty	19.9971 (p<0.0001)	5.5573 (p=0.0041)	3.2429 (p=0.0220)	2.2171 (p=0.0663)

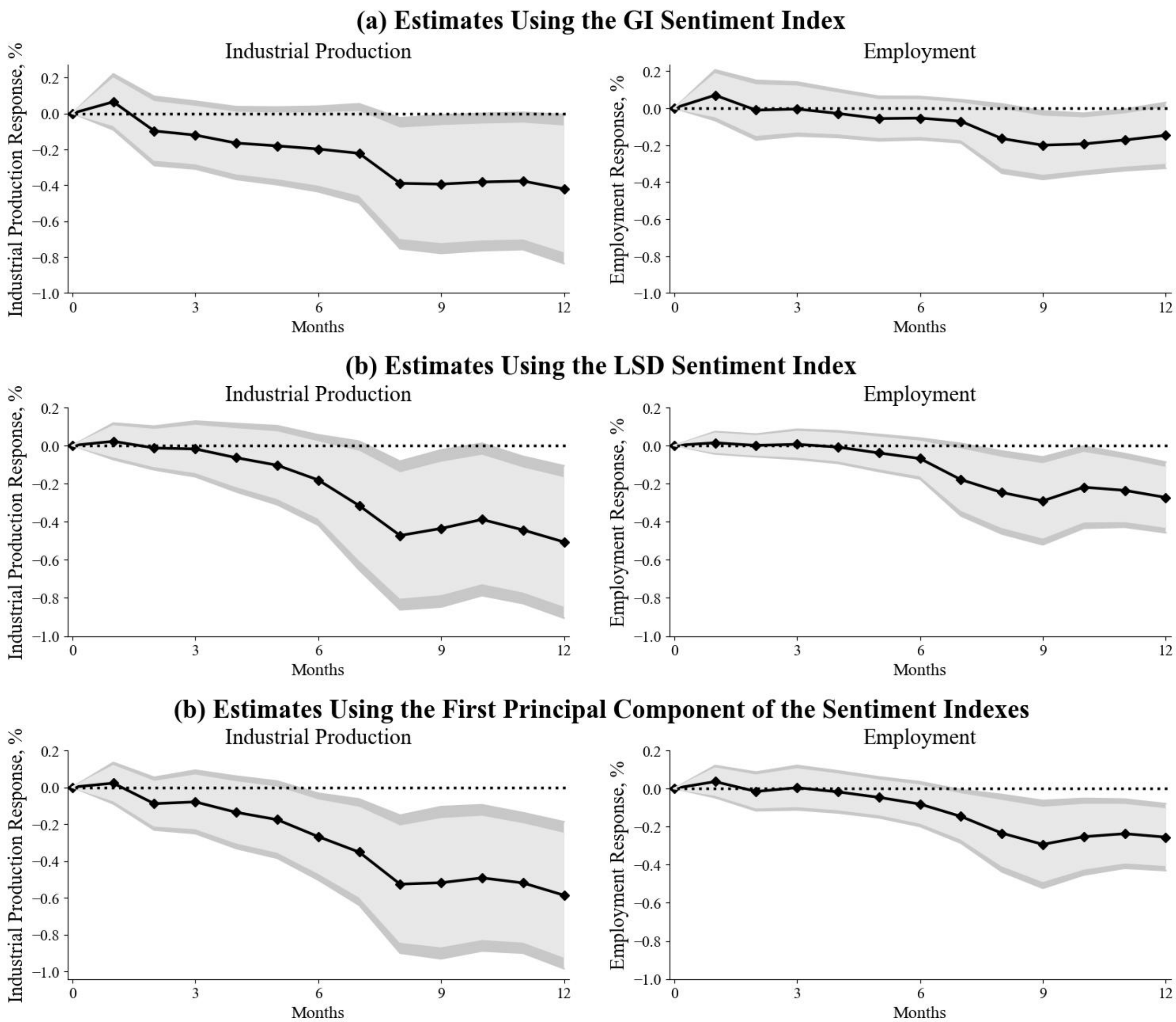
Notes: The economic sentiment measure is from Shapiro et al. (2020). The economic policy uncertainty (EPU) and regulatory EPU measures are from Baker et al. (2016).

F Stationarity Tests for the Regulatory Sentiment and Uncertainty Indexes

Index	**ADF test statistic**	**Phillips-Perron test statistic**	**KPSS test statistic**
LM sentiment index	-3.5766 (p=0.0319)	-14.7391 ($p<0.0001$)	0.1847 (p=0.0213)
GI sentiment index	-2.5887 (p=0.2851)	-17.2737 ($p<0.0001$)	0.2941 (p=0.0019)
LSD sentiment index	-4.7789 (p=0.0005)	-15.7126 ($p<0.0001$)	0.2056 (p=0.0133)
Sentiment PC	-4.4592 (p=0.0018)	-15.4792 ($p<0.0001$)	0.2415 (0.0059)
Uncertainty index	-3.4016 (p=0.0512)	-16.8879 ($p<0.0001$)	0.2841 (p=0.0023)

Notes: The sentiment PC represents the first principal component of the LM, GI, and LSD sentiment indexes. All tests include a constant and linear time trend.

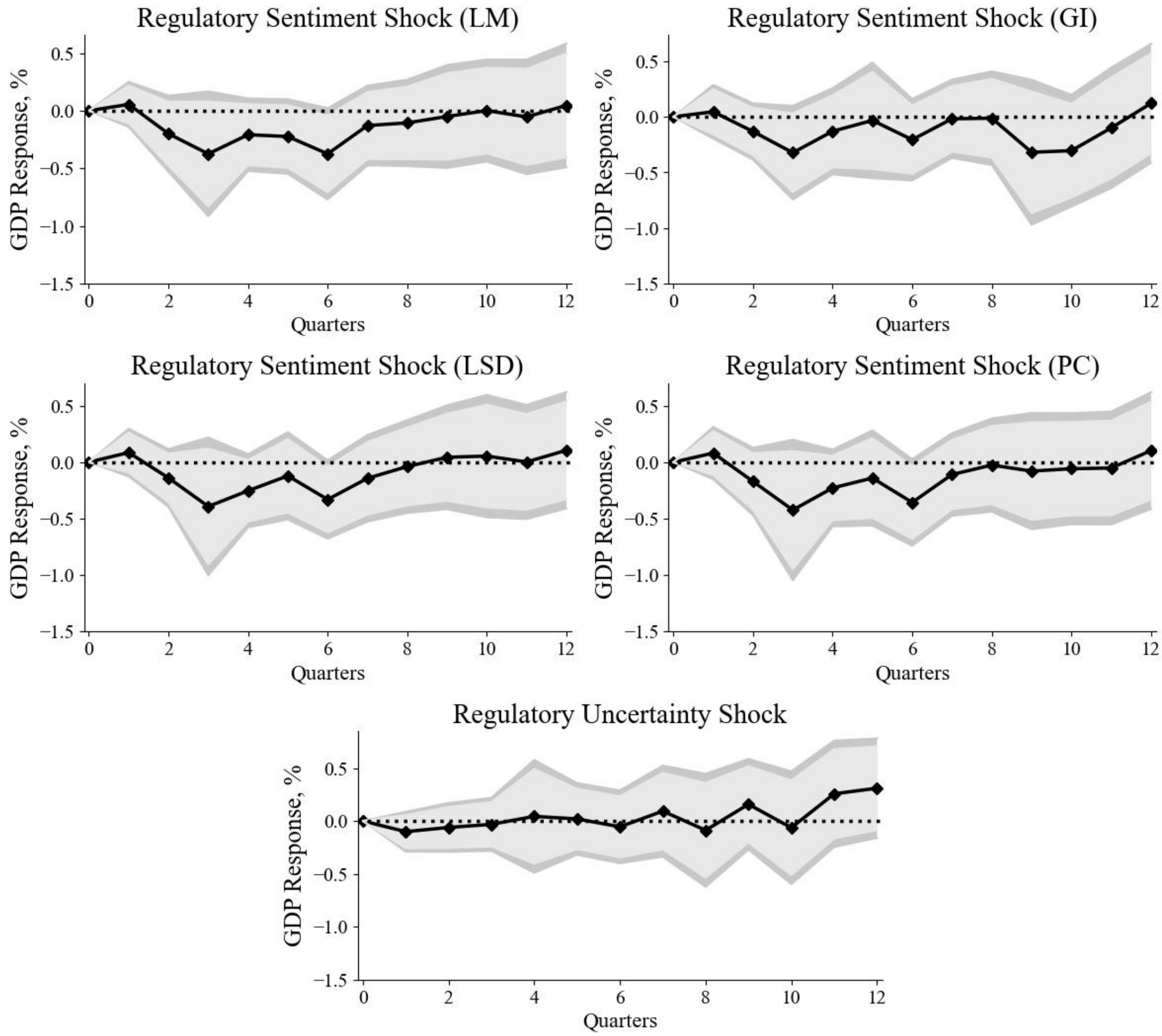
G Impulse Responses Using Alternative Regulatory Sentiment Indexes (Local Projections)



Notes: The figures plot impulse response functions for industrial production and employment to a one-standard-deviation negative shock to regulatory sentiment, using the sentiment indexes estimated from the General Inquirer (GI) dictionary and the Lexicoder Sentiment Dictionary (LSD) as well as the first principal component of the GI, LSD, and Loughran and McDonald (LM) sentiment indexes. Shaded areas show 90 percent (light gray) and 95 percent (dark gray) confidence bands.

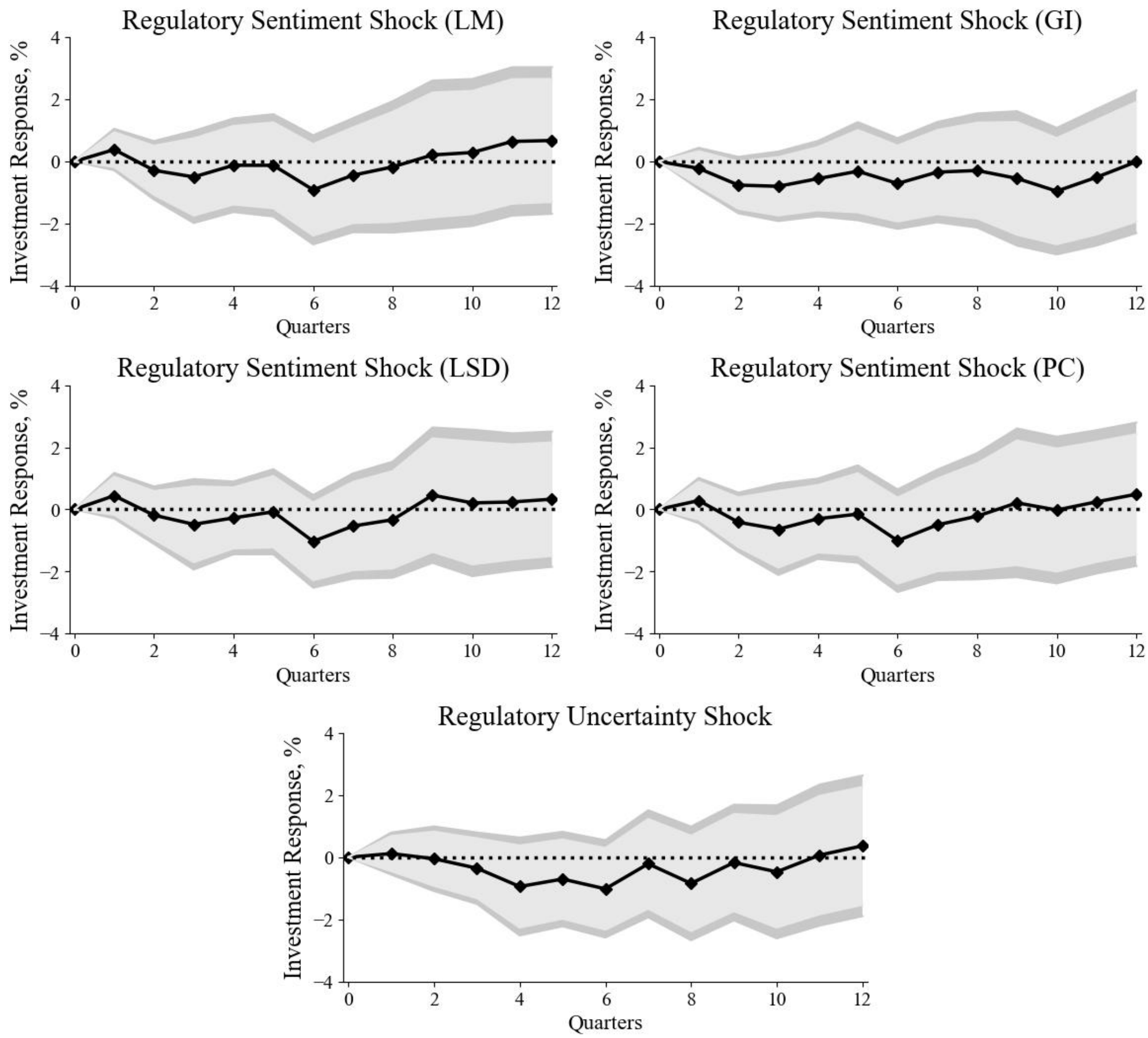
H Impulse Responses (Quarterly Local Projections)

H.1 GDP Responses



Notes: The figures plot GDP responses to a one-standard-deviation negative shock to regulatory sentiment or a one-standard-deviation upward shock to regulatory uncertainty. Sentiment measures are indexes estimated from the Loughran and McDonald (LM) dictionary, the General Inquirer (GI) dictionary, the Lexicoder Sentiment Dictionary (LSD), and the first principal component (PC) of the three sentiment indexes. Shaded areas show 90 (light gray) and 95 (dark gray) percent confidence bands.

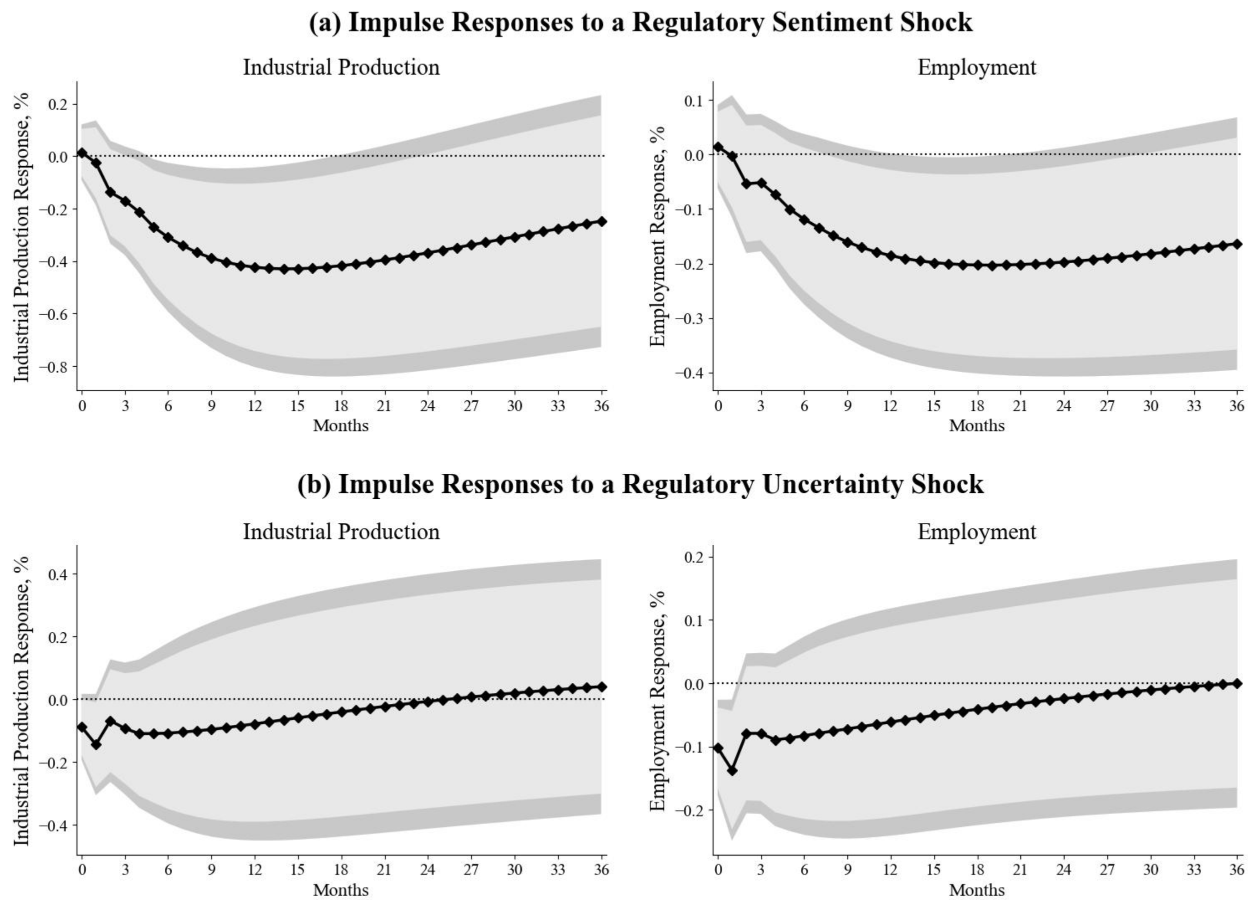
H.2 Investment Responses



Notes: The figures plot investment responses to a one-standard-deviation negative shock to regulatory sentiment or a one-standard-deviation upward shock to regulatory uncertainty. Sentiment measures are indexes estimated from the Loughran and McDonald (LM) dictionary, the General Inquirer (GI) dictionary, the Lexicoder Sentiment Dictionary (LSD), and the first principal component (PC) of the three sentiment indexes. Shaded areas show 90 (light gray) and 95 (dark gray) percent confidence bands.

I VAR-estimated Impulse Responses

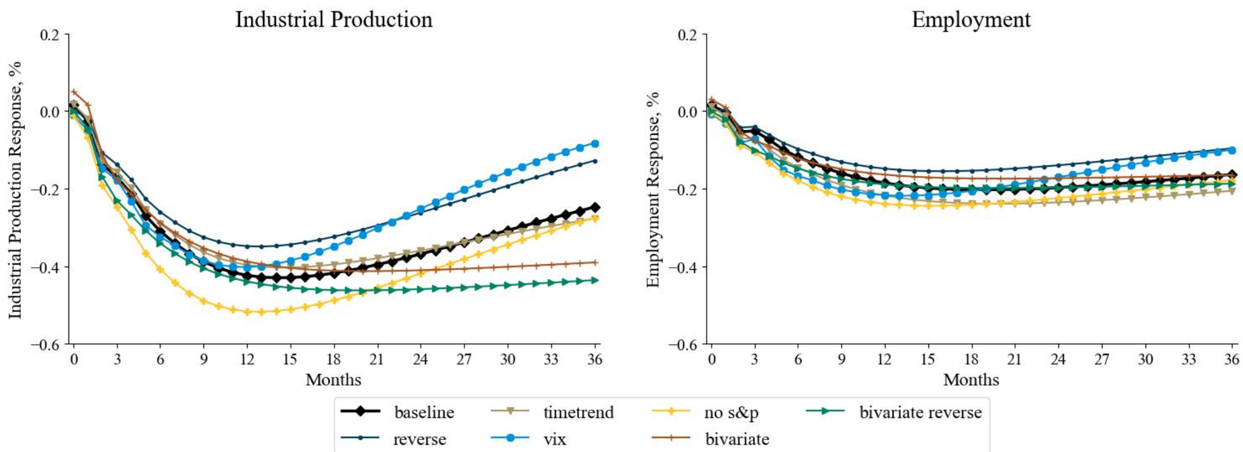
I.1 Baseline VAR



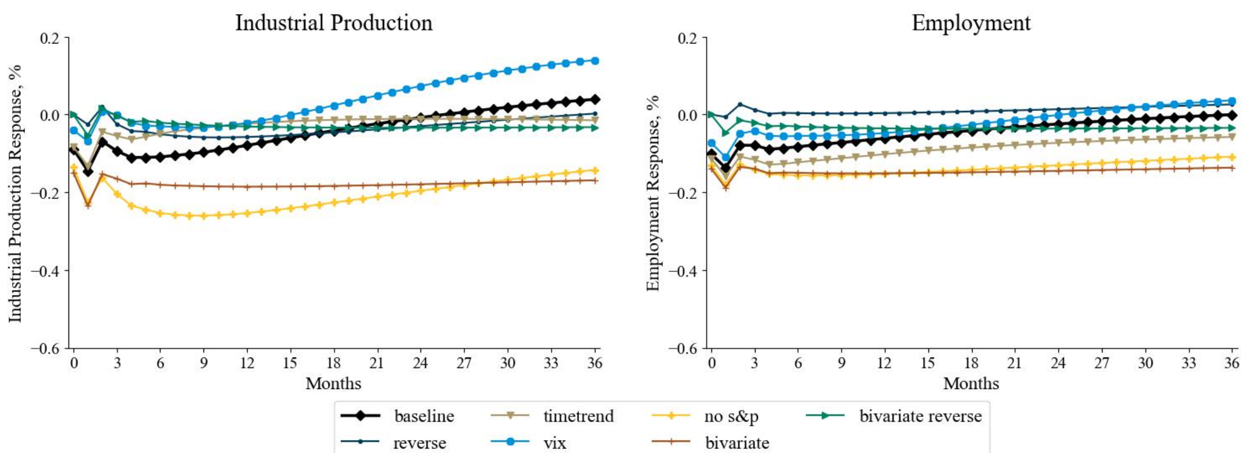
Notes: The figures plot VAR-estimated impulse response functions for industrial production and employment to: (a) a one-standard-deviation negative shock to regulatory sentiment, and (b) a one-standard-deviation upward shock to regulatory uncertainty. The sentiment index is estimated using the Loughran and McDonald (LM) dictionary. Shaded areas show 90 (light gray) and 95 (dark gray) percent confidence bands.

I.2 Alternative VAR Specifications

(a) Impulse Responses to a Regulatory Sentiment Shock



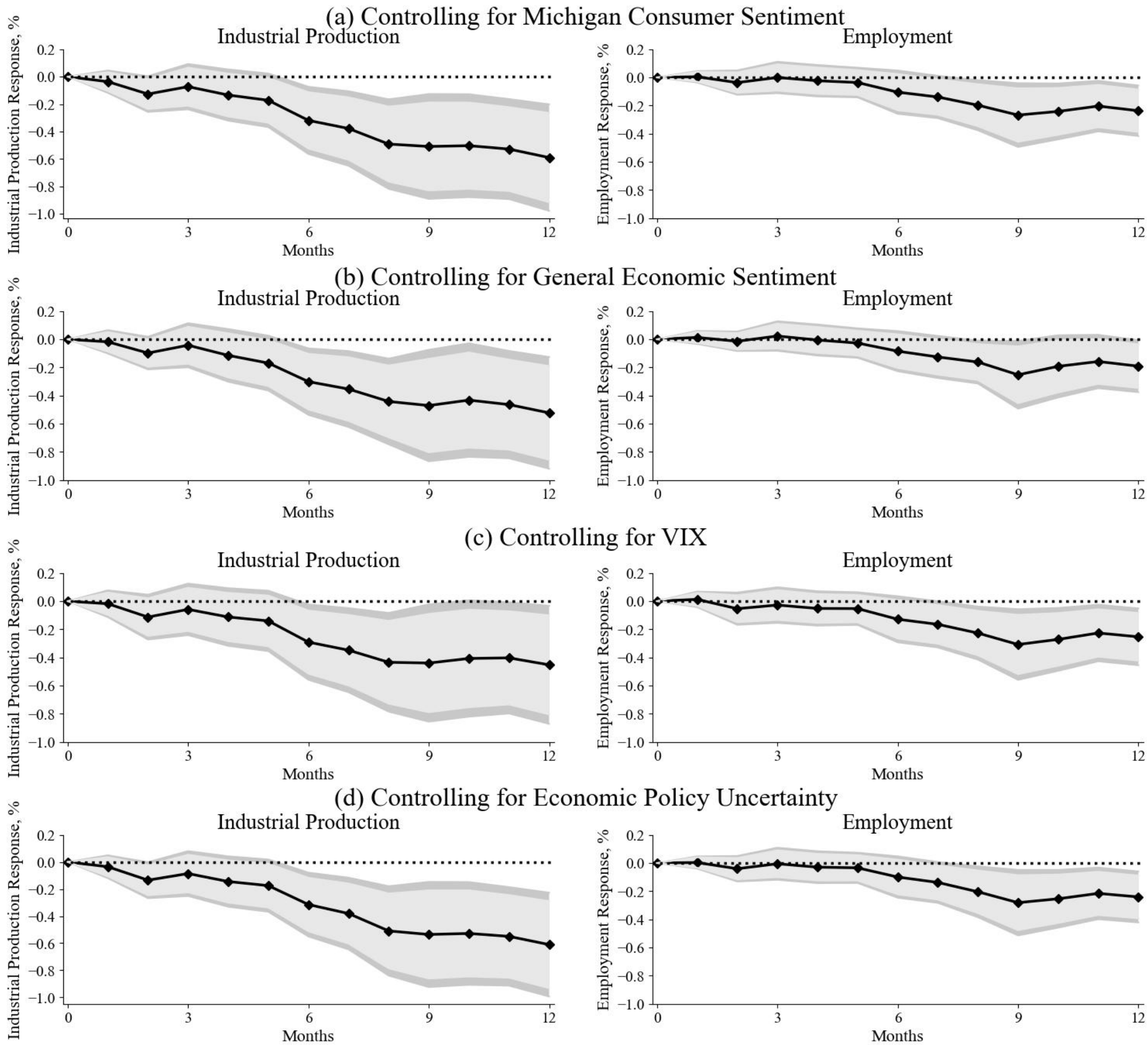
(b) Impulse Responses to a Regulatory Uncertainty Shock



Notes: The figures plot VAR-estimated impulse response functions for industrial production and employment to: (a) a one-standard-deviation negative shock to regulatory sentiment, and (b) a one-standard-deviation upward shock to regulatory uncertainty. The sentiment index is estimated using the Loughran and McDonald (LM) dictionary. Several modifications are made to the baseline VAR specification, including reverse ordering, a bivariate VAR, a bivariate VAR with reverse ordering, dropping the S&P index, including the VIX, and including time trends.

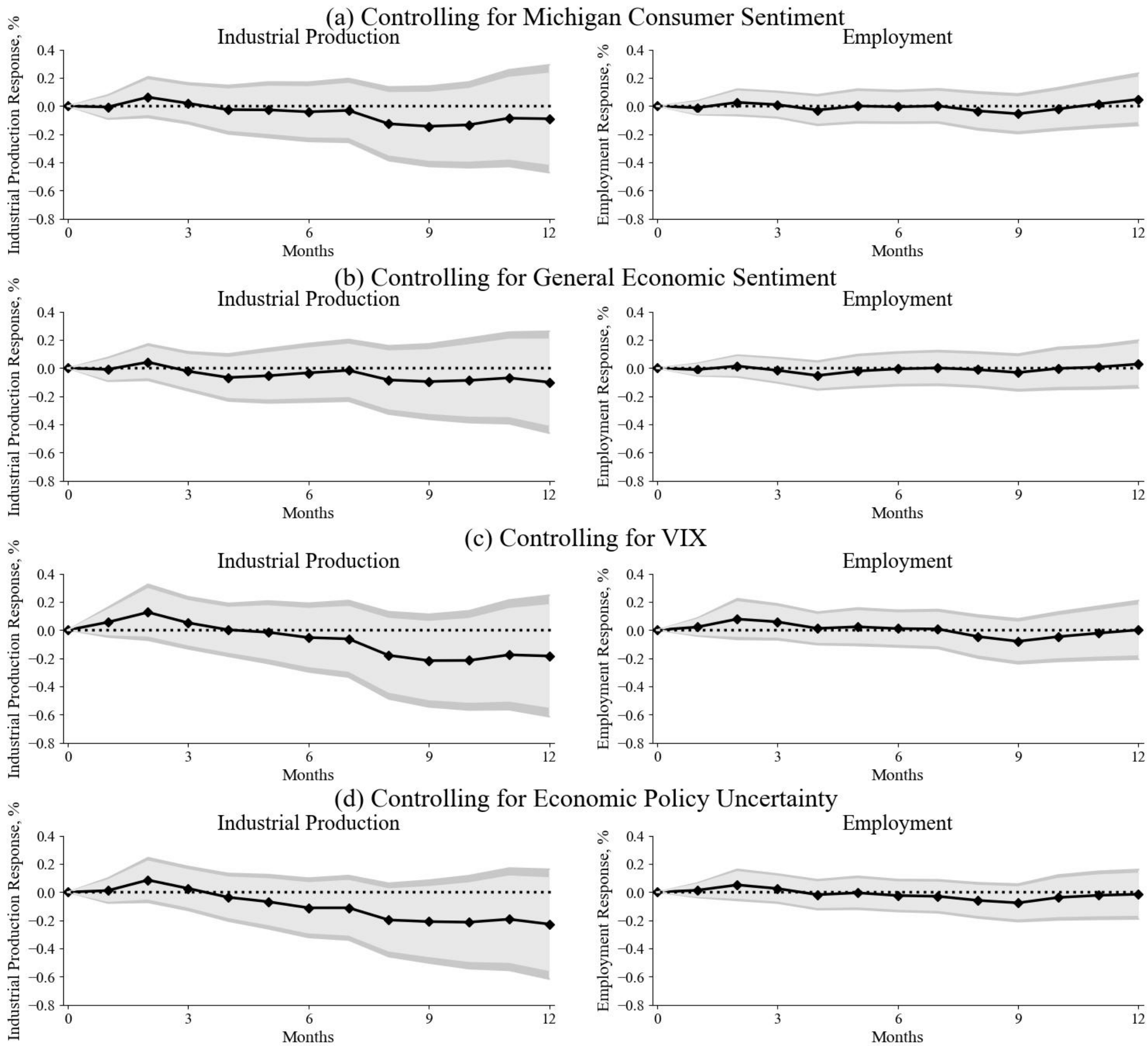
J Impulse Responses (Local Projections, Controlling for General Economic Sentiment and Policy Uncertainty)

J.1 Impulse Responses to Regulatory Sentiment Shocks



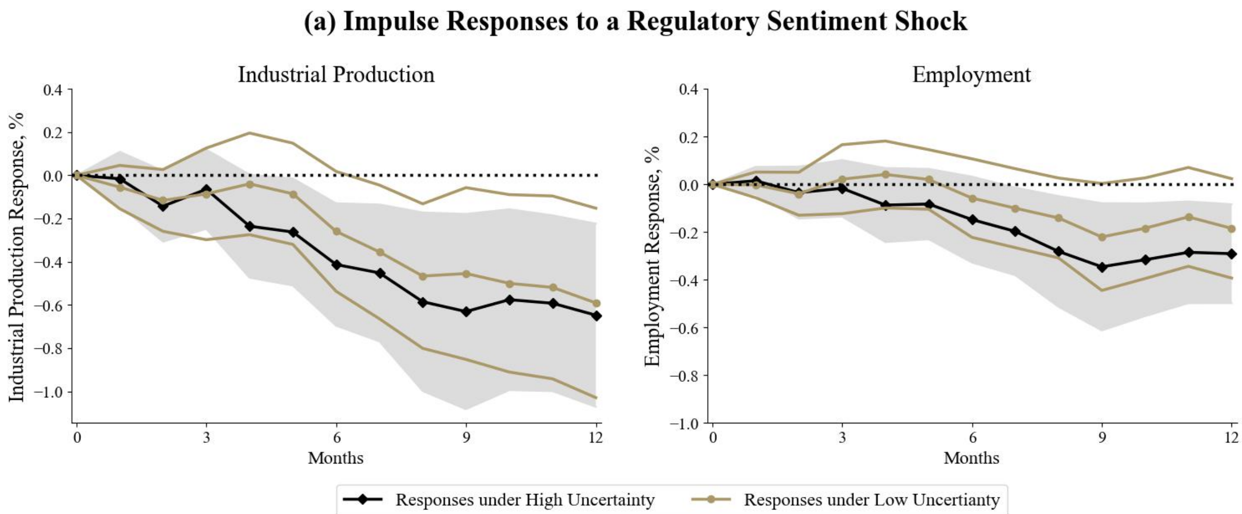
Notes: The figures plot impulse response functions for industrial production and employment to a one-standard-deviation negative shock to regulatory sentiment, controlling for the Michigan Consumer Sentiment Index, the economic sentiment index of Shapiro et al. (2020), VIX, or the EPU index of Baker et al. (2016). Shaded areas show 90 (light gray) and 95 (dark gray) percent confidence bands.

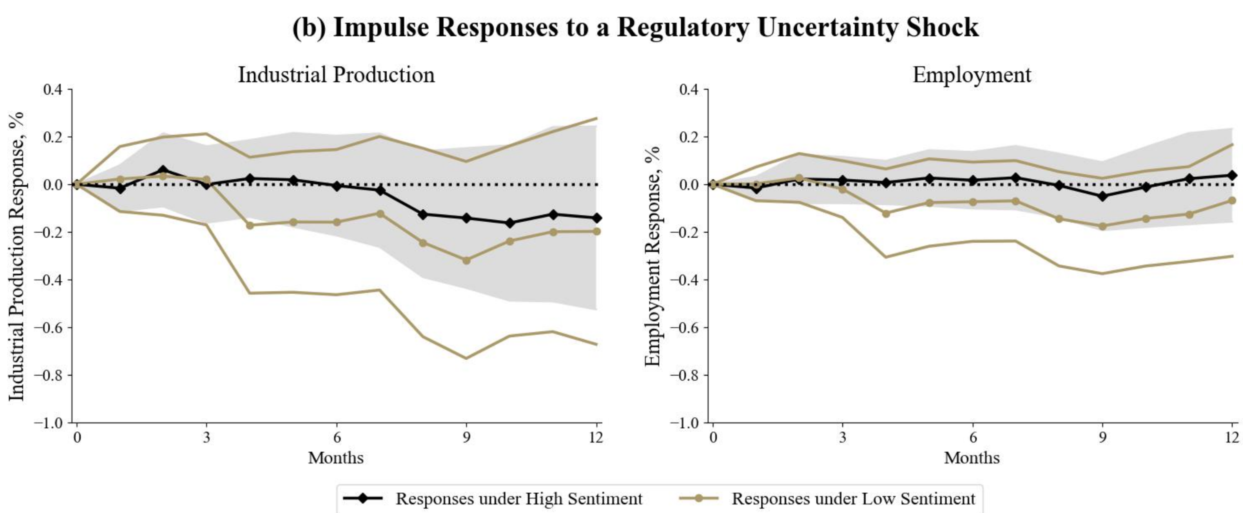
J.2 Impulse Responses to Regulatory Uncertainty Shocks



Notes: The figures plot impulse response functions for industrial production and employment to a one-standard-deviation upward shock to regulatory uncertainty, controlling for the Michigan Consumer Sentiment Index, the economic sentiment index of Shapiro et al. (2020), VIX, or the EPU index of Baker et al. (2016). Shaded areas show 90 (light gray) and 95 (dark gray) percent confidence bands.

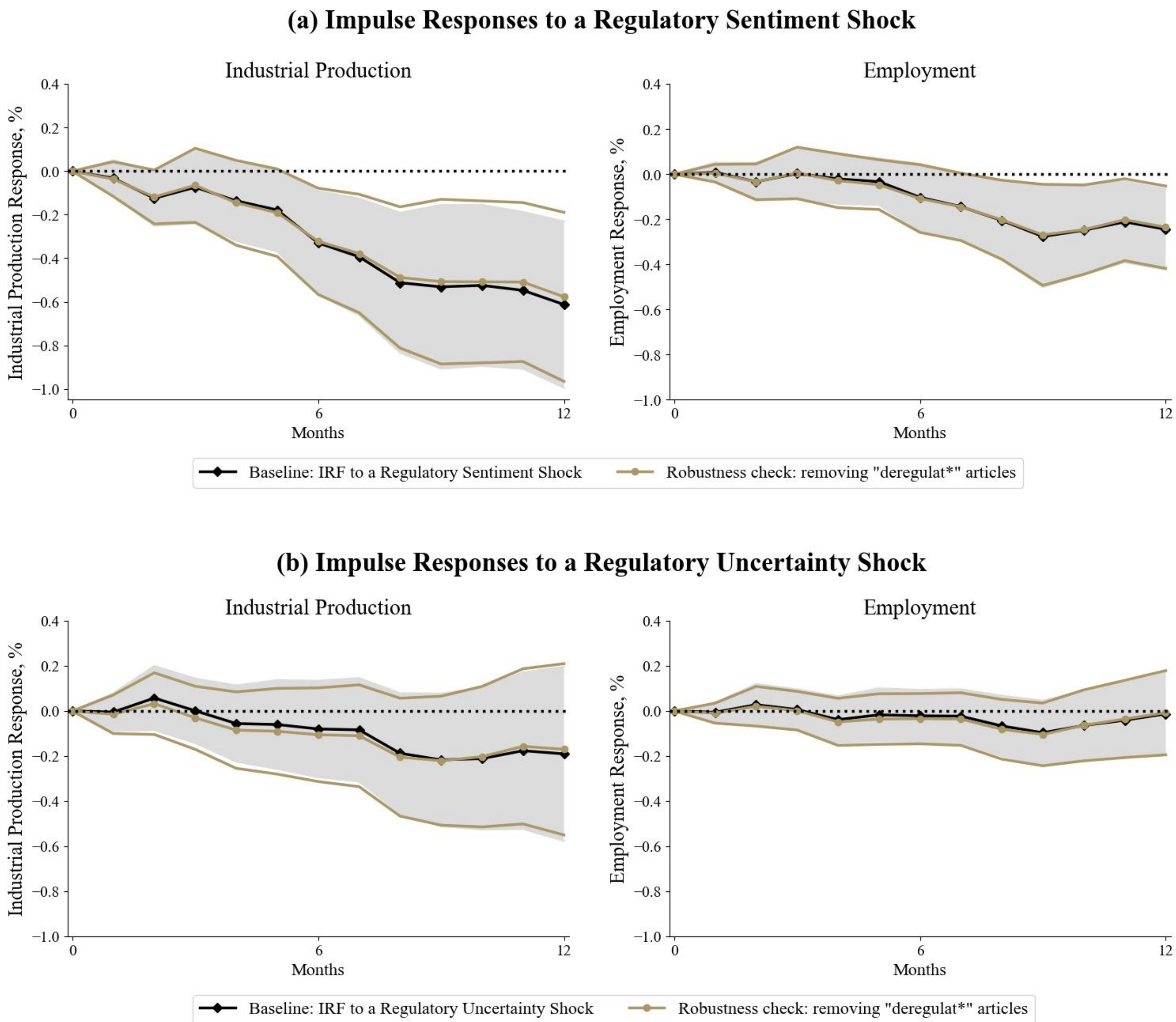
K Interactions between Regulatory Sentiment and Uncertainty





Notes: Panel (a) plots impulse responses to a one-standard-deviation negative regulatory sentiment shock conditional on levels of regulatory uncertainty at one standard deviation above and below its mean (high uncertainty and low uncertainty, respectively). Panel (b) plots impulse responses to a one-standard-deviation upward regulatory uncertainty shock conditional on levels of regulatory sentiment at one standard deviation above and below its mean (high sentiment and low sentiment, respectively). Gray areas and yellow solid lines show 95 percent confidence bands.

L Sentiment and Uncertainty about Regulation and Deregulation



Notes: The figures plot impulse response functions for industrial production and employment to: (a) a one-standard-deviation negative regulatory sentiment shock, and (b) a one-standard-deviation upward regulatory uncertainty shock. The sentiment and uncertainty indexes are estimated using the Loughran and McDonald (LM) dictionary, after removing news articles that contain words starting with "deregulat." The impulse response functions are estimated from local projections using monthly data from January 1985 through December 2021. Gray areas and yellow solid lines show 95 percent confidence bands.

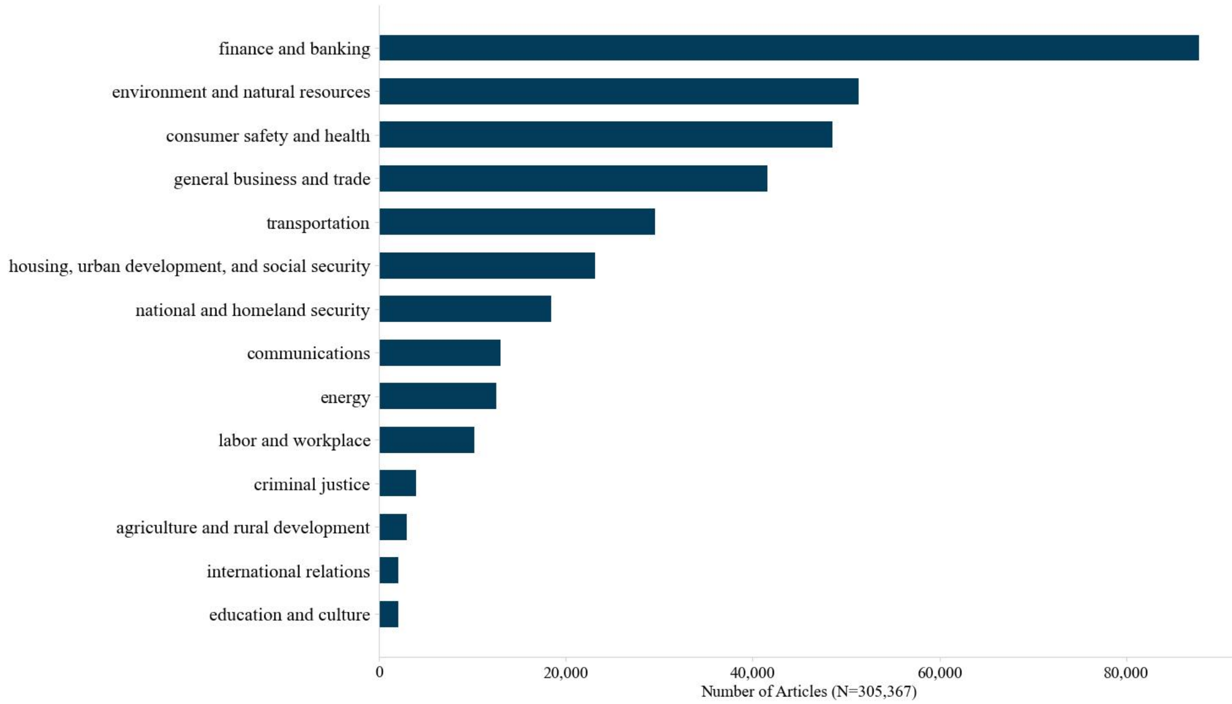
M Examples of Agencies, Regulatory Areas, and Rule Titles

Regulatory Area	Agency	Department	Rule Title
agriculture and rural development	Agricultural Marketing Service	Department of Agriculture	National Organic Program
communications	Federal Communications Commission	N/A	Streamlining the Commission's Rules and Regulations for Satellite Application and Licensing Procedures (IB Docket No. 95-117)
consumer safety and health	Centers for Medicare & Medicaid Services	Department of Health and Human Services	Deduction of Incurred Medical Expenses (Spenddown) (HCFA-2020-F)
criminal justice	Bureau of Prisons	Department of Justice	Volunteer Community Service Projects
education and culture	Office of Elementary and Secondary Education	Department of Education	Improving Basic Programs Operated by Local Educational Agencies
energy	Energy Efficiency and Renewable Energy	Department of Energy	Energy Efficiency Standards for Room Air Conditioners
environment and natural resources	Office of Air and Radiation	Environmental Protection Agency	National Volatile Organic Compounds (VOC) Emission Standards for Consumer Products; Amendments
finance and banking	Commodity Futures Trading Commission	N/A	Review of Commission Disclosure Requirements Concerning Commodity Pool Operators
general business and trade	Small Business Administration	N/A	Certificate of Competency
international relations	Agency for International Development	N/A	Administration of Grants and Cooperative Agreements
labor and workplace	Employment and Training Administration	Department of Labor	Airline Deregulation: Employee Benefit Program
national and homeland security	Bureau of Citizenship and Immigration Services	Department of Homeland Security	Employment Verification by Employers That Are Members of a Multi-Employer Association
society	Office of Fair Housing and Equal Opportunity	Department of Housing and Urban Development	Economic Opportunities for Low- and Very-Low-Income Persons (FR-2898)
transportation	Federal Aviation Administration	Department of Transportation	Objects Affecting Navigable Airspace

N The Most Common Area-Specific Noun Chunks by Regulatory Area

Notes: Each word cloud shows 50 most common area-specific regulatory noun chunks that occur in the regulatory sections classified into the corresponding area. n indicates the number of unique area-specific regulatory noun chunks for each area.

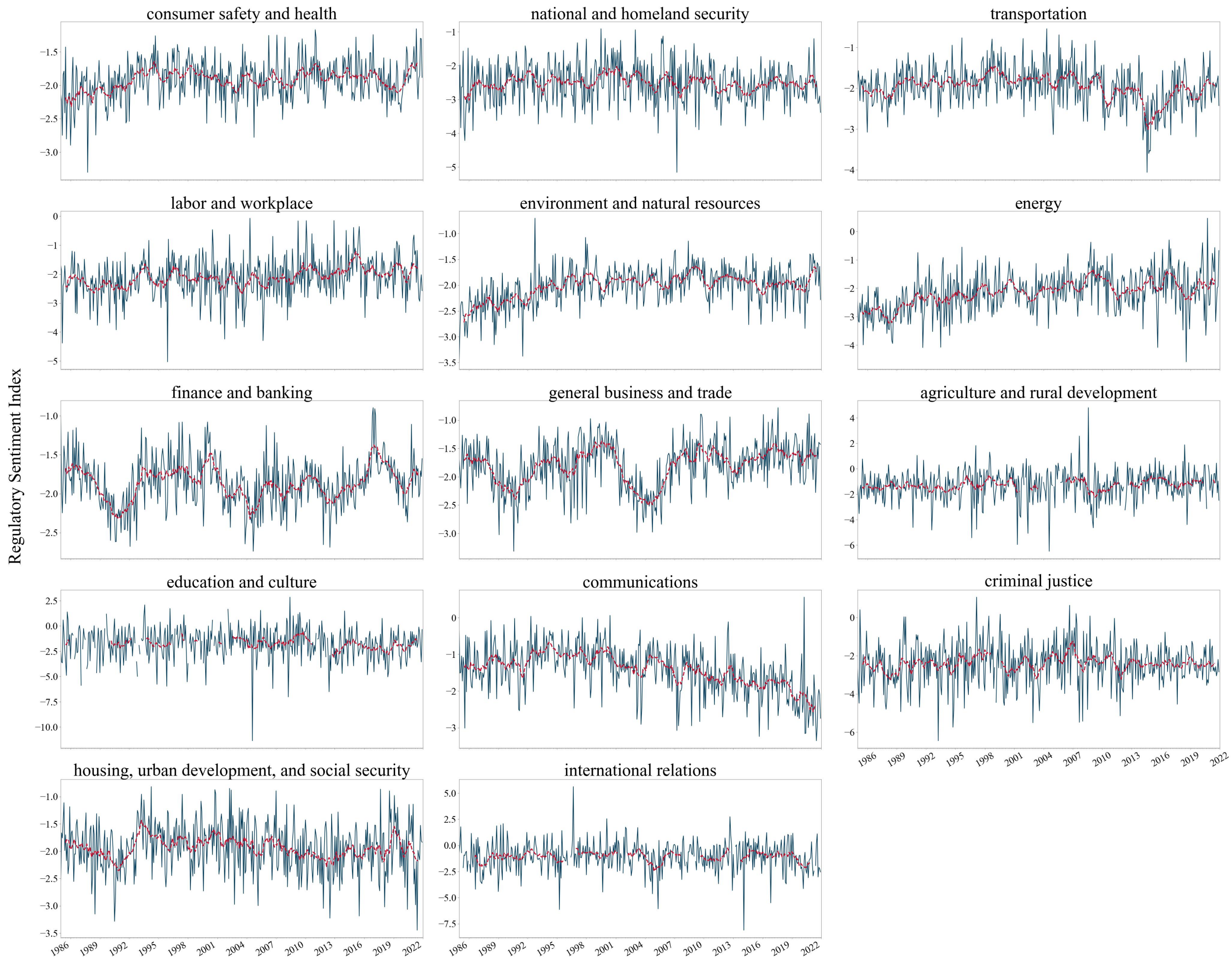
O Frequencies of Articles By Regulatory Area



Notes: The figure plots the number of news articles classified into each regulatory policy area in our sample. An article can be classified into multiple areas.

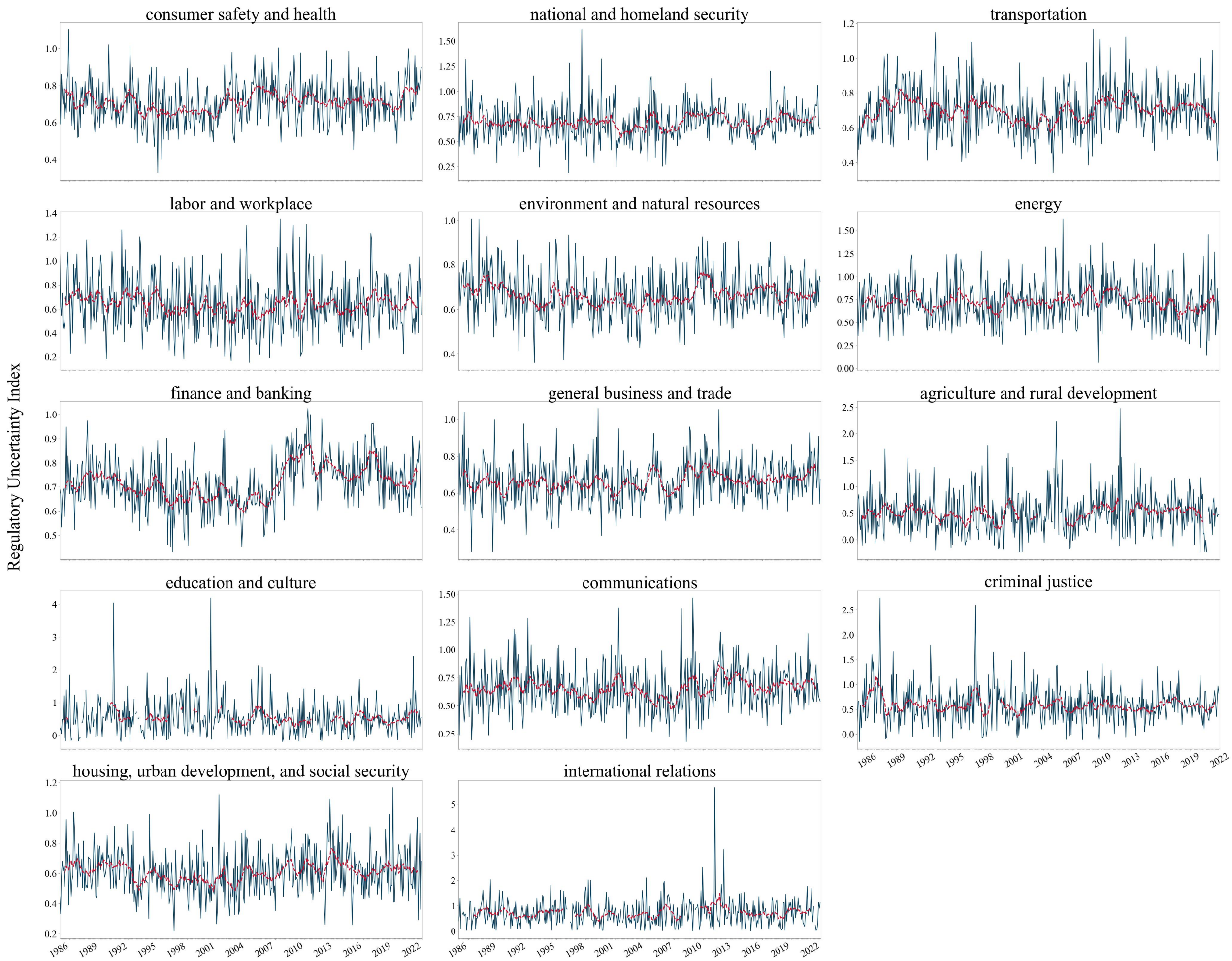
P Monthly Indexes By Regulatory Area

P.1 Monthly Sentiment Index By Regulatory Area



Notes: The figures plot the sentiment indexes estimated using the Loughran and McDonald (LM) dictionary for each regulatory policy area from January 1985 through December 2021. Dashed red lines show 12-month rolling means.

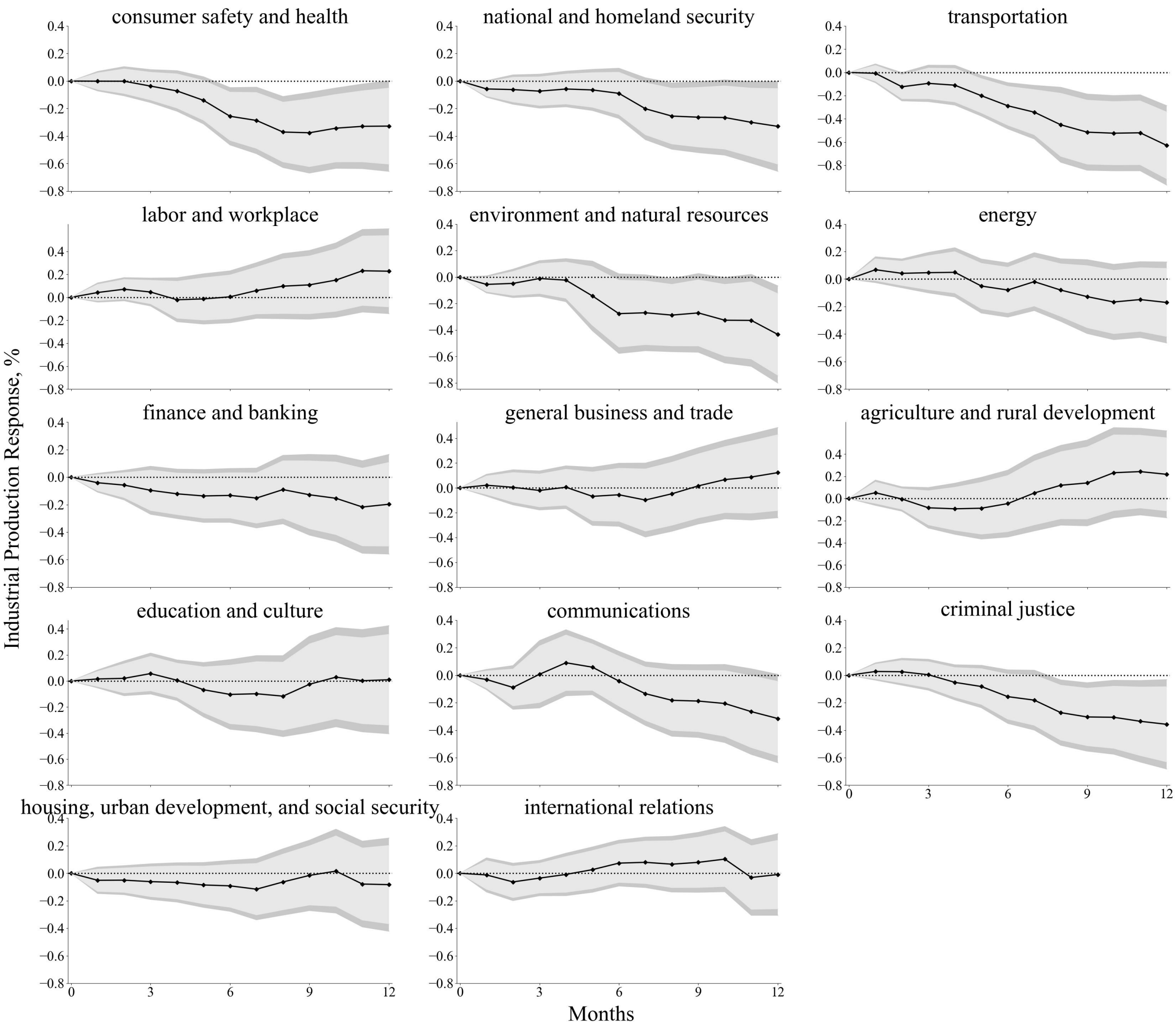
P.2 Monthly Uncertainty Index By Regulatory Area



Notes: The figures plot the uncertainty indexes estimated using the Loughran and McDonald (LM) dictionary for each regulatory policy area from January 1985 through December 2021. Dashed red lines show 12-month rolling means.

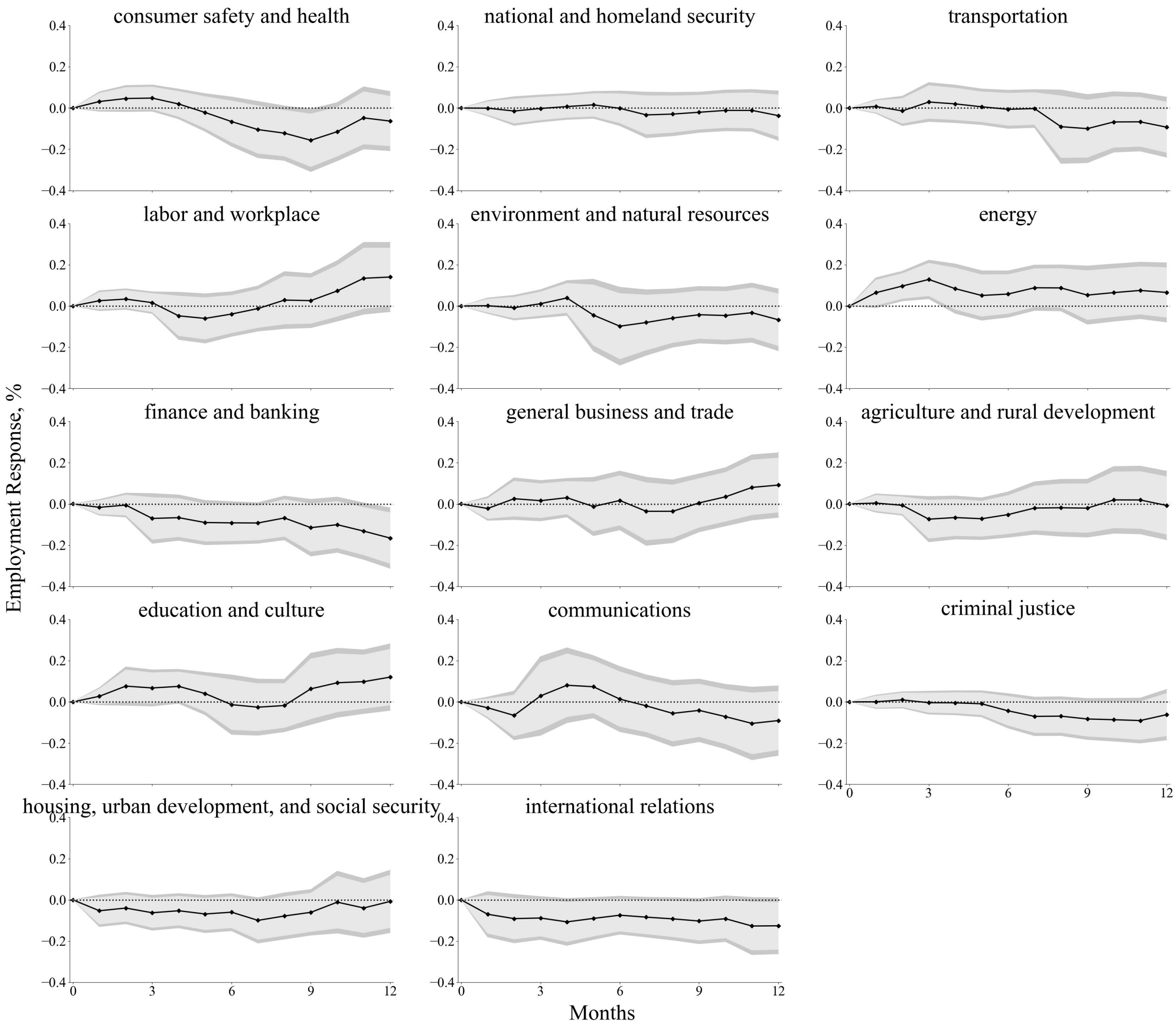
Q Impulse Responses by Regulatory Area (Local Projections)

Q.1 Industrial Production Responses to Regulatory Sentiment Shocks



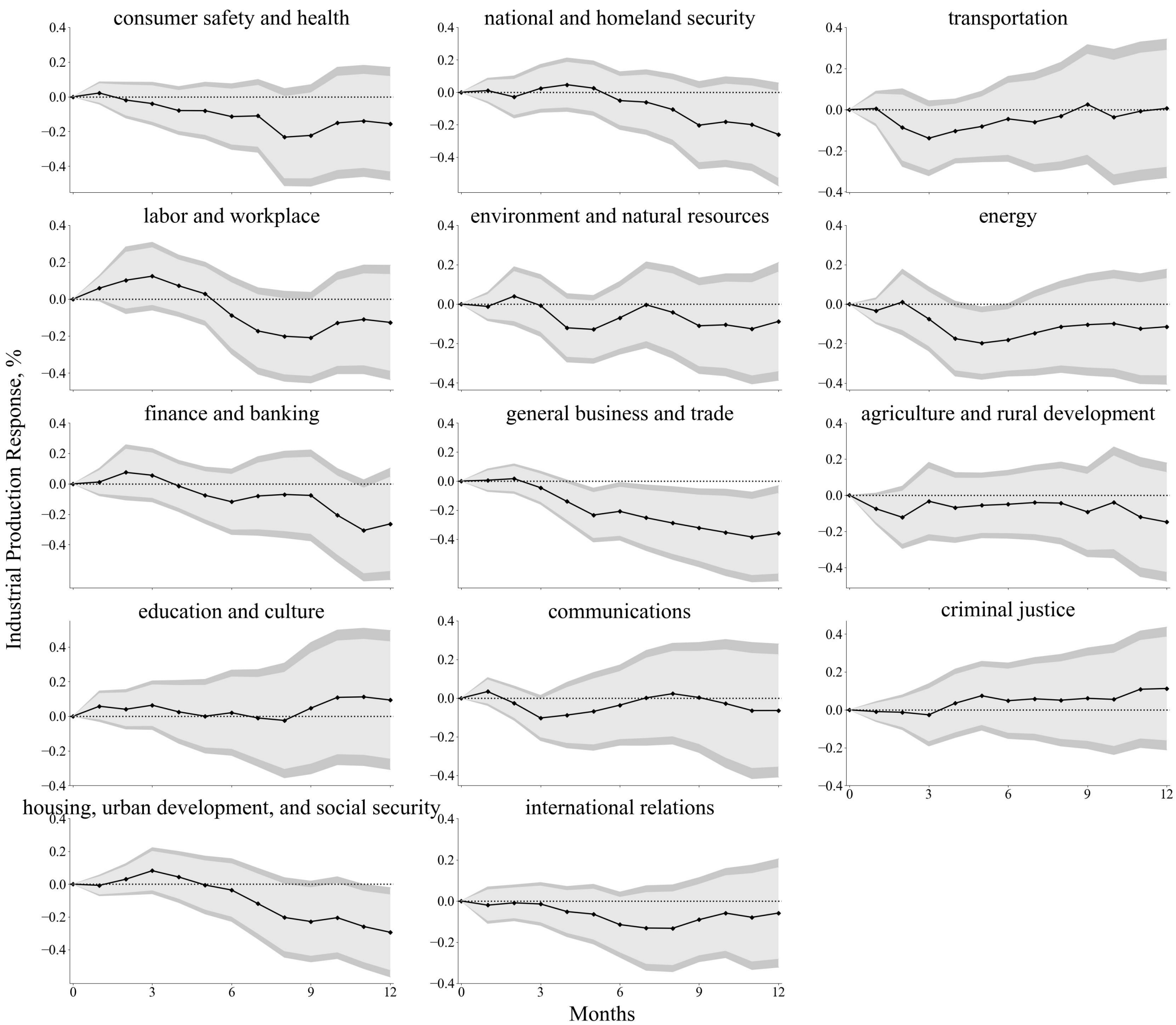
Notes: The figures plot impulse responses of industrial production to a one-standard-deviation negative sentiment shock for each regulatory policy area. The sentiment indexes are estimated using the Loughran and McDonald (LM) dictionary. The impulse response functions are estimated from local projections using monthly data from January 1985 through December 2021. Shaded areas show 90 (light gray) and 95 (dark gray) percent confidence bands.

Q.2 Employment Responses to Regulatory Sentiment Shocks



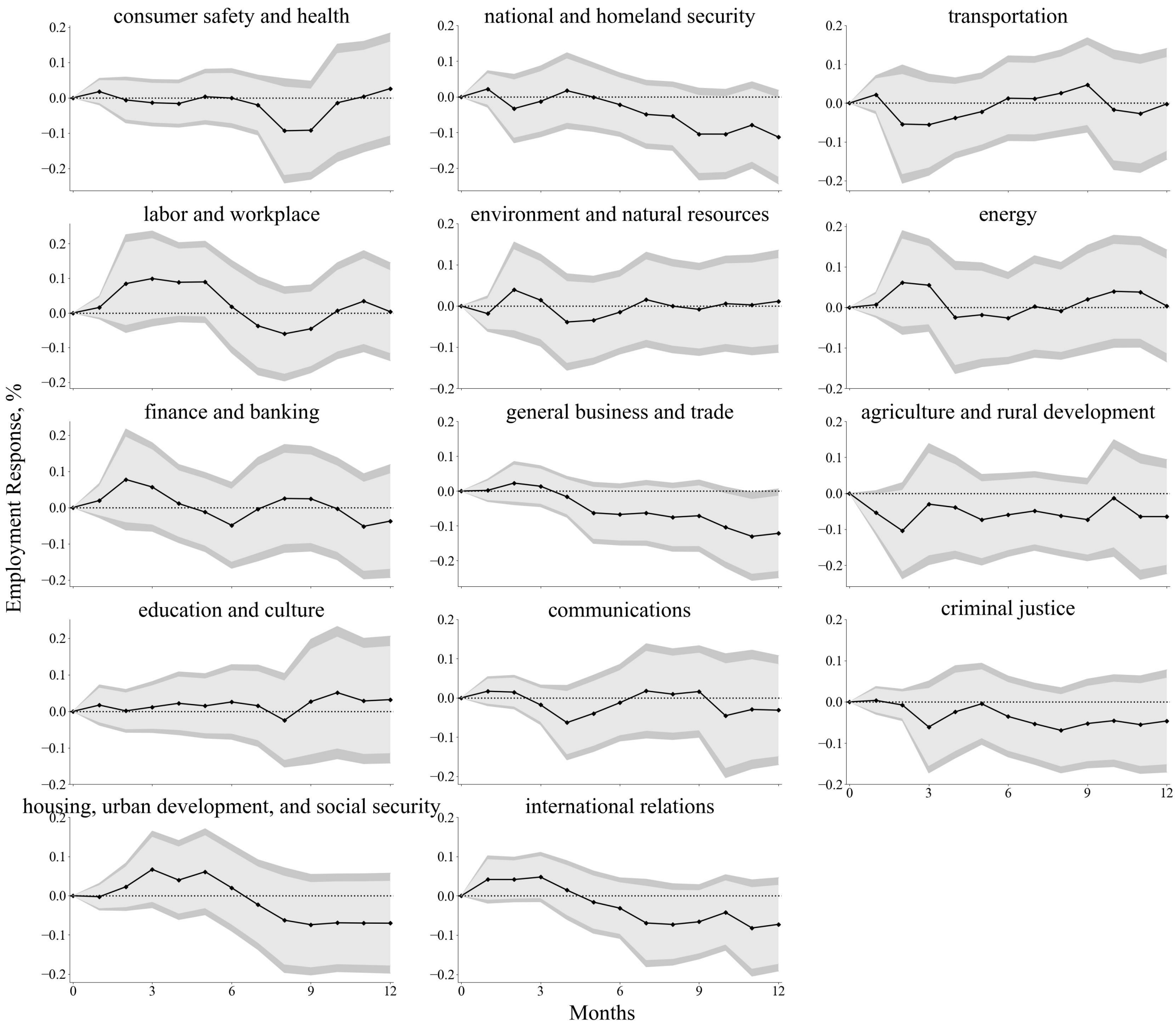
Notes: The figures plot impulse responses of employment to a one-standard-deviation negative sentiment shock for each regulatory policy area. The sentiment indexes are estimated using the Loughran and McDonald (LM) dictionary. The impulse response functions are estimated from local projections using monthly data from January 1985 through December 2021. Shaded areas show 90 (light gray) and 95 (dark gray) percent confidence bands.

Q.3 Industrial Production Responses to Regulatory Uncertainty Shocks



Notes: The figures plot impulse responses of industrial production to a one-standard-deviation upward uncertainty shock for each regulatory policy area. The impulse response functions are estimated from local projections using monthly data from January 1985 through December 2021. Shaded areas show 90 (light gray) and 95 (dark gray) percent confidence bands.

Q.4 Employment Responses to Regulatory Uncertainty Shocks



Notes: The figures plot impulse responses of employment to a one-standard-deviation upward uncertainty shock for each regulatory policy area. The impulse response functions are estimated from local projections using monthly data from January 1985 through December 2021. Shaded areas show 90 (light gray) and 95 (dark gray) percent confidence bands.