The Exaggerated Life of Death Panels: The Limits of Framing Effects on Health Care Attitudes

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Abstract

Experiments demonstrate that framing can influence public opinion. Yet in practice, political elites employ frames in use by the public, making their causal effects unclear. The 2009-12 health care debate provides an unparalleled opportunity to observe the interplay of elite rhetoric and public opinion. This paper couples automated content analyses with survey data from 30,370 Americans to better measure elite frames, public opinion, and their relationship. Multiple empirical tests uncover only limited evidence of framing effects. While the frames employed by political elites are punctuated, mass attitudes are not. Nor do we observe opinion shifts among the subgroups targeted by frames. Even the language Americans use to explain their opinions proves generally stable, although there is evidence that the public adopts the language of both parties' elites in a roughly symmetric fashion. The automated analysis of elite rhetoric and open-ended survey questions shows considerable promise in illuminating elite-mass interactions.

Introduction

March 2010 represented a turning point in the health care debate, as the House of Representatives passed the sweeping health care reform legislation known as the Affordable Care Act (ACA) or "Obamacare." In the period since then, the law has typically been viewed unfavorably by a plurality of Americans (but see Berinsky and Margolis, 2011), with those who hold "strongly unfavorable" views consistently outnumbering those with "strongly favorable" views (Kaiser Family Foundation 2012; see also Sussman, Blendon and Campbell 2009). Opposition to the ACA had a demonstrable political impact, reducing support for Democratic candidates in the 2010 elections (Konisky and Richardson, 2012; Nyhan et al., 2012). To many political commentators, the strength of this opposition was evidence of the effectiveness of its opponents' rhetoric. For instance, the *New York Times* stated the conventional wisdom when it wrote that "the Obama administration and Democrats...largely lost the health care message war in the raucous legislative process"(Steinhauer and Pear, 2011).

Scholars have joined commentators in contending that politicians' rhetorical choices influenced public views of health care reform, with former Alaska Governor Sarah Palin's use of the term "death panels" cited as particularly effective anti-ACA rhetoric (Shapiro and Jacobs, 2010; Nyhan, 2010; Scherer, 2010; Krugman, 2012). The notion that rhetoric can influence public opinion is closely related to the concept of issue framing, a concept that has received sustained attention from political scientists in recent years (e.g. Iyengar and Kinder, 1987; Iyengar, 1991; Nelson, Clawson and Oxley, 1997; Mutz, 1998; Berinsky and Kinder, 2006; Chong and Druckman, 2007*a*,*b*; Smith, 2007; Baumgartner, De Boef and Boydstun, 2008; Winter, 2008; Chong and Druckman, 2010; Huber and Paris, 2012). In the words of Kinder (1998), issue frames "define what the problem is and how to think about"(pg. 170). Issue frames are rhetorical structures which emphasize a subset of the considerations relevant to a given issue. Issues of public policy are usually complex, giving political elites the capacity to focus on aspects of the problem that advantage their side

of the argument (see especially Riker, 1986; Jacobs and Shapiro, 2000). The influence of frames or related concepts is an area of substantial interest for researchers in fields from psychology and linguistics (e.g. Lakoff and Johnson, 1980; Bargh, 2006) to marketing and sociology (e.g. Gamson, 1992; Heath and Heath, 2007) as well.

There is a wealth of evidence from survey experiments that frames' differential emphases can influence Americans' political attitudes (Iyengar and Kinder 1987; Chong and Druckman 2007*b*, 2010; but see Druckman 2001; Druckman and Nelson 2003; Huber and Paris 2012). While there is some observational evidence from shifts in salient frames as well (e.g. Kellstedt, 2003; Jacobs et al., 2003; Entman, 2004; Smith, 2007; Baumgartner, De Boef and Boydstun, 2008; III, 2009), it seems safe to conclude that scholars know less about how framing operates in real-world conditions (see also Chong and Druckman, 2011). Still, there are a number of reasons to suspect that framing's real-world influence might be more limited and contingent than experimental studies imply (Barabas and Jerit, 2010), from public inattention (Prior, 2007; Arceneaux, Johnson and Murphy, 2012) to conflicting media incentives (Entman, 2004) and political parties' internal coordination problems.

Here, we focus on a threat to external validity that the experimentally driven framing literature is not designed to address: the possibility that political elites adopt frames already in widespread use among the public. Contemporary political elites craft their language using polling and focus groups (Jacobs and Shapiro, 2000; Jacobs and Burns, 2004), a practice which might make salient frames more of a reflection of public opinion than an independent influence on it. When scholars generalize the results of framing experiments to real-world settings, we implicitly assume that elites have leverage in choosing which frames to adopt. If elites are adopting the frames already salient among the public, that assumption might prove inaccurate. This manuscript thus develops tests of framing effects that are robust to the endogenous influence of public opinion on elites' choice of frames (see also Chong and Druckman, 2011; Nelson, 2011).

The public debates surrounding health care reform provide an unusual opportunity to test the

influence of frames on public opinion. Health care reform is a multifaceted issue, giving supporters and opponents alike framing opportunities (Jacobs and Shapiro, 2000). And frame they did. In September of 2009, President Obama gave a prime-time Congressional address devoted entirely to health care. Between January 2009 and December 2010, U.S. Senators sent out 1,488 press releases related to health care reform. The fact that the debate stretched over many months gave political elites and interest groups time to test, hone, and change their appeals.

The lengthy debate also gave the American public time to get information about the issue. By December 2010, more than 40% of Americans had seen at least one television advertisement on health care reform. In addition, the Kaiser Family Foundation's monthly cross-sectional surveys provide researchers with more than 30,000 fully observed respondents who were asked about health care reform between January 2009 and January 2012. Critically, the Pew Research Center and the Kaiser Family Foundation together asked open-ended questions about health care reform in seven different surveys. By coupling these data sources with emerging tools for automated content analysis, we are able to observe the specific words and frames that both elected officials and American citizens use to describe their views of health care reform—and we can do so before and after the issue became salient. This focus on word choice allows us to measure elite frames and public opinion on the same scale, and to identify the extent to which elite frames induce shifts in public arguments about a given issue. Moreover, the analysis of open-ended survey responses enables us to measure public opinion with more subtlety than is typically possible in observational settings.

The results indicate important limits on real-world framing effects. We first apply a clustering algorithm known as 'Latent Dirichlet Allocation" (Blei, Ng and Jordan, 2003) to Senators' press releases, and show that there is substantial over-time variation in the frames that elites employ. Yet public opinion on health care reform polarizes by partisanship and racial/ethnic indicators and then remains very stable thereafter (see also Henderson and Hillygus, 2011; Kriner and Reeves, 2012*b*), with little variability and no evidence that groups targeted by specific frames

respond accordingly. These initial analyses show that automated content analyses can improve the measurement of elite frames. Yet it can also allow us to analyze open-ended survey responses—and by doing so, we show that public opinion is stable not just in overall attitudes but also in the arguments Americans employ. Certainly, there is evidence that the public adopts the arguments made by political elites, and that it does so in a roughly symmetric fashion. But the broad contours of the public's arguments for and against health care reform were visible as early as July 2009, before the two parties began a multi-year struggle to reshape public opinion. In this case, framing induces detectable shifts in language, but not more widespread shifts in opinion.

This study also aims to contribute to research on the measurement of public opinion by illustrating the value of tools from automated content analysis, a fast-growing field within political science (e.g. Laver and Garry, 2003; Ho and Quinn, 2008; Lowe, 2008; Hopkins and King, 2010; Quinn et al., 2010; Grimmer, 2010; Grimmer and King, 2011; Spirling, 2011; Diermeier et al., 2012). Prior applications of automated content analysis have focused on lengthy, elite-level documents, from speeches and newspaper articles to treaties and judicial decisions. Yet this paper shows that these tools can also add substantial value when applied to open-ended survey responses that are typically no longer than a sentence. The analysis of respondents' language and the application of automated content analysis to public opinion research allows for richer and more subtle measures of public opinion, measures which have the capacity to improve our understanding of the interplay between elite arguments and mass opinion.

Hypotheses

Frames have been subject to a host of definitions, leading to concerns that the concept has become a "fractured paradigm" (Entman 1993; see also Nelson 2011). Here, we follow (Chong and Druckman, 2010) by focusing on issue framing, which they define as occurring "when a communication changes people's attitudes toward an object by changing the relative weights

they give to competing considerations about an object"(665). In recent years, a large body of experimental research has advanced our understanding of issue framing. Separate but related research has argued that political elites have incentives to frame issues in ways that increase support (Riker, 1986; Carmines and Stimson, 1989; Vavreck, 2009). Yet as this section argues, challenges remain in generalizing these experimental findings and elite-level predictions to real-world settings.

So defined, framing effects operate by influencing the cognitive accessibility of considerations relevant to an issue. Issue frames "embody a complex semantic structure"(Nelson 2011, pg. 192 ; see also Lakoff and Johnson 1980) which facilitates certain mental associations at the expense of many others. To invoke "death panels" is to foreground considerations about government control at the expense of considerations about access or cost. As a result, framing effects are expected to be stronger among those with more knowledge of a given subject, as they will have a wider variety of considerations to connect to that issue (Chong and Druckman, 2007*a*). The fact that framing effects operate through cognitive accessibility also means that they are likely be stronger among those with relevant personal experiences (Mutz, 1994; Strauss, 2009). Framing effects are distinctive from learning or persuasion, as the underlying mechanism of framing is the cognitive accessibility of competing considerations (see also Lenz, 2009; Huber and Paris, 2012). In observational settings, however, we commonly lack the measurement tools to differentiate framing from these related communication effects, an issue we address below.

The study of framing has developed rapidly in recent years, driven by experimental research embedded in surveys (Iyengar and Kinder, 1987; Iyengar, 1991; Zaller, 1992; Nelson, Clawson and Oxley, 1997; Mutz, 1998; Berinsky and Kinder, 2006; Chong and Druckman, 2007*a*,*b*; Winter, 2008; Chong and Druckman, 2010; Malhotra and Margalit, 2010; Slothuus and de Vreese, 2010; Druckman, Fein and Leeper, 2012; Huber and Paris, 2012). This research generates expectations about real-world framing, including the hypothesis that framing effects will be especially pronounced when the frames come from trusted elites within one's party and address salient issues

(Zaller 1992; Druckman 2003; Slothuus and de Vreese 2010; but see Bullock 2011). Attentive to concerns about external validity, scholars of framing have increasingly adopted research designs that more closely approximate real-world settings, whether by allowing for competition among frames (Sniderman and Theriault, 2004; Chong and Druckman, 2007*b*), differing frames over time (Chong and Druckman, 2010), or choices about exposure to frames (Arceneaux, Johnson and Murphy, 2012; Druckman, Fein and Leeper, 2012).

In the typical framing experiment, the researcher chooses the frames to manipulate with few limitations. Yet in real-world settings, politicians and political elites are likely to face significant limitations in choosing frames. One limitation stems from intra-party coordination problems, as lone officials are unlikely to advance frames that are at odds with their co-partisans. Even if parties successfully coordinate, the news media might prove uninterested in transmitting a frame to the public (e.g. Patterson, 1993; Entman, 2004). A related limitation stems from public inattention, as few prospective voters closely follow political discourse. Partisan polarization poses an additional limitation on framing. Citizens with partisan loyalties are likely to discount frames offered by elites from the other party (Zaller, 1992; Slothuus and de Vreese, 2010).

Still, the central limitation of interest here stems from the heavy use of polling and focus groups in shaping contemporary elite rhetoric (Jacobs and Burns, 2004), something that Jacobs and Shapiro (2000) illustrate in the context of the 1993-94 debate over health care. In salient, high-stakes debates, national political elites are likely to use information about public opinion to craft their appeals. As Jacobs and Shapiro (2000) note, "politicians track public opinion to identify the words, arguments, and symbols about specific policies that the centrist public finds most appealing"(48). If so, the real-world causal effect might be the opposite of that identified in experimental studies, with elites adopting the language and frames already in use among the public. This possibility suggests the importance of measuring not simply baseline opinion but also baseline word choice in public discussions of a given issue.

Given these limitations, it is not surprising that studies of real-world framing effects report

mixed results (e.g. Gamson and Modigliani 1989; Kellstedt 2003; Entman 2004; Smith 2007; but see Jacobs et al. 2003; III 2009), and that they have conceived of framing as an interactive process between public officials, journalists, citizens, and other actors (e.g. Jacobs and Shapiro, 2000; Baumgartner, De Boef and Boydstun, 2008). Also, research on real-world framing has typically examined changes in responses to close-ended survey questions over time, a fact which makes it difficult to distinguish framing from related processes such as learning (Lenz, 2009). In the empirical sections that follow, this paper contends that the use of automated content analysis and the measurement of public word choice over time can effectively address these limitations. In focusing on mass-elite interactions, this manuscript follows the advice of Chong and Druckman (2011).

Measuring Real-World Frames and Their Impacts

Multiple measurement problems have limited our capacity to study real-world framing and its influence on public opinion. At the elite level, it is difficult and resource-intensive to measure the frames that elites employ precisely, let alone observing their changes over time or their causes. Outside of experimental settings, surveys do not typically include the questions needed to observe the subtle changes in mass cognition that framing posits, such as the increased accessibility of certain considerations. Also, prior scholarship has not measured frames and public opinion on the same scale, making it difficult to test the alternative explanation that politicians adopt frames that are already in use among citizens.

This section contends that analyses of word choice at both the elite and mass levels offers substantial leverage to address these limitations—and thus to understand framing and mass-elite dynamics. It first outlines why a variant of cluster analysis—Latent Dirichlet Allocation (LDA) (Blei, Ng and Jordan, 2003)—is a promising technique for measuring elite frames in real-world settings. Departing from prior applications of LDA in political science (e.g. Schrodt, 2011;

Bagozzi and Schrodt, 2012; Lauderdale and Clarke, 2012; Rice, 2012), this section then proposes using LDA to analyze even one-sentence documents such as open-ended survey responses. By analyzing open-ended survey responses, we can also identify more subtle framing effects, such as changes in the rationale underlying a given policy attitude. This section then outlines how scholars can exploit changes in elite and mass word usage to examine whether elites are simply adopting mass-level language.

Measuring Elite Framing with LDA

As the theoretical discussion makes clear, issue frames are rhetorical structures which call attention to a subset of the considerations relevant to an issue. Frames are in essence subtopics of a larger issue. Demarcating frames necessarily has a subjective element. But at a time of fragmented and polarized sources of political information (Prior, 2007), how can we measure the prominent frames in a real-world political debate?

Frames are closely associated with a speaker's choices of words. Given that, we might think of frames as being probability distributions over the relevant vocabulary. The health care frame emphasizing an expansion of governmental authority is more likely to use words including "government," "takeover," and perhaps "death" or "panel." In such a frame, terms like "affordable" or "pre-existing condition" would have far lower probabilities of occurring. In recent years, computer scientists have developed models that closely match this conception of frames as being probability distributions over a vocabulary. The most prominent of such models is LDA, a multilevel Bayesian model (Blei, Ng and Jordan, 2003). LDA represents each document in a collection or corpus of texts as a mixture from a pre-defined number of clusters or topics. This means that a single document can draw from different clusters–or frames, in the application below. Each cluster is in turn represented by a distinctive probability distribution over the corpus's vocabulary.

To understand LDA, it is valuable to state the model formally using the notation of Blei, Ng and Jordan (2003). Let K be a pre-defined number of clusters in a set of documents, with

w a vector representing a document and V representing the number of unique words in the vocabulary. LDA models a collection of documents as emerging through the following process. First, the length of the document N is chosen from a Poisson distribution with prior parameter ξ ($N \sim Poisson(\xi)$). The length of the average document is thus increasing as ξ increases. Then, the distribution of topics in that document–a vector called θ–is chosen from a Dirichlet distribution with prior parameter α ($\theta \sim Dirichlet(\alpha)$). As α increases, the probability mass should be increasingly diffuse across the topics. From there, for each of the N words w_n, we first draw a word-specific topic z_n from a Multinomial distribution with parameter vector θ ($z_n \sim Multinomial(\theta)$), and then choose a word w_n from $p(w_n|z_n, \beta)$ ($w_n \sim p(w_n|z_n, \beta)$), where β is a $V \times K$ matrix indicating the probability that each of the K topics associates with each of the V words.

As with similar models in political science (Quinn et al., 2010; Grimmer, 2010), this approach can be highly valuable in reducing the dimension of a textual data set and in partitioning a set of documents into meaningful subtopics. The fact that the Dirichlet distribution is conjugate to the Multinomial enables researchers to fit the model using either a Gibbs sampler or variational inference (Blei, Ng and Jordan, 2003; Grimmer, 2011).[1]

Analyzing Open-Ended Survey Responses

The impacts of real-world frames are almost always measured using survey questions with fixed responses. The use of closed-ended survey questions allows for easy comparisons across respondents, as all responses are on the same scale. Yet it has limitations as well. Open-ended survey

[1]In theory, LDA has an important limitation when applied to framing. Political rhetoric commonly involves invoking a combination of frames, such as mentioning both rising taxes and expanding governmental authority. Yet LDA's use of the Dirichlet distribution to model topic generation means that the topics are assumed to be independent of one another. We confirm our analyses of elite rhetoric with the Correlated Topic Model (Blei and Lafferty, 2006), which replaces the Dirichlet distribution giving rise to the topic probabilities. Specifically, instead drawing θ from a Dirichlet distribution, CTM draws a parameter η from a normal distribution with mean μ and covariance matrix Σ. By transforming η using the logistic transformation $f(\eta_i) = \frac{exp(\eta_i)}{\sum_j exp(\eta_j)}$, we can simultaneously estimate the covariances between the topics Σ and constrain the topic probabilities $f(\eta)$ to the simplex.

questions are known to provide a window into citizens' cognitive processes (Fowler 1995, pg. 178; see also Bradburn 1983). Summarizing this trade-off, Payne (1951) writes that an open-ended question's "virtues and its fault all stem from this open feature. Its results are as full of variety as a country store, and just as hard to divide into departments"(54). Open-ended questions elicit additional information, but information which is more difficult to summarize or compare across respondents. Automated techniques like LDA have the potential to reduce the disadvantages associated with open-ended questions, as they enable us to cluster responses based on the words they use. We can identify that a respondent complaining about "too much control" and one talking about a "government takeover" are voicing related concerns. Yet to date, within political science, LDA and similar techniques have been applied primarily to lengthier documents of at least a few hundred words (e.g. Quinn et al., 2010; Grimmer, 2010; Grimmer and King, 2011; Schrodt, 2011; Bagozzi and Schrodt, 2012; Lauderdale and Clarke, 2012; Rice, 2012). Empirically, it is unclear whether brief open-ended responses of several words will provide sufficient density for such techniques to return meaningful clusters (see also Song et al., 2011; Guo and Diab, 2011; Tang et al., 2012).

Even without a clustering technique, the ability to analyze the words that Americans use to explain their health care views provides leverage in understanding framing. Words are the way that we identify elite frames, but to date, they have not been part of scholars' strategy for measuring framing effects among the public. By comparing elites' and citizens' word use, we will be able to measure whether the public adopts elite-level word choices as the health care debate unfolds. This approach allows for a more subtle test of framing than is commonly found in real-world framing studies, as we can observe whether citizens adopt elites' messages in explaining their views. This approach also has the critical advantage that it allows us to rule out endogeneity in word choice. By observing both mass and elite language at multiple points in time, we can identify whether elites are adopting the frames already prominent among the public.

Elite Framing: Data and Results

In the course of a campaign or debate, frames shift as circumstances change. Claims that health care reform was being passed through corrupt, back-room deals became meaningful only as the legislative process unfolded. To observe shifting frames, we need sources of political rhetoric that are available at many points in time. Since this paper's primary goal is to assess politicians' framing capacities, we also prefer rhetoric that is not yet filtered by the media. Speeches on the House or Senate floor might prove useful, but they are available primarily when a bill is formally being debated, truncating the over-time variation. For those reasons, press releases are an unparalleled source of information, as Grimmer (2010) shows. From January, 2009 to July 2010, U.S. Senators alone sent out 1,488 press releases using a health care-related term.[2] Often written in a form that mimics newspaper articles, press releases enable politicians to frame the issues in their preferred way. Figure 7 in the Appendix depicts the distribution of press releases by month, and shows that they peak at times of key legislative events.[3]

To prepare the press releases and television appearances for model-fitting, they were first pre-processed using common techniques (e.g. Quinn et al., 2010; Hopkins and King, 2010). All words were reduced to common stems such as "senat" for "Senate,", "Senator," etc. (Porter, 1980), and those word stems that appeared in fewer than 1% of the documents were removed. Our analyses focus only on single words or unigrams, although incorporating common bigrams (such as "public option") would be a straightforward extension. In all, this pre-processing leaves us with 2,043 word stems.

[2]The search terms were "healthcare", "health care", "obamacare", "health reform", and "health insurance reform."

[3]To supplement the press releases, additional analyses consider all 221 Sunday television appearances by figures of both parties, including Senators, Representatives, and members of the Obama administration that dealt with health care reform. Such press appearances are widely seen as attempts at agenda-setting, and present prime opportunities to offer health care-related frames. We collected such press appearances from five media outlets: Fox News, CNN, ABC, NBC, and CBS.

Elite Framing: Results

To assess framing effects, we must first identify the elite frames employed in a given policy area. This section does so by applying LDA to 1,488 press releases from U.S. Senators between January 2009 and December 2010. Specifically, with the `topicmodels` package for R, we fit LDA using a Gibbs sampler.[4] LDA returns a θ vector of length $K-1$ indicating the topic probabilities as well as a β matrix. The β matrix has dimension $K * V$, with each cell indicating the probability that each word would be used conditional on each topic.[5]

After initial tests, we chose 12 clusters as a substantively meaningful representation of the press releases. Figure 1 illustrates the resulting clusters for LDA estimated via Gibbs sampling.[6] The first cluster is presented at the top left. For each cluster, the corresponding figure shows the smoothed probability over the prior 30 days of press release content falling into that cluster. Solid blue lines indicate trends in cluster usage among Democrats, while the dashed red lines do the same for Republicans. Each cluster is labeled with the 15 word stems with the largest differences in probabilities between that cluster and the corpus overall.

[4]The Gibbs sampler was run for 200,000 iterations after discarding 30,000 burn-in iterations, and then thinned by 1/1000. The prior for α is set to 50/K, or 4.1667. We fit the CTM using variational expectation-maximization, with the two tolerance parameters set to 10^{-5}. The convergence of the Gibbs sampler was checked informally by running it three times with varying starting points and observing essentially identical clustering patterns; for formal evidence, see the cumulative summation plots for the topic probabilities for the first 50,000 iterations in Figure 9 in the Appendix.

[5]CTM also returns a $(K-1) \times (K-1)$ matrix Σ indicating the covariances between the transformed topic probabilities.

[6]For the robustness check using CTM, see Figure 10 in the Appendix.

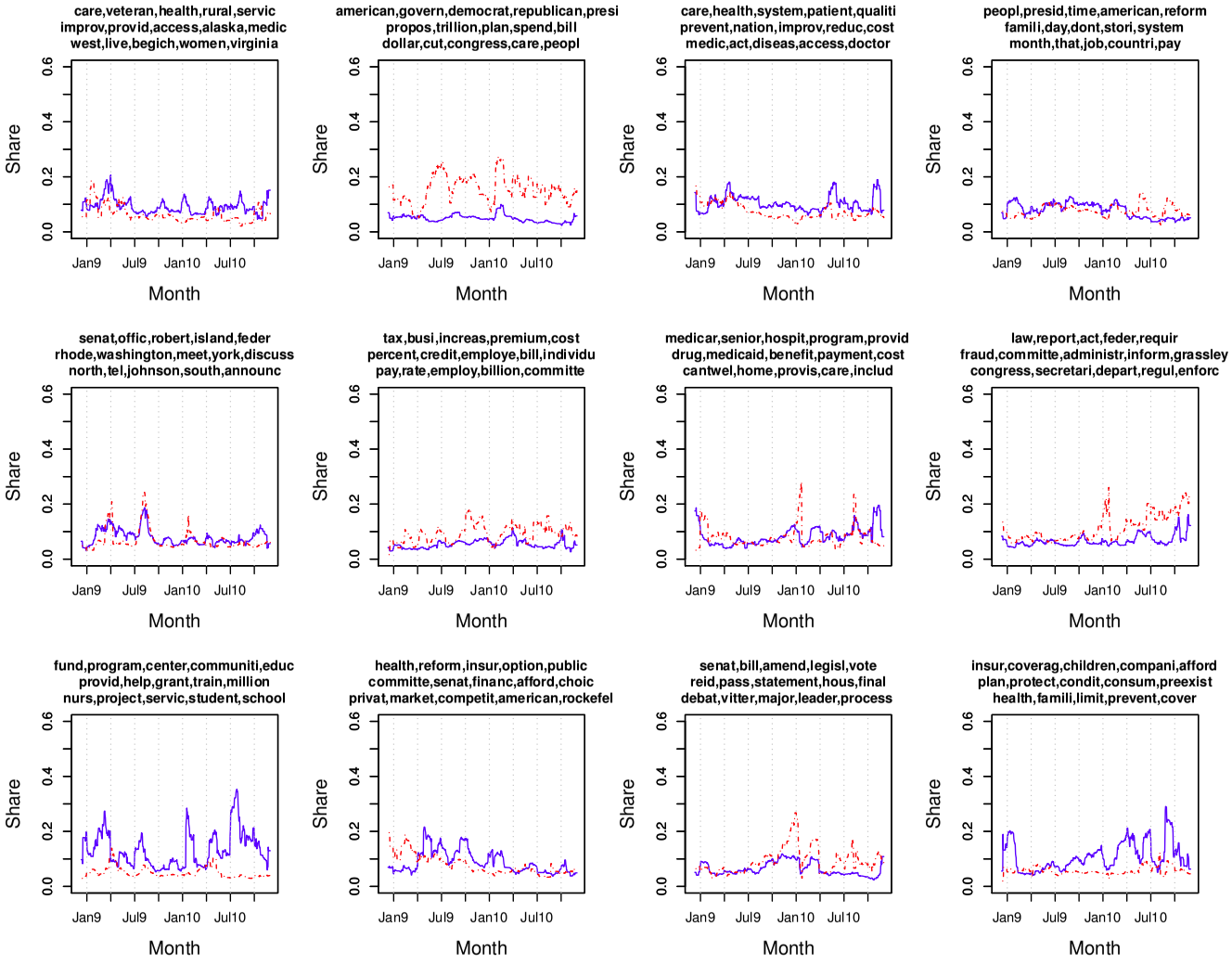

Figure 1: Variation in Topics Over Time. Model: LDA, fit to 1,488 press releases.

The LDA results in Figure 1 have several notable features. Certainly, the clusters returned correspond in sensible ways to our expectations. For instance, there is a frame that emphasizes the legislative process, which is defined by word stems including "senat", "bill", "amend," "legislate," and "vote" (see Figure 1, bottom row, second from the right). Not surprisingly, this frame accounts for some of the language throughout the debate: reporting on legislative actions is among Senators' primary goals in communicating with the public. Still, this frame becomes polarized in December of 2009, reaching a peak of 27% of all word usage in Republican press releases. This timing makes sense, as that is precisely when health care reform legislation moved to the Senate floor and when Senate Majority Leader Harry Reid's side-deals with Joseph Lieberman and Ben Nelson took place. Elite frames do track political events (see also Jacobs and Burns, 2004).

Another prominent Republican cluster throughout the debate draws on word stems including "American," "govern," "Democrat", "Republican," "trillion," and "spend" (top row, second from left). That frame emphasizes the cost of the legislation and the increasing role of government it entails. It, too, reaches a maximum of 27% of all Republican content. True to Republican strategist Frank Luntz's spring 2009 advice,[7] the GOP consistently discussed health care reform as a costly expansion of government. It is also worth noting that the words "death" and "panel" are not a constitutive element of this or any cluster.

A third heavily Republican cluster is more oriented towards business costs and taxes, with prominent word stems including "tax," "business," "increase," "premium," and "cost" (middle row, second from left). This frame emerges in the fall of 2009, and is more common in the early stages of the debate. It accounts for 18% of Republican rhetoric at its zenith. Notice as well the Medicare-oriented frame, defined by stems including "medicare", "senior", "hospit",and "program" (middle row, second from right). This frame is used by both parties, but with a spike in Republican usage in January of 2010 that reaches 28%. Just after health care reform passed

[7]In a memorandum, Luntz argued: "Stop talking economic theory and start personalizing the impact of a government takeover of healthcare... they are deathly afraid that a government takeover will lower their quality of care."

the U.S. Senate, Republican press releases portrayed health care reform as undermining Medicare. Again, Republican Senators framed health care reform in different ways as the debate unfolded.

The LDA-based partitions also allow us to observe the heavily Democratic clusters, including a "public option" frame—"health," "reform", "insurance," "option," and "public" (bottom row, second from the left)—which was more salient in the fall of 2009 than it was later, and which accounts for up to 22% of Democratic rhetoric. The suggestion of Lynch and Gollust (2010) that Democratic rhetoric emphasized affordable insurance coverage and middle-class economic security proves accurate. See, for example, the cluster defined by the stems "insure," "coverage", "children", "company," and "afford" (bottom right), which reaches a maximum of 29%. Given the prior for α, it is not surprising that the LDA model distributes the probability relatively evenly across the twelve categories. The lowest-probability frame still had 0.074 of the total probability mass, while the highest-probability frame had only 0.092. When considering the difference between the 916 Democratic press releases and the 552 Republican press releases, the average absolute difference across topics is 0.04. When viewed over time, the average standard error within a topic is 0.07 for Republicans and 0.08 for Democrats, indicating substantial punctuation over time.[8]

As a robustness check, we also fit an LDA model using the transcripts from 221 appearances on Sunday talk shows by Members of Congress and Obama administration officials between July 2009 and March 2010, when the legislation was signed into law.[9] In television appearances, officials are speaking to a much broader audience, and we observe exactly what attentive citizens observe. The results are presented in Figure 11 in the Appendix—and despite the markedly smaller sample size, they corroborate the core claims made above using Senators' press releases. Republicans are consistently more likely to talk about "trillions" and "taxes," and their discussion of "Medicare" and "cut" peaks in January of 2010. The Democrats are likely to draw from a

[8]While most of these clusters are frames which emphasize a subset of the health care debate, some are procedural clusters without significant framing value. The cluster labeled with the stems "law," "act," "report," "feder," and "require" appears to be one such cluster.

[9]In this data set, we use 1,606 separate word stems that appear in more than 1% of appearances.

cluster of words including "public" and "option" early in the debate, and to talk in terms of "coverage," "benefits," and the "system." While our conclusions about framing are drawn from Senators' press releases, they are not specific to that mode of communication. Elite frames on health care show considerable over-time variability.

Frames and Sub-group Opinion

LDA is a promising tool with which to measure elite-level framing, and it identifies substantial variability in the health care frames used by Senators. We now proceed as analyses of real-world framing typically do and examine closed-ended survey data. Doing so allows us to assess the stability of public opinion on health care reform, which might place an upper bound on framing effects: variable elite frames cannot explain stable opinions. Analyzing citizens' closed-ended assessments of health care reform also enables us to measure sub-group trends that provide tests of targeted framing effects. The results advance the claim that real-world framing effects are limited, as we find no evidence that sub-groups targeted by frames subsequently shift their attitudes. At the same time, the limitations of this common approach help motivate the use of open-ended responses to measure public opinion and mass-elite interactions.

To analyze public health care attitudes, we turn to 32 telephone surveys of American adults conducted by the Kaiser Family Foundation between February 2009 and January 2012. With at least 1,200 respondents, the Kaiser surveys jointly provide us with information on 30,370 Americans' attitudes toward health care reform.[10] For this analysis, we focus on a single question: "Do you think the country as a whole would be better off or worse off if the president and Congress passed health care reform, or don't you think it would make much difference?"[11] This question was asked consistently throughout the debate, providing us with a common metric of respondents'

[10]Prior to listwise deletion, there are 43,887 respondents. The results remain quite similar when omitting the measure of respondents' income, which itself accounts for 47% of the missingness.

[11]After the bill's passage, the language was modified to ask about conditions "under the new health reform law."

health care reform attitudes. The responses are coded on a scale from 1 to 3, with 1 indicating that the country will be worse off, 2 indicating no difference, and 3 indicating that the country will be better off. The over-time decline in positive assessments of health care reform is visible in Figure 8 in the Appendix.

Drawing on Gelman and Hill (2006), the analysis proceeds by estimating separate linear models of attitudes toward health care reform in each month. The models include basic demographics, such as a respondent's gender, race, ethnicity, age and education in years, and income in thousands of dollars. They also include measures for self-reported Republicans and Independents, although in most administrations the survey did not push Independents to "lean" to a party. In addition, the models employ a few health care-related measures that gauge respondents' self-interest in the debate. These include indicator variables for receiving Medicare or Medicaid as well as an indicator for lacking health insurance and a five-category measure of self-reported health. To analyze any shifts in public opinion over time, the analysis ran separate linear regression models for each month's survey. It then aggregated each variable's coefficients into a single plot, presented in 2. The x-axis indicates time while the y-axes indicate the size of each coefficient. Note that the scale of the y-axis differs by variable. Each dot indicates the corresponding month's mean coefficient, while the surrounding line depicts the 95% confidence interval. The coefficients are listed separately in Table 2 in the Appendix.

The first thing to notice is an observation made by Kriner and Reeves (2012*a*,*b*), Henderson and Hillygus (2011), and Richardson and Konisky (2012): partisanship is a uniquely powerful predictor of attitudes toward health care reform, and increasingly so as the debate went on. From the coefficient magnitudes, we see that identifying as a Republican or as an Independent leads to markedly reduced assessments of health care reform's benefits. There are small but discernible changes over time in these coefficients, with increasing evidence of partisan polarization as the debate unfolds. We see, for example, that Republican identifiers are less negative on health care reform during the spring and summer of 2009, when President Obama was still enjoying a

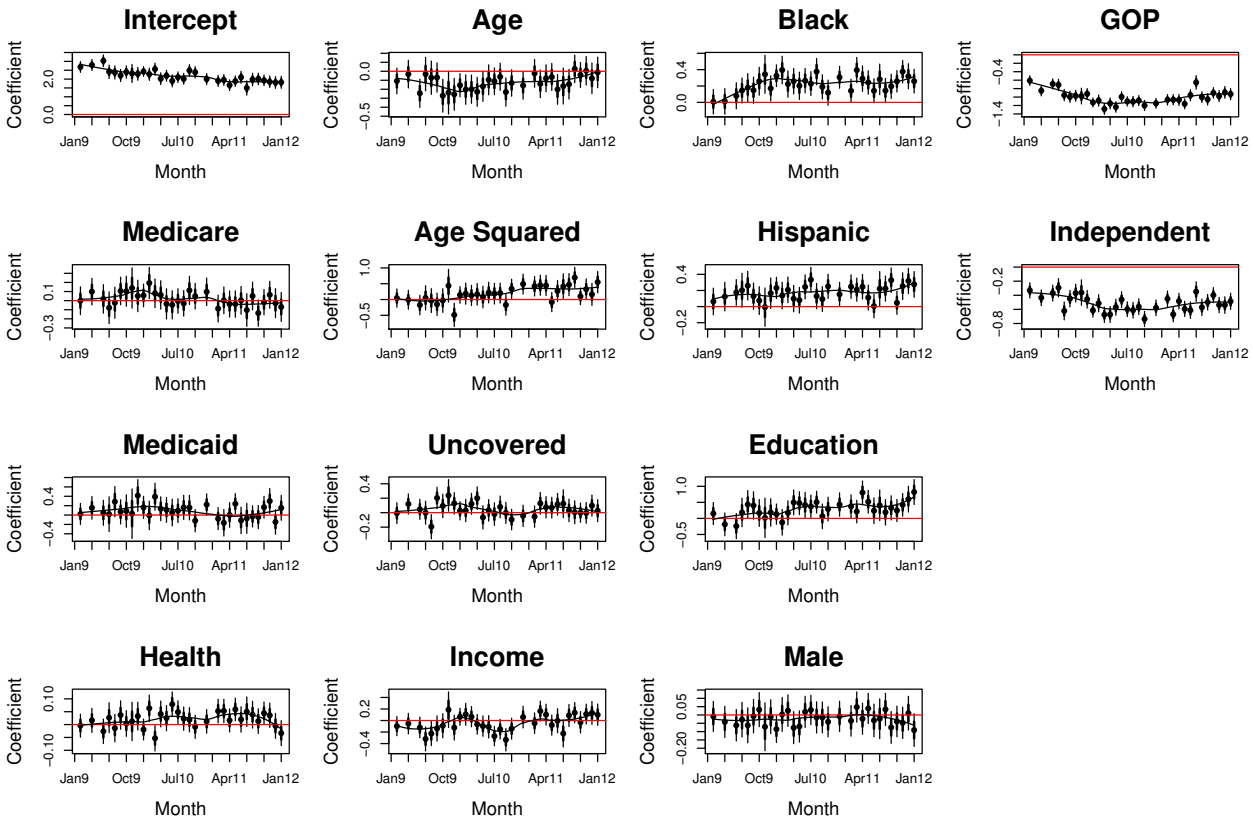

Figure 2: Data: 30,370 American adults interviewed in 32 monthly Kaiser Family Foundation surveys between February 2009 and January 2012. The x-axis indicates the number of months into the Obama administration, meaning that "15" labels March 2010, the month that health care reform passed. The dependent variable is each respondent's assessment that health care reform is good for the country as a whole, measured on a scale from 1 ("worse off") to 3 ("better off"). Each dot indicates the mean coefficient estimate for an OLS model of that month's data, with lines reflecting 95% confidence intervals.

honeymoon and when the health care had yet to take center stage. GOP assessments of health care reform drop notably in August of 2009, as angry town hall meetings captured national media attention. They then remain at a plateau during the fall of 2009 before dropping again in January 2010, just after the ACA passed the U.S. Senate. Both the GOP and Independent coefficients reach their nadir around the spring of 2010, when the ACA was passed and signed

into law. As with several other covariates, including the indicators for race and ethnicity (see also Henderson and Hillygus, 2011; Tesler, 2012), the pattern for partisanship shows initial polarization in the early months of the debate and then impressive stability thereafter. Notice as well that the objective measures of self-interest, such as self-reported health or receipt of Medicare or Medicaid, have very little predictive power at any point during the debate (see also Richardson and Konisky, 2012). Those without health care coverage are mildly more positive in their assessments, but there is little evidence those assessments are bolstered by Democrats' use of related frames just after the law's passage. This contrasts with findings for subjective measures of self-interest reported in Henderson and Hillygus (2011). If anything, Medicare recipients appear slightly more positive about health care reform in early 2010, when Republican Senators were emphasizing its reductions in Medicare spending (but see Campbell, 2011).

Figure 2 also demonstrates the stability of opinions, especially after the issue of health care reform became salient in August and September of 2009. (For a measure of the salience of health care reform, see the distribution of press releases by month in Figure 7 in the Appendix. The volume of press releases on health care rises steadily from August 2009 to a peak in December of 2009, and then peaks again in March of 2010 with the law's passage.) The changes afterward tend to be small, such as the potential uptick in positive views among the well-educated in late 2011, the gradual increase in support among the elderly, or the gradual decline in the baseline respondent. This stability of sub-group opinion contrasts with the punctuation in frames identified above: the sudden shifts in elite framing do not match up with the stability of sub-group opinion. In that way, these results amplify the conclusion of Druckman, Fein and Leeper (2012) that choosing to be exposed to certain initial health care frames induces opinion stability thereafter.

Granger Tests of Framing Effects

Expecting a single frame to produce a homogeneous effect across the population might set the bar for framing too high. Prior research shows that partisans respond to frames or arguments

in quite different ways (Zaller, 1992; Bartels, 2002; Taber and Lodge, 2006; Levendusky, 2009; Gerber and Huber, 2010), and Americans' responses to health care frames might also hinge on their their personal relevance (e.g. Mutz, 1994; Strauss, 2009). We thus consider whether three of the pronounced shifts in framing identified above disproportionately influenced the sub-groups targeted by those frames. First, if the sudden spike in Medicare-related rhetoric by Republicans in January 2010 was influential, those on Medicare might become less sanguine about health care reform just afterward. Second, if the Democratic emphasis on extending coverage and increasing its affordability after the law's passage was influential, we might expect the prominence of that frame to be especially powerful among those without health insurance. Alternately, the Republicans drew from a frame about rising taxes and increased business costs at multiple times, a frame that might have been more influential among well-to-do respondents.

To test these possibilities, we begin with the 20 months for which we have Senators' press releases and public opinion data, which covers the period from February 2009 to December 2010. We extract the relevant coefficient from the regressions conducted above which predict assessments about health care reform's impact on the country as a whole. We then use Granger tests to examine the sequencing of the frames and any shifts in sub-group opinion during the subsequent month. To measure frames, we consider both the difference in partisan usage of the frame and the share of usage by the party deploying the frame strategically, as Table 1 shows. On the Medicare frame, for example, we consider the difference between Republican and Democratic usage as well as Republican usage alone. Frames are measured based on the maximum share of a party's discourse that drew on related language in the prior month, although the results are robust to the use of means instead.

As the consistently high p-values indicate, there is no evidence that increased use of a frame shifts the opinion of the relevant sub-group in the subsequent month. This same pattern of null results holds if we increase the lag to two months. It also holds when we multiply the frame shares by the total number of press releases in each month, which allows us to measure the

Table 1: This table reports the results of Granger tests when examining the relationship between the "Medicare," "Coverage," and "Taxes" frames presented in Figure 1 and the opinions of relevant sub-groups as presented in Figure 2.

	F Statistic	P-Value
Medicare, GOP-Dem	0.367	0.553
Medicare, GOP	0.235	0.635
Coverage, Dem-GOP	0.349	0.563
Coverage, Dem	1.818	0.196
Taxes, Dem-GOP	0.697	0.416
Taxes, GOP	0.071	0.793

frames' salience.[12] Groups targeted by frames are not differentially responsive to those frames, a finding anticipated by Hersh and Schaffner (2012).

Open-Ended Responses over Time

When scholars measure the effects of framing, they almost exclusively rely on closed-ended survey questions asking about policies or political choices related to the frame (but see Gamson, 1992), as did the Granger tests above. Yet it is plausible that frames could influence public opinion without shifting overall policy attitudes: they might instead operate by shifting the reasons people give for a policy attitude, for example. In this section, we apply LDA to open-ended responses from seven surveys during the health care debate to examine the reasons respondents give for their views. Even given sparse responses that are rarely more than several words, LDA effectively partitions the responses into meaningful clusters, and enables scholars to observe the stability of public opinion through language.

We identified seven telephone surveys conducted from July 2009 through November 2011 which asked open-ended questions about respondents' views on health care reform. The first two

[12]Specifically, the p-values associated with the Medicare frame are 0.48 (when examining the difference between salient frames used by Republicans and Democrats) and 0.30 (when examining the salient frames used by Republicans). For insurance coverage, the comparable p-values are 0.52 and 0.40 (for the difference and Democratic salient frames, respectively), while for taxes they are 0.13 and 0.41 (for the difference and Republican salient frames, respectively).

surveys were conducted by the Pew Research Center in July (n=1,506) and November (n=1,003) of 2009,[13] while the remaining five were conducted by the Kaiser Family Foundation in May of 2010 (n=1,210), October of 2010 (n=1,202), March of 2011 (n=1,202), June of 2011 (n=1,201), and November of 2011 (n=1,209).[14] In all, we observe 8,533 responses over a period of 29 months spanning from before the salient public debate until a year after the 2010 mid-term elections. While reviewing the open-ended responses, we identified spelling or formatting errors in between 9% and 14% of the Pew open-ended responses and corrected them.[15] We then conducted standard pre-processing, including stemming words (Porter, 1980), removing stop words, and removing words of one and two letters. There are 3,715 unique word stems in the corpus as a whole, but we then remove all but the 225 word stems which appear in at least 0.25% of the documents. Our analyses focus on the 6,363 respondents who used at least one of those 225 words in their responses. Can LDA meaningfully structure text as sparse as open-ended responses?

As shown in Figure 3, the answer is an unambiguous "yes." The Figure presents the results using six panels, each of which illustrates the share of responses in a particular category over the first 36 months of the Obama administration. As a reference point, the health care reform debate became salient in August and September of 2009, which are the 8th and 9th months in the figure, and it was signed into law in month 15. The response shares among supporters and opponents are shown separately, with opponents depicted using dotted red lines and supporters depicted using solid black lines.

The cluster of words at the top left shows one coherent set of responses dominated by concerns about the expansion of government control. Unsurprisingly, this cluster is far more likely to be used by health care reform's opponents: it never accounts for more than 9% of supporters' words and always accounts for at least 18% of opponents' words. While there is some evidence of a

[13]Pew asked respondents, "what would you say is the main reason you favor/oppose the health care proposals being discussed in Congress?"

[14]The Kaiser question asked, "Can you tell me in your own words what is the main reason you have a favorable/an unfavorable opinion of the health care reform law?"

[15]For the Kaiser surveys, the comparable error rates were 1%-2%.

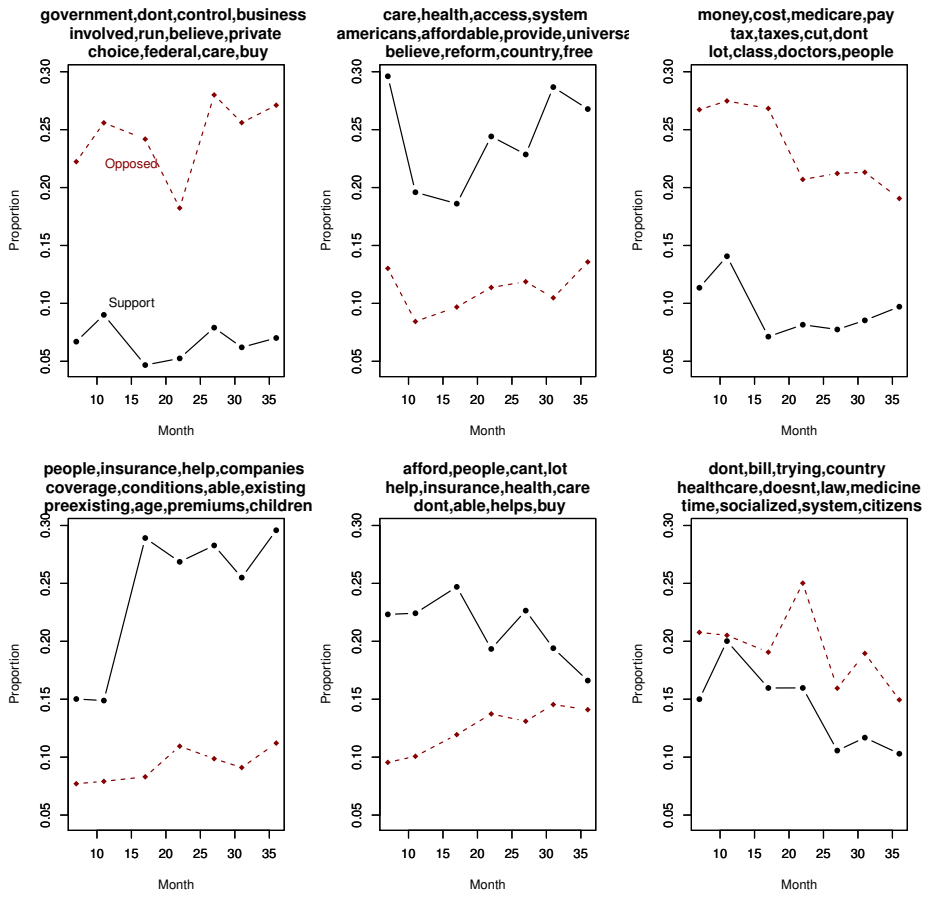

Figure 3: Variation in open-ended responses for health care reform supporters and opponents over time. The x-axis indicates months of the Obama administration. Model: LDA, fit to 6,355 open-ended survey responses in 7 surveys.

decline in its use in October 2010, the general trend is one of consistent usage. Opponents were concerned about health care reform's impact on the scope of government as early as July of 2009, before the issue became salient nationally, and remained so well after the polarized public debate and the passage of the law. The same is generally true for a separate cluster emphasizing the legislation's cost and tax impacts (top right), a cluster which declines in use but always accounts for at least 19% of opponents' explanations.

These two clusters both correspond to clusters of words identified above in the press releases of Republican Senators. But it is critical to note that these clusters were prominent in public opinion even before health care reform became a central issue in the late summer and early fall of 2009. The timing strongly suggests that the the effect of the elite-level frames was not causal: the core sources of opposition to the Affordable Care Act were visible long before the legislation itself took shape. While there is some evidence of a shift in rhetoric among health care reform opponents, there is also considerable stability. Consistently, opponents are concerned that the ACA represents an increase in governmental authority that is likely to entail significant costs to the government. Even the catch-all sixth cluster, shown on the bottom right, reinforces this point, as "socialized" is among its prominent words. In no case do we see the words "death" or "panel," an observation which further limits the direct impact of Governor Palin's formulation. In fact, in the first survey after Governor Palin's use of the term, not a single respondent employed the phrase.

The general theme of stability over the course of the debate is clear among supporters as well. We do see health care reform supporters shifting into the category defined by words like "people," "insurance," "help," and "companies" (see bottom left), although the concomitant decline is from a similar cluster emphasizing the affordability of health insurance (see bottom middle). What's more, even after the decline, 17% of all rhetoric from health care reform's supporters draws on affordability-related frames. Supporters also make heavy use of a frame emphasizing universal access and affordability (top middle), one defined by words such as "access,"

"affordable," "provide," and "universal." This frame always accounts for at least 19% of the explanations given by supporters for their views. It is worth noting that this frame is used somewhat more before the salient political debate (30% in July 2009) and afterwards (27% in November of 2011), meaning that it might be something of a default frame among supporters.

Elite-level framing might explain the observed subtle shifts from focusing on universal coverage and on affordability to focusing more specifically on insurance companies. Above, we saw that Democratic Senators focused on words like "insurance," "coverage," and "afford," a focus which grew more pronounced after the passage of the ACA in March 2010. Still, the overall finding is one of stability among mass-level supporters and opponents alike. There are shifts in the prominence of frames, but all of the core frames that citizens use during and after the salient moments of the health care debate were used to a significant extent beforehand as well.

Identifying Mass-Elite Convergence in Language

Both in experimental and real-world settings, studies of framing tend to analyze the effect of variation in frame exposure on public opinion, which is measured through closed-ended survey questions. Yet this approach has multiple limitations. One we began to address above: framing might influence the rationale behind a policy attitude without changing the attitude itself, making it plausible that the typical approach will underestimate framing effects. Second, to the extent that political elites use polls, focus groups, or other feedback from their constituents in developing frames, frames' purported effects could in fact be reflections of endogeneity. Put differently, politicians' might choose precisely those frames that resonate with pre-existing public opinion, making their causal impact unclear. As this section details, examining the relationship between elite and mass-level word choice over time provides a way to put both groups on the same scale and so to address these limitations.

We begin by identifying the word stems that appear both in more than 1% of the 1,488 press releases and in more than 0.25% of the open-ended survey responses. There are exactly 100 such

word stems. For these analyses, we focus on the open-ended responses from three surveys. The first is July 2009, before health care reform became salient with the August town hall meetings and the September Presidential address. The second is November 2009, in the thick of the legislative debate. And the third is in May 2010, more than one month after the passage of the ACA. We then identify the press releases that occur between each of these surveys, giving us three measurements of opinion and two measurements of elite framing. With baseline measures of public language on the issue, we are able to measure how it changes as the issue becomes salient and as political leaders deploy their frames. We can thus identify framing effects as separate from elites' co-optation of public language.

We aim to measure the relationship between elite rhetoric and mass rhetoric, and to chart changes in those relationships over time. We begin by representing a given set of surveys or press releases as a probability distribution across the V words in the overall vocabulary. The distribution of interest is $p(w_v) = \frac{w_v}{\sum_{i=1}^{V} w_v}$, calculated simply as the share of the total words in a given corpus accounted for by each particular word w_v. We can then calculate the distance d between the distribution of words in a group of press releases $p_{pr}(w_v)$ and the distribution of the same words among the public $p_{sur}(w_n)$ using any of several distance metrics (see also Grimmer and King, 2011). We focus here on *changes* in the distance metrics when comparing opinions prior to a set of press releases with those subsequent to the press releases. Declines in distance indicate that when elites adopt language in their press releases, the members of the public subsequently shift their vocabulary by adopting some of the same words.

To give some sense of these distributions, we plot the difference in the distributions of words for press releases in Figure 4. On the x-axis, we plot each word's overall frequency divided by its standard deviation across press releases, while on the y-axis we plot the difference in word usage between Democrats (positive numbers) and Republicans (negative numbers). For example, we see that the most Democratic word in press releases between July and October 2009 is "help," followed by "afford"; in the period from November 2009 to April 2010, those words are joined

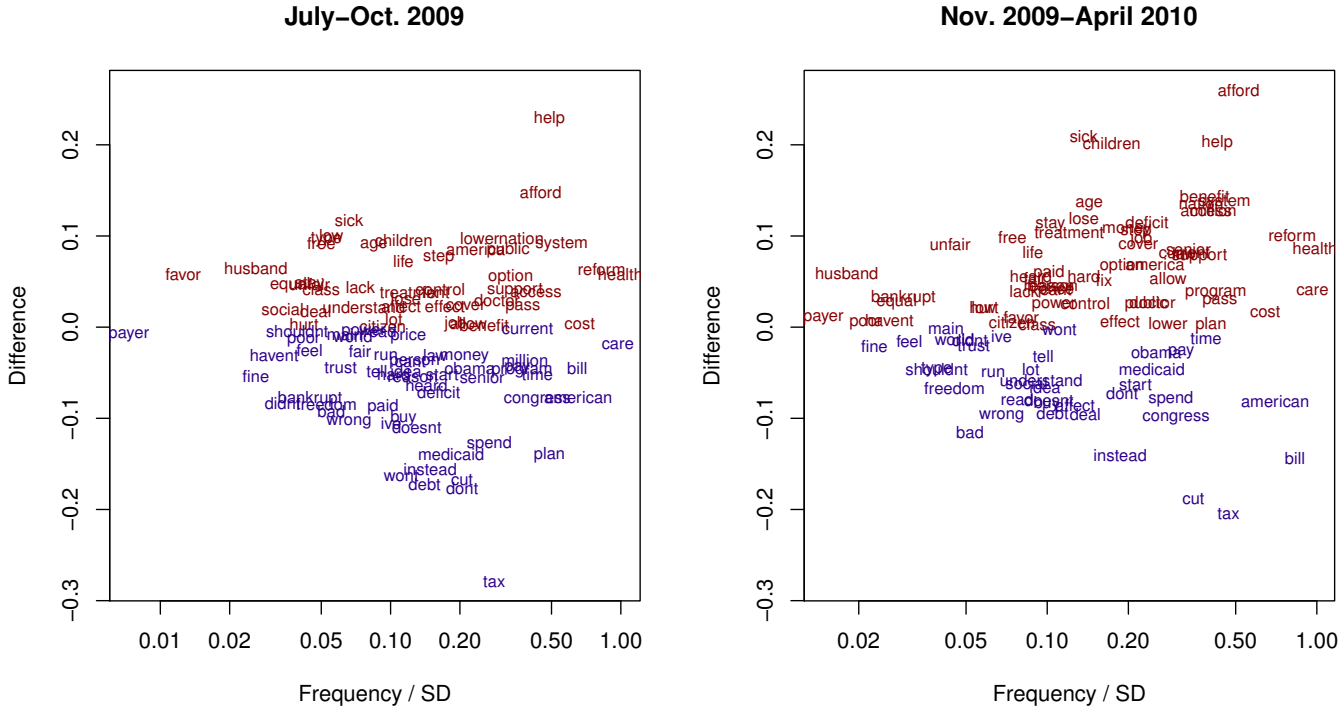

Figure 4: This figure presents the difference in word usage for Democratic and Republican press releases (y-axis) as a function of each word's overall frequency divided by its standard deviation (x-axis).

by "sick" and "children." For Republican Senators, the word "tax" is consistently prominent, followed in the second period by "cut" and "bill." Figure 5 shows the same results for the words used by supporters and opponents of health care reform in four of the surveys spanning from July 2009 to October 2010. Here again, the stability of the popular vocabulary on this issue is on display, with opponents consistently using words like "pay" and "money" and supporters using words like "help," "health," and "care."

Distance in Speech

How can we use these probability distributions to measure framing effects? To take a specific example, we measure the effects of Democratic frames on American citizens in the early stage of the debate by creating three vectors of word distributions. The first and second denote the distribution of words in the July 2009 Pew open-ended responses and in the November 2009 Pew open-ended responses, while the third denotes the distribution of words in Democratic press releases made public after the July Pew survey but before the November Pew survey. In July of 2009, for example, the stems "health" and "care" accounted for 29% of the common words used by citizens, with "don't" and "cost" being prominent as well. We then measure the distance between this distribution and the distribution of words in subsequent press releases, in this case by using the Manhattan distance metric. The result: 0.90, a number that is not very meaningful on its own but which provides a baseline estimate of the relationship between elite language and mass language. By replicating this process for the same press releases and the open-ended responses measured *after* the press releases were made public, we can measure whether supporters grew more likely to use specific words after those words had been employed by elites. The distance between the word distribution in the press releases and that in the subsequent open-ended responses measured in November is 0.87. The public did grow more likely to use words after they appeared in Democratic press releases.

To measure whether such differences are meaningful, we use bootstrapping (Efron and Tibshi-

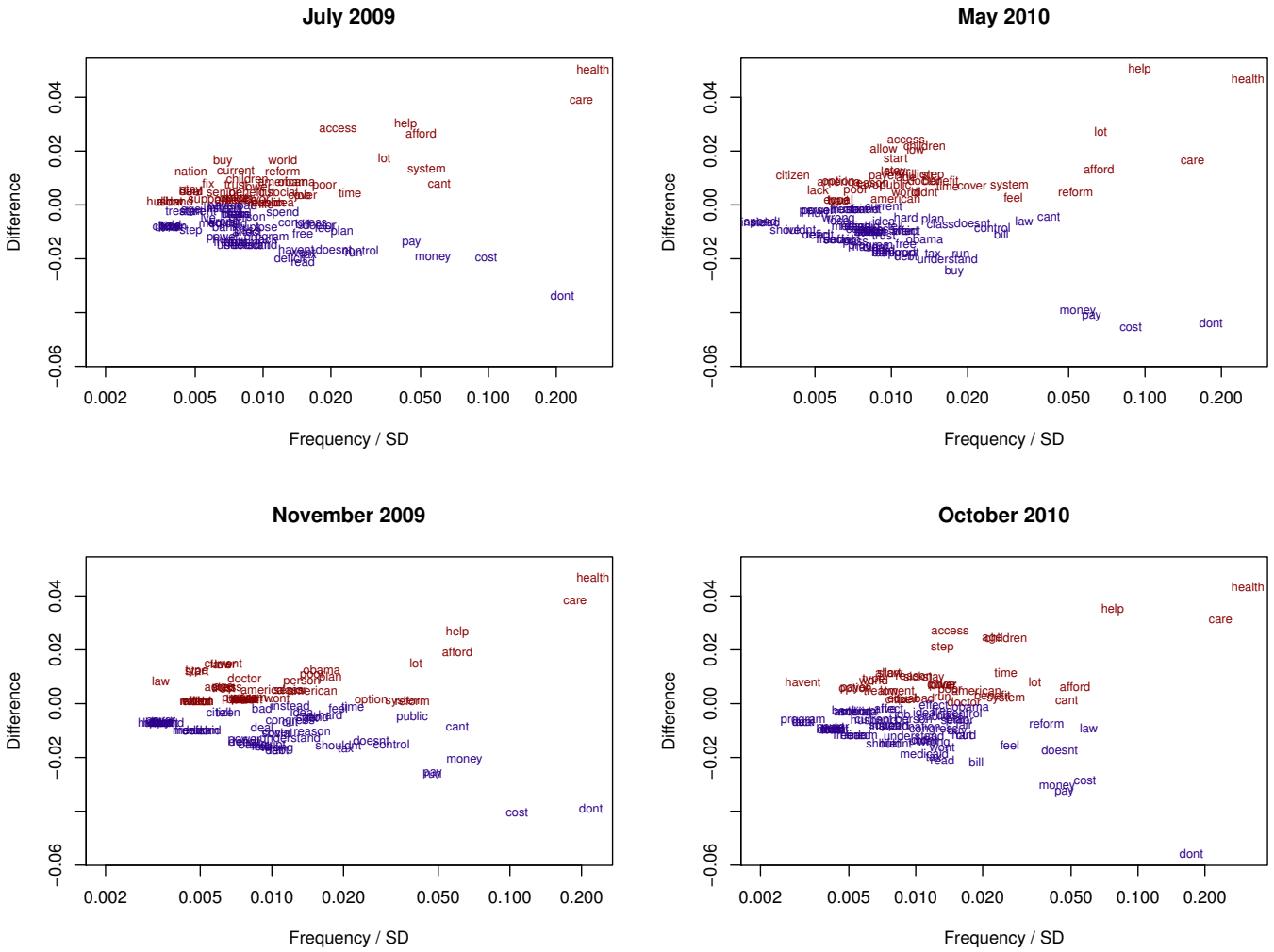

Figure 5: This figure presents the difference in word usage for the open-ended responses of health care reform supporters and opponents (y-axis) as a function of each word's overall frequency divided by its standard deviation (x-axis).

rani, 1993), randomly drawing 10,000 new data sets of press releases and open-ended responses and repeating the measurement procedure outlined above. As the left side of the left panel in Figure 6 makes clear, the decline in the Manhattan distance between Democratic press releases and citizens' language is not statistically significant for the early period between July and November (p=0.28). The arrow indicates that the change in the mean Manhattan distance across bootstrapped simulations is a slight but insignificant decline, with the arrow's starting point illustrating the baseline relationship. However, when we conduct the same analyses for the second period, between November 2009 and May 2010, we see a substantial and significant decline in distance (p=0.006), one that holds for Republican Senators and citizens' language as well (p=0.022). The relationship between Senator's press releases and the electorate's language increases notably during the most salient phase of the health care reform debate. It is not simply that political elites and the public use similar words: the similarity actually grew after the elites' public statements.

In the middle and right panels of Figure 6, we examine how robust this conclusion is to the use of alternate measures such as Euclidean distance or the Pearson's correlation. (When interpreting Figure 6, keep in mind that the Pearson's correlation is negatively correlated with distance, so upward arrows in the right panel indicate an increasingly close relationship.) We again observe that during the November to May period, mass-level word choice became more closely related to the word choice in Senators' press releases. There are some differences across these metrics which are important to note. The Euclidean distance detects statistically significant declines in the first time period from late July to November 2009, with p-values of 0.004 for Democratic press releases as well as for Republican press releases. Also, using the Pearson's correlation, the result for Republicans in the second period does not reach the threshold for statistical significance (p=0.147). Still, the broad pattern holds, and was confirmed using still other distance metrics such as the Canberra metric. From November 2009 to May 2010, citizens increasingly used the words common among Democratic elites, and that the same appears true for Republican Senators'

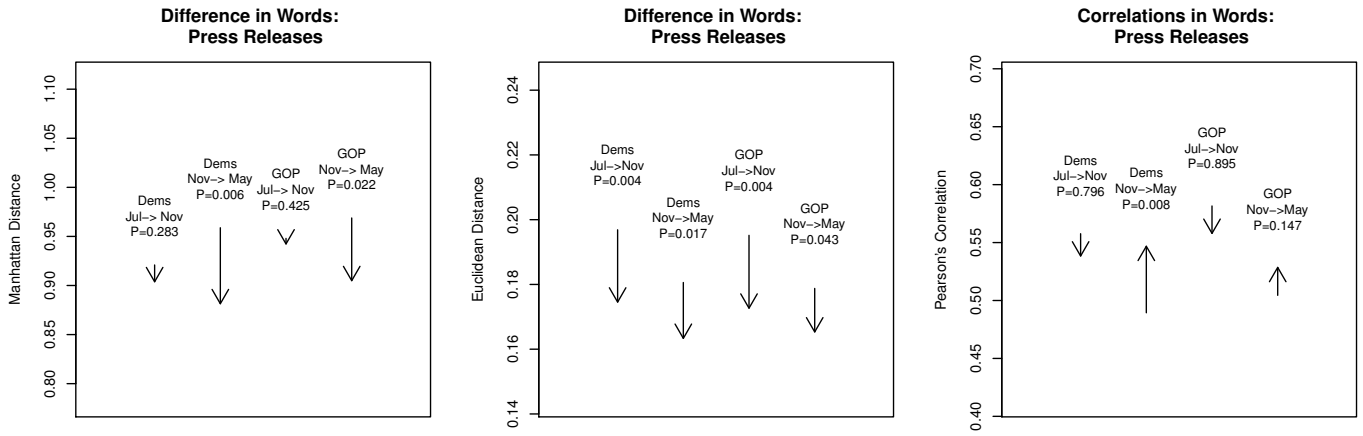

Figure 6: Distances or correlations between words used in Senators' press releases and all survey respondents' open-ended survey responses before and after the press releases were issued. Declining distances and increasing correlations indicate that the public is using words more similar to the press releases when surveyed after the press releases were issued. The p-values are estimated through bootstrapping using 10,000 iterations.

word choices as well. Framing might not influence aggregate opinion in demonstrable ways, but it does shape how citizens talk about an issue. Also, in contrast to the arguments of several commenators, there is no evidence that Republican words were more likely to be adopted than Democratic words.

Discussion and Conclusion

The role of focus groups and polling in the development of officials' rhetoric is well known (e.g. Jacobs and Shapiro, 2000; Jacobs and Burns, 2004). Yet when studying framing effects through traditional survey experiments, we risk losing sight of the ways in which elite frames are themselves shaped by public opinion. To address that challenge, this manuscript applies automated content analysis to the health care rhetoric of public officials and American citizens from 2009 to 2012. These tools enable us to summarize the central arguments for and against health care reform, and to analyze any shifts over the course of the debate. We see, for example, that supporters at the elite and mass levels alike emphasized the expansion of insurance and increased access to health care. Yet supporting citizens used these arguments to explain their views even before the health care reform debate came to dominate headlines, a fact which suggests the limited influence of elite rhetoric.

For opponents of the ACA at both the mass and elite levels, the legislation's cost to taxpayers and the increased governmental role it authorized were central reasons behind their opposition. Consider the following argument: "This may be your last chance to weigh the consequences of taking the first step toward establishment of socialized medicine in the United States... When costs get out of line... there are three possible courses of action. The first is to reduce the benefits; the second is to increase taxes; the third is to impose government controls of the services." Certainly, that argument summarizes the core elements of opposition to the Affordable Care Act. It would have been an unsurprising addition to the press releases analyzed above. But that

particular quotation actually comes from the 1965 debates over Medicare, when it was written by the President of the American Medical Association. Even across decades, the rhetoric used to support and oppose health care reform has been notable in its consistency, a point our results reinforce. Such consistency places a low ceiling on the influence that framing effects at any one moment can have on public opinion: a variable cannot explain a constant. This observation in turn suggests the value of studying not just specific political debates but the contours of public debate over broad swaths of time, as is done in Smith (2007) and Noel (2012).

More traditional tests of real-world framing effects using Granger tests do not indicate any substantive effect on public attitudes among the sub-groups targeted by specific rhetoric. Republicans' emphasis on Medicare in the winter of 2010 did not increase opposition among Medicare recipients, and Democrats' focus on expanding coverage did little among the uninsured. Still, analyzing the fit between elite and mass word choice enables us to measure framing effects with increased precision and subtlety. When doing so, we see that citizens do grow more likely to use the same words as their elected officials over the course of the public debate. In this case, such effects appear to be roughly symmetric: there is an increasing correlation between the word choices of both Democratic and Republican Senators and the citizenry at large. The changing distance between elite-level word choice and mass-level word choice is a metric that could be productively employed and developed in future analyses of framing, whether experimental or observational. One might study which subsets within the electorate are especially likely or unlikely to adopt elite rhetoric, for example. Future research might also develop unified statistical models that allow us to track shifts in vocabulary across different types of speech.

Scholars of public opinion have long recognized the trade-offs inherent in using open-ended or closed-ended survey questions (Payne, 1951; Bradburn, 1983; Fowler, 1995). Still, research on framing and on public opinion generally has relied overwhelmingly on closed-ended questions to date. The growing set of tools for automated content analysis has the potential to shift this balance, and to improve the measurement of key concepts in public opinion research. By using

press releases and open-ended survey questions to test hypotheses about framing, this paper provides an example of how text and automated content analysis can provide new vantagepoints on old questions.

References

Arceneaux, Kevin, Martin Johnson and Chad Murphy. 2012. "Polarized Political Communication, Oppositional Media Hostility, and Selective Exposure." *Journal of Politics* Forthcoming.

Bagozzi, Benjamin E. and Philip A. Schrodt. 2012. "The Dimensionality of Political News Reports.". Available online at: `http://eventdata.psu.edu/papers.dir/BagozziSchrodt.EPSA12.pdf`.

Barabas, Jason and Jennifer Jerit. 2010. "Are Survey Experiments Externally Valid?" *American Political Science Review* 104(2):226–242.

Bargh, John A. 2006. "What Have We Been Priming All These Years? On the Development, Mechanisms, and Ecology of Nonconscious Social Behavior." *European Journal of Social Psychology* 36(2):147–168.

Bartels, Larry M. 2002. "Beyond the running tally: Partisan bias in political perceptions." *Political Behavior* 24(2):117–150.

Baumgartner, Frank R., Suzanna De Boef and Amber E. Boydstun. 2008. *The Decline of the Death Penalty and the Discovery of Innocence*. New York, NY: Cambridge University Press.

Berinsky, Adam J. and Donald R. Kinder. 2006. "Making Sense of Issues Through Media Frames: Understanding the Kosovo Crisis." *Journal of Politics* 68(3):640–656.

Berinsky, Adam J. and Michele Margolis. 2011. "Missing Voices: Polling and Health Care." *Journal of Health Politics, Policy and Law* 36(6):975–987.

Blei, David M., Andrew Y. Ng and Michael I. Jordan. 2003. "Latent Dirichlet Allocation." *Journal of Machine Learning Research* 3:993–1022.

Blei, David M. and John D. Lafferty. 2006. "Correlated Topic Models." *Advances in Neural Information Processing Systems* 18:147.

Bradburn, Norman M. 1983. Response Effects. In *Handbook of Survey Research*, ed. Peter H. Rossi, James D. Wright and Andy B. Anderson. New York, NY: Academic Press.

Bullock, John G. 2011. "Elite influence on public opinion in an informed electorate." *American Political Science Review* 105(3):496–515.

Campbell, Andrea L. 2011. "Policy Feedbacks and the Impact of Policy Designs on Public

Opinion." *Journal of Health Politcs, Policy, and Law* 36(6):961–73.

Carmines, Edward G. and James A. Stimson. 1989. *Issue Evolution: Race and the Transformation of American Politics*. Princeton, NJ: Princeton University Press.

Chong, Dennis and James N. Druckman. 2007*a*. "A Theory of Framing and Opinion Formation." *Journal of Communication* 57:99–118.

Chong, Dennis and James N. Druckman. 2007*b*. "Framing Public Opinion in Competitive Democracies." *American Political Science Review* 101(04):637–655.

Chong, Dennis and James N. Druckman. 2010. "Dynamic Public Opinion: Communication Effects over Time." *American Political Science Review* 104(4):663–680.

Chong, Dennis and James N. Druckman. 2011. Public-Elite Interactions: Puzzles in Search of Researchers. In *The Oxford Handbook of American Public Opinion and the Media*, ed. Robert Y. Shapiro and Lawrence Jacobs. New York, NY: Oxford University Press.

Diermeier, Daniel, Jean-Francois Godbout, Bei Yu and Stefan Kaufmann. 2012. "Language and Ideology in Congress." *British Journal of Political Science* 42(01):31–55.

Druckman, James N. 2001. "On the Limits of Framing Effects: Who Can Frame?" *The Journal of Politics* 63(04):1041–1066.

Druckman, James N. 2003. "On the Limits of Framing Effects: Who Can Frame?" *Journal of Politics* 63(4):1041–1066.

Druckman, James N., Jordan Fein and Thomas J. Leeper. 2012. "A Source of Bias in Public Opinion Stability." *American Political Science Review* 106(2):430–454.

Druckman, James N. and Kjersten R. Nelson. 2003. "Framing and Deliberation: How Citizens' Conversations Limit Elite Influence." *American Journal of Political Science* 47(4):729–745.

Efron, B. and R. Tibshirani. 1993. *An Introduction to the Bootstrap*. London: Chapmand and Hall.

Entman, Robert M. 1993. "Framing: Towards Clarification of a Fractured Paradigm." *McQuail's Reader in Mass Communication Theory* pp. 390–397.

Entman, Robert M. 2004. *Projections of Power: Framing News, Public Opinion, and U.S. Foreign Policy*. Chicago, IL: University of Chicago Press.

Fowler, Floyd J. 1995. *Improving Survey Questions: Design and Evaluation*. Thousand Oaks, CA: Sage Publications.

Gamson, William A. 1992. *Talking Politics*. New York, NY: Cambridge University Press.

Gamson, William and Andre Modigliani. 1989. "Media Discourse and Public Opinion on Nuclear Power: A Constructionist Approach." *American Journal of Sociology* 95(1):1–37.

Gelman, Andrew and Jennifer Hill. 2006. *Data Analysis Using Regression and Multilevel/Hierarchical Models*. New York, NY: Cambridge University Press.

Gerber, Alan S. and Gregory A. Huber. 2010. "Partisanship, Political Control, and Economic Assessments." *American Journal of Political Science* 54(1):153–173.

Grimmer, Justin. 2010. "A Bayesian Hierarchical Topic Model for Political Texts: Measuring Expressed Agendas in Senate Press Releases." *Political Analysis* 18(1):1–35.

Grimmer, Justin. 2011. "An Introduction to Bayesian Inference via Variational Approximations." *Political Analysis* 19(1):32.

Grimmer, Justin and Gary King. 2011. "General Purpose Computer-Assisted Clustering and Conceptualization." *Proceedings of the National Academy of Sciences* 108(7):2643–2650.

Guo, Weiwei and Mona Diab. 2011. Modeling Sentences in the Latent Space. In *Proceedings of the 50th Annual Meeting of the Association for Computational Linguistics*. pp. 864–872. Available online at: `http://www.public.asu.edu/~jtang20/publication/short%20message.pdf`.

Heath, Chip and Dan Heath. 2007. *Made to Stick: Why Some Ideas Survive and Others Die*. New York, NY: Random House.

Henderson, Michael and D. Sunshine Hillygus. 2011. "The Dynamics of Health Care Opinion, 2008-2010: Partisanship, Self-Interest, and Racial Resentment." *American Journal of Political Science* 36(6):945–960.

Hersh, Eitan D. and Brian F. Schaffner. 2012. "Targeted Campaign Appeals and the Value of Ambiguity." *Journal of Politics* Forthcoming.

Ho, Daniel E. and Kevin M. Quinn. 2008. "Measuring Explicit Political Positions of Media." *Quarterly Journal of Political Science* 3(4):353–377.

Hopkins, Daniel J. and Gary King. 2010. "A Method of Automated Nonparametric Content

Analysis for Social Science." *American Journal of Political Science* 54(1):229–247.

Huber, Gregory A. and Celia Paris. 2012. "Assessing the Programmatic Equivalence Assumption In Question Wording Experiments: Understanding Why Americans like Assistance to the Poor more than Welfare." *Public Opinion Quarterly* Forthcoming.

III, George C. Edwards. 2009. *The Strategic President: Persuasion and Opportunity in Presidential Leadership*. Princeton, NJ: Princeton University Press.

Iyengar, Shanto. 1991. *Is Anyone Responsible? How Television Frames Political Issues*. Chicago, IL: University of Chicago Press.

Iyengar, Shanto and Donald R. Kinder. 1987. *News that Matters*. Chicago IL: University of Chicago Press.

Jacobs, Lawrence R., Benjamin I. Page, Melanie Burns, Gregory McAvoy and Eric Ostermeier. 2003. "What Presidents Talk About: The Nixon Case." *Presidential Studies Quarterly* 33(4):751–771.

Jacobs, Lawrence R. and Melanie Burns. 2004. "The Second Face of the Public Presidency: Presidential Polling and the Shift from Policy to Personality Polling." *Presidential Studies Quarterly* 34(3):536–556.

Jacobs, Lawrence R. and Robert Y. Shapiro. 2000. *Politicians Don't Pander: Political Manipulation and the Loss of Democratic Responsiveness*. Chicago, IL: University of Chicago Press.

Kaiser Family Foundation. 2012. "Kaiser Health Tracking Poll: August 2012.". Available online at: `http://www.kff.org/kaiserpolls/8342.cfm`.

Kellstedt, Paul M. 2003. *The Mass Media and the Dynamics of American Racial Attitudes*. New York: Cambridge University Press.

Kinder, Donald R. 1998. "Communication and Opinion." *Annual Review of Political Science* 1:167–197.

Konisky, David M. and Lilliard E. Richardson. 2012. "Penalizing the Party: Health Care Reform Issue Voting in the 2010 Election." *American Politics Research* 40(5):903–926.

Kriner, Douglas L. and Andrew J. Reeves. 2012*a*. "The American Public and Health Care Reform: Past, Present, and Future." Typescript, Boston University.

Kriner, Douglas L. and Andrew J. Reeves. 2012*b*. "Responsive Partisanship: Public Support for the Clinton and Obama Health Care Plans." Typescript, Boston University.

Krugman, Paul. 2012. "An Unserious Man." *The New York Times* August 19.

Lakoff, George and Mark Johnson. 1980. *Metaphors We Live By*. University of Chicago Press.

Lauderdale, Benjamin and Tom S. Clarke. 2012. "Scaling Meaningful Political Dimensions.". Available online at: `http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2079561&http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2079561`.

Laver, Michael, Kenneth Benoit and John Garry. 2003. "Extracting Policy Positions from Political Texts Using Words as Data." *American Political Science Review* 97(2):311–331.

Lenz, Gabriel S. 2009. "Learning and Opinion Change, not Priming: Reconsidering the Priming Hypothesis." *American Journal of Political Science* pp. 821–837.

Levendusky, Matthew. 2009. *The Partisan Sort: How Liberals Became Democrats and Conservatives Became Republicans*. Chicago, IL: University of Chicago Press.

Lowe, Will. 2008. "Understanding Wordscores." *Political Analysis* 16(4):356–371.

Lynch, Julia and Sarah E. Gollust. 2010. "Playing Fair: Fairness Beliefs and Health Policy Preferences in the United States." *Journal of Health Politics, Policy and Law* 35(6):849–887.

Malhotra, Neil and Yotam Margalit. 2010. "Risk Orientations and Policy Frames." *Journal of Politics* 72(2):381–396.

Mutz, Diana C. 1994. "Contextualizing Personal Experience: The Role of Mass Media." *The Journal of Politics* 56(3):689–714.

Mutz, Diana C. 1998. *Impersonal Influence: How Perceptions of Mass Collectives Affect Political Attitudes*. New York, NY: Cambridge University Press.

Nelson, Thomas. 2011. Issue Framing. In *The Oxford Handbook of American Public Opinion and the Media*, ed. Robert Y. Shapiro and Lawrence Jacobs. New York, NY: Oxford University Press pp. 189–203.

Nelson, Thomas E., Rosealee A. Clawson and Zoe M. Oxley. 1997. "Media Framing of a Civil Liberties Conflict and its Effect on Tolerance." *American Political Science Review* 91(3):567–583.

Noel, Hans. 2012. "The Coalition Merchants: The Ideological Roots of the Civil Rights Realignment." *The Journal of Politics* 74(01):156–173.

Nyhan, Brendan. 2010. "Why the "Death Panel" Myth Wouldn't Die: Misinformation in the Health Care Reform Debate." *The Forum* 8(1):1–24.

Nyhan, Brendan, Eric McGhee, John Sides, Seth Masket and Steven Greene. 2012. "One Vote Out of Step? The Effects of Salient Roll Call Votes in the 2010 Election." *American Politics Research* 40(5):844–879.

Patterson, Thomas E. 1993. *Out of Order*. New York, NY: Vintage Books.

Payne, Stanley L. 1951. *The Art of Asking Questions*. Princeton, NJ: Princeton University Press.

Porter, M. F. 1980. "An Algorithm for Suffix Stripping." *Program: Electronic Library and Information Systems* 14(3):130–137.

Prior, Markus. 2007. *Post-Broadcast Democracy: How Media Choice Increases Inequality in Political Involvement and Polarizes Elections*. New York, NY: Cambridge University Press.

Quinn, Kevin M., Burt L. Monroe, Michael Colaresi, Michael H. Crespin and Dragomir R. Radev. 2010. "How to Analyze Political Attention with Minimal Assumptions and Costs." *American Journal of Political Science* 54(1):209–228.

Rice, Douglas. 2012. "Measuring the Issue Content of Supreme Court Opinions through Probabilistic Topic Models.". Available online at: `http://qssi.psu/files/NF5Rice.pdf`.

Richardson, Lilliard E. and David M. Konisky. 2012. "Personal and Collective Evaluations of the 2010 Health Care Reform.". Mimeo, Georgetown University.

Riker, William H. 1986. *The Art of Political Manipulation*. New Haven, CT: Yale University Press.

Scherer, Michael. 2010. "The White House Scrambles to Tame the News Cyclone." *Time* March 4.

Schrodt, Philip A. 2011. "Forecasting Political Conflict in Asia and the Middle East using Latent Dirichlet Allocation Models.". Available online at: `http://eventdata.psu.edu/papers.dir/Schrodt.LDA.Starr.2011.pdf`.

Shapiro, Robert Y. and Lawrence Jacobs. 2010. "WSimulating Representation: Elite Mobilization

and Political Power in Health Care Reform." *The Forum* 8(1):1–15.

Slothuus, Rune and Claes H. de Vreese. 2010. "Political Parties, Motivated Reasoning, and Issue Framing Effects." *Journal of Politics* 72(3):630–645.

Smith, Mark A. 2007. *The Right Talk: How Conservatives Transformed the Great Society into the Economic Society*. Princeton, NJ: Princeton University Press.

Sniderman, Paul M. and Sean M. Theriault. 2004. The Structure of Political Argument and the Logic of Issue Framing. In *Studies in Public Opinion: Attitudes, Nonattitudes, Measurement Error, and Change*. Princeton, NJ: Princeton University Press pp. 133–65.

Song, Yangqiu, Haixun Wang, Zhongyuan Wang, Hongsong Li and Weizhu Chen. 2011. Short Text Conceptualization Using a Probabilistic Knowledge Base. In *Proceedings of the Twenty-Second International Joint Conference on Artificial Intelligence*. Available online at: `http://ijcai.org/papers11/Papers/IJCAI11-388.pdf`.

Spirling, Arthur. 2011. "US Treaty Making with American Indians: Institutional Change and Relative Power, 1784–1911." *American Journal of Political Science* 56(1):84–97.

Steinhauer, Jennifer and Robert Pear. 2011. "G.O.P. Newcomers Set Out to Undo Obama Victories." *New York Times* .

Strauss, Aaron B. 2009. Political Ground Truth: How Personal Experience Counters Partisan Bias PhD thesis Princeton University.

Sussman, Tara, Robert J. Blendon and Andrea L. Campbell. 2009. "Will Americans Support the Individual Mandate?" *Health Affairs* 28(3):501–509.

Taber, Charles S. and Milton Lodge. 2006. "Motivated Skepticism in the Evaluation of Political Beliefs." *American Journal of Political Science* 50(3):755–769.

Tang, Jiliang, Xufei Wang, Huiji Gao, Xia Hu and Huan Liu. 2012. "Enriching Short Text Representation in Microblog for Clustering." *Frontiers in Computational Science* 6(1).

Tesler, Michael. 2012. "The Spillover of Racialization into Health Care: How President Obama Polarized Public Opinion by Racial Attitudes and Race." *American Journal of Political Science* Forthcoming.

Vavreck, Lynn. 2009. *The Message Matters: The Economy and Presidential Campaigns*. Prince-

ton, NJ: Princeton University Press.

Winter, Nicholas G. 2008. *Dangerous Frames: How Ideas about Race and Gender Shape Public Opinion.* Chicago, IL: University of Chicago Press.

Zaller, John R. 1992. *The Nature and Origins of Mass Opinion.* New York, NY: Cambridge University Press.

Appendix A: Supplementary Tables

	Income	Black	Hispanic	Education	Male	GOP	Independent
FEB09	-0.098	0.009	0.063	0.151	-0.009	-0.611	-0.330
APR09	-0.054	0.012	0.124	-0.185	-0.042	-0.849	-0.434
JUN09	-0.121	0.081	0.176	-0.241	-0.062	-0.690	-0.369
JUL09	-0.318	0.146	0.203	0.185	-0.028	-0.712	-0.293
AUG09	-0.226	0.180	0.260	0.433	-0.062	-0.954	-0.622
SEP09	-0.139	0.148	0.129	0.402	-0.008	-0.994	-0.448
OCT09	-0.091	0.258	0.074	0.171	0.032	-0.971	-0.369
NOV09	0.187	0.343	-0.007	0.019	-0.071	-0.976	-0.361
DEC09	-0.123	0.171	0.166	0.186	-0.011	-0.924	-0.456
JAN10	0.065	0.326	0.232	0.134	-0.086	-1.129	-0.614
FEB10	0.107	0.395	0.137	-0.123	0.003	-1.083	-0.513
MAR10	0.066	0.224	0.207	0.173	0.026	-1.283	-0.675
APR10	-0.066	0.260	0.099	0.498	-0.076	-1.151	-0.672
MAY10	-0.097	0.203	0.079	0.477	-0.069	-1.235	-0.569
JUN10	-0.109	0.265	0.244	0.418	0.019	-0.996	-0.462
JUL10	-0.271	0.229	0.334	0.373	0.030	-1.102	-0.598
AUG10	-0.150	0.376	0.130	0.506	-0.015	-1.109	-0.612
SEP10	-0.333	0.190	0.093	0.065	-0.015	-1.083	-0.561
OCT10	-0.142	0.118	0.251	0.291	-0.041	-1.200	-0.736
DEC10	0.060	0.306	0.152	0.432	-0.008	-1.149	-0.578
FEB11	-0.046	0.142	0.248	0.373	-0.035	-1.065	-0.449
MAR11	0.163	0.394	0.210	0.213	0.048	-1.063	-0.670
APR11	0.101	0.290	0.246	0.807	-0.023	-1.069	-0.483
MAY11	-0.080	0.243	0.112	0.519	0.039	-1.162	-0.593
JUN11	-0.004	0.142	0.005	0.238	-0.033	-0.957	-0.612
JUL11	-0.225	0.281	0.222	0.409	-0.023	-0.653	-0.349
AUG11	0.087	0.144	0.224	0.191	0.034	-1.004	-0.571
SEP11	0.135	0.197	0.328	0.328	-0.075	-1.055	-0.498
OCT11	-0.031	0.258	0.047	0.246	-0.039	-0.903	-0.398
NOV11	0.112	0.376	0.253	0.422	-0.047	-0.978	-0.537
DEC11	0.132	0.319	0.318	0.600	0.011	-0.890	-0.539
JAN12	0.100	0.259	0.275	0.822	-0.091	-0.929	-0.486

	Intercept	Medicare	Medicaid	Health	Age	Age Squared	Uncovered
FEB09	2.683	-0.001	0.023	-0.004	-0.108	0.046	-0.007
APR09	2.798	0.099	0.154	0.016	-0.032	-0.005	0.120
JUN09	3.033	0.019	0.048	-0.026	-0.244	-0.173	0.046
JUL09	2.412	-0.078	0.018	0.027	-0.032	0.054	-0.000
AUG09	2.377	-0.023	0.286	-0.014	-0.072	-0.033	-0.194
SEP09	2.205	0.107	0.068	0.037	-0.069	-0.150	0.203
OCT09	2.398	0.103	0.086	0.004	-0.272	-0.031	0.093
NOV09	2.319	0.139	0.029	0.012	-0.238	0.435	0.238
DEC09	2.297	0.052	0.416	0.033	-0.257	-0.485	0.129
JAN10	2.428	0.057	0.162	-0.019	-0.156	0.145	0.026
FEB10	2.275	0.193	-0.009	0.063	-0.204	0.187	0.029
MAR10	2.562	0.081	0.391	-0.053	-0.199	0.131	0.122
APR10	2.024	0.063	0.134	0.041	-0.228	0.166	0.201
MAY10	2.190	-0.035	0.110	0.025	-0.168	0.079	-0.065
JUN10	1.900	-0.047	0.053	0.079	-0.095	0.218	0.032
JUL10	2.107	-0.005	0.094	0.048	-0.112	0.187	-0.019
AUG10	2.014	-0.030	0.163	0.023	-0.061	0.203	0.080
SEP10	2.486	0.113	0.159	0.019	-0.231	-0.169	-0.003
OCT10	2.386	0.049	-0.121	-0.009	-0.130	0.339	-0.095
DEC10	2.000	0.097	0.222	0.012	-0.159	0.490	-0.044
FEB11	1.899	-0.087	-0.077	0.052	-0.024	0.421	-0.055
MAR11	1.950	0.003	-0.165	0.053	-0.140	0.452	0.129
APR11	1.657	-0.037	0.001	0.016	-0.078	0.445	0.075
MAY11	1.882	-0.038	0.240	0.059	-0.064	-0.080	0.070
JUN11	2.101	0.003	-0.114	0.020	-0.201	0.271	0.116
JUL11	1.497	-0.104	-0.071	0.050	-0.165	0.413	0.124
AUG11	1.977	0.051	-0.029	0.039	-0.144	0.471	0.031
SEP11	2.010	-0.137	-0.043	0.013	0.026	0.696	0.006
OCT11	1.925	-0.018	0.166	0.044	-0.041	0.100	0.000
NOV11	1.849	0.064	0.298	0.036	0.005	0.325	-0.003
DEC11	1.810	-0.028	-0.148	-0.005	-0.078	0.163	0.097
JAN12	1.817	-0.069	0.153	-0.033	-0.013	0.550	0.027

Table 2: This table presents the results of models estimated for each month on a total of 30,370 respondents to the Kaiser Family Foundation monthly health care tracking poll from February 2009 through January 2012.

	1	2	3	4	5	6
1	government	people	care	afford	money	dont
2	dont	insurance	health	people	cost	bill
3	control	help	access	cant	medicare	trying
4	business	companies	system	lot	pay	country
5	involved	coverage	americans	help	tax	healthcare
6	run	conditions	affordable	insurance	taxes	doesnt
7	believe	able	provide	health	cut	law
8	private	existing	universal	care	dont	medicine
9	choice	preexisting	believe	dont	lot	time
10	federal	age	reform	able	class	socialized
11	care	premiums	country	helps	doctors	system
12	buy	children	free	buy	people	citizens
13	purchase	que	costs	pay	paying	public
14	forced	income	canada	benefit	middle	change
15	individual	covered	coverage	time	healthcare	passed
16	program	covers	countries	healthcare	costs	senior
17	tell	pre	quality	expensive	social	read
18	freedom	low	american	sick	dollars	didnt
19	socialism	helps	change	elderly	debt	feel
20	choose	health	world	issues	medicaid	thats

Table 3: This table presents the most commonly occurring words in each of the six clusters of open-ended responses identified through LDA.

Appendix B: Supplementary Figures

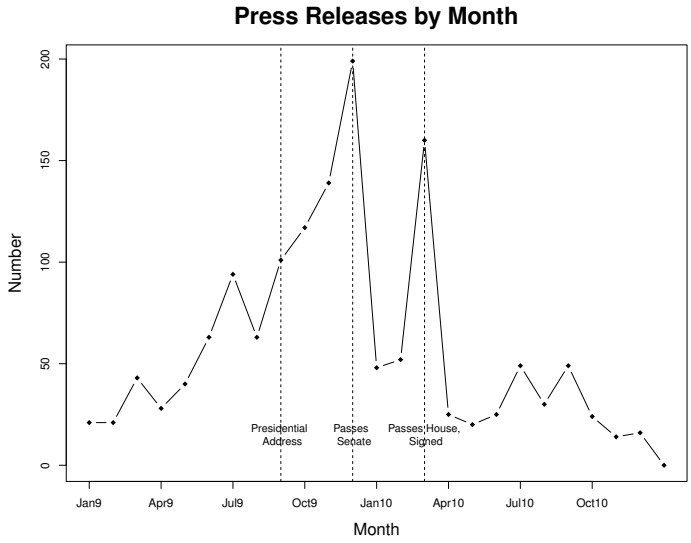

Figure 7: This figure depicts the number of press releases by month, and identifies key events in the legislative timeline.

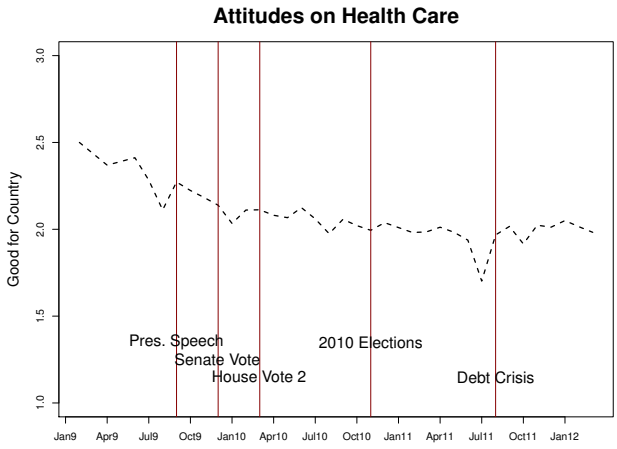

Figure 8: Variation in assessment's of health care reform's impact on the country as a whole, February 2009 to January 2012. The results are from 30,370 respondents surveyed in 32 separate months.

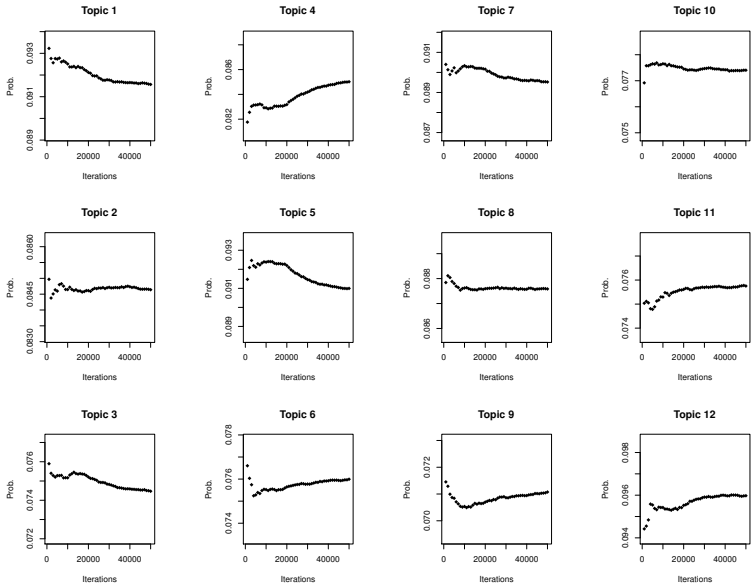

Figure 9: To allow for assessments of convergence for the Gibbs sampler, this figure shows the cumulative average as the number of iterations increases for each of the twelve topics uncovered by LDA in 1,488 press releases.

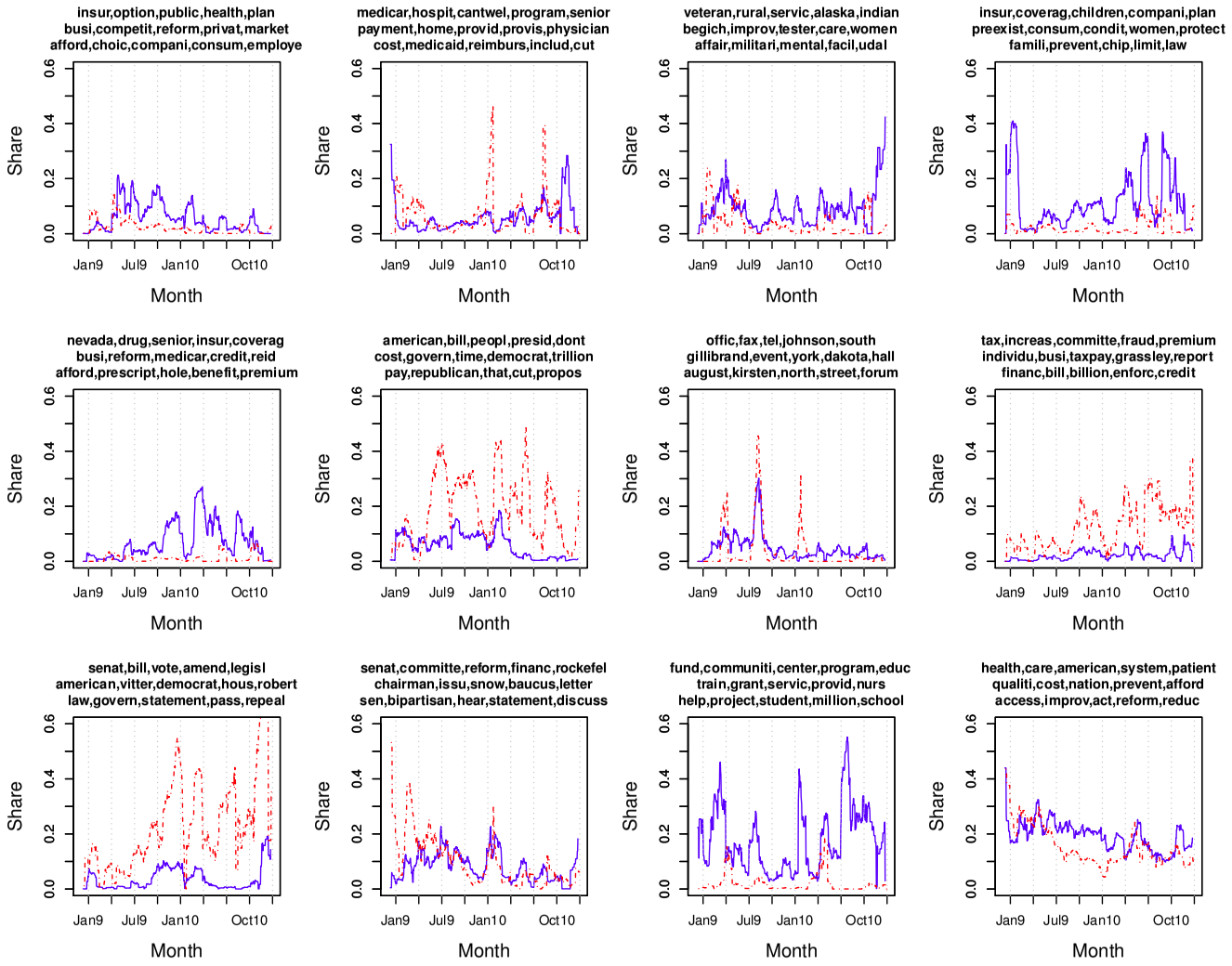

Figure 10: Variation in Topics Over Time. Topic probabilities smoothed over the prior 28 days. Model: CTM, fit to 1,488 press releases.

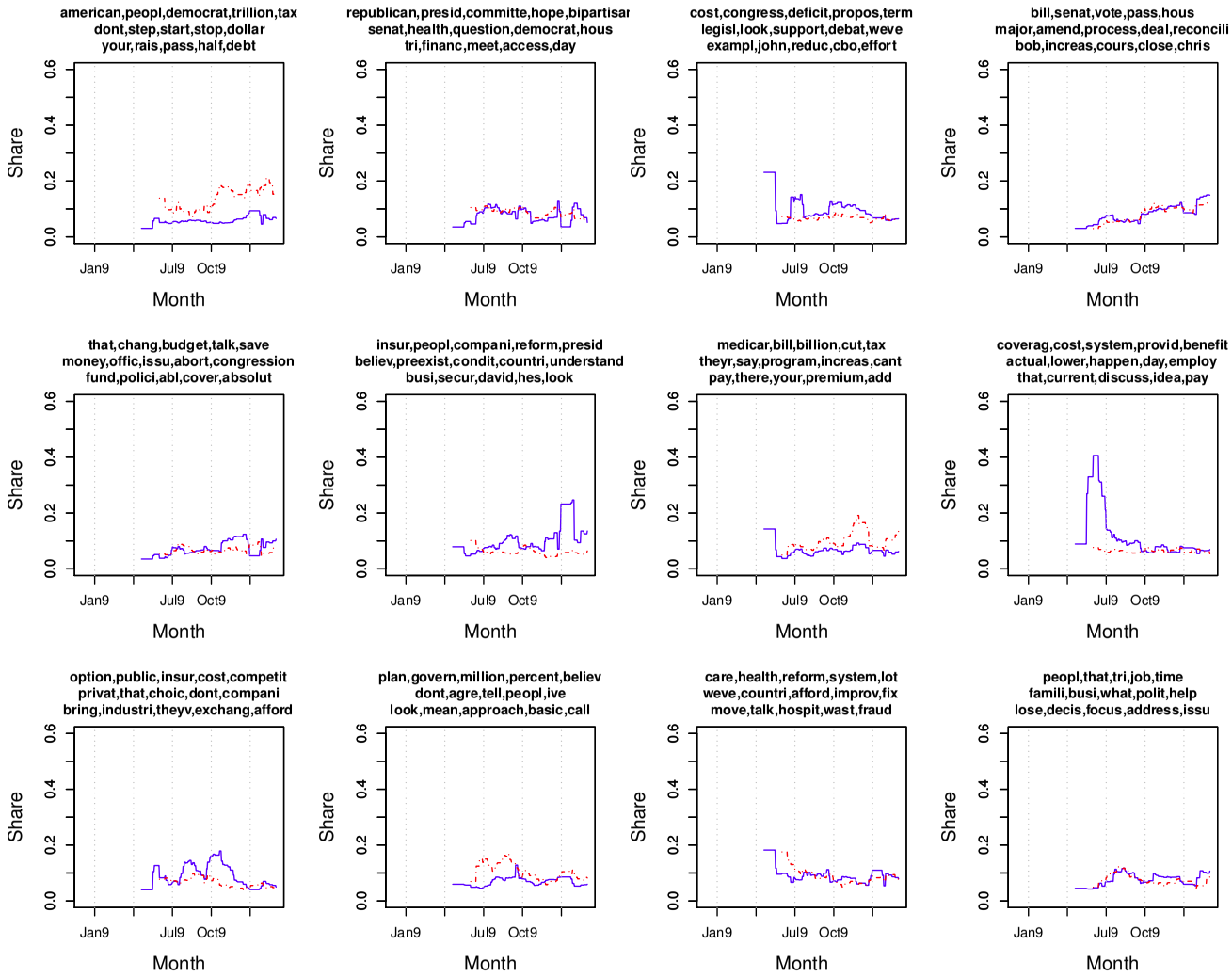

Figure 11: Variation in Topics Over Time. Topic probabilities smoothed over the prior 28 days. Model: LDA, fit to 221 transcripts from television appearances by administration officials and Congressional leaders.