

Data Mining for Climate Change: Framing and Issue Attention in the US Congress and Media

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Abstract

The Obama administration addressed climate change as a global security threat issue. Some scholars argue this shows climate change underwent a major securitization process within the US. To sustain this claim first we need to understand the role of the media and Congress in framing climate change, and which narratives were the most dominant across these actors. First, this project implements quantitative text analysis tools (STM, cosine similarity and as-hoc dictionaries) to uncover a potential latent securitization process within an original corpus of 5054 news media articles and Congressional speeches. Second, it runs a vector auto-regression analysis with cumulative impulse response functions to understand the flow of information between Congressmen and media. The results show no indication of a dominant securitization process within the corpus, that the media and Congress have no influence over each-other's coverage of the different topics around climate change.

1 Introduction

Climate change has become one of the central public agenda issues of the last decade. It has gone from being the concern of a reduced scientific community to becoming a major political problem requiring immediate attention at a global scale (Giddens, 2009). To understand the evolution of this debate we need to explore the emergence and dominance of the different issue frames around climate change. This means understanding how aspects related to climate change have been made more salient to promote a particular problem definition, causal interpretation and moral evaluation over the issue in order to address it (Entman, 1993). One of the most recently identified frames deals with climate change as a

security threat, as presented in 2007 by the United Nations Security Council (UNSC) and the 2010 North Atlantic Treaty Organization (NATO) report. Securitization Theory defends that securitization frames call for imminent action to protect the threaded object and invokes legitimacy in taking radical measures in order to avoid devastating consequences for the nation (Buzan, Wæver, Wilde, 1998). Framing an issue as a existential threat opens a policy window that can be used to insert a certain agenda that would otherwise be hard to promote (Birkland, 2009; Lowry, 2006).

Within the United States, President Obama's administration was seen as promoting a securitization frame around climate change (Peterson, 2016; Thomson, 2017). Examples of such frame are found in the 2011 Department of Defense Report and in the 2015 National Security Strategy, presenting climate change as equally as dangerous for the US nation as international terrorism. However, we are unaware if this securitization processes trickled beyond official Government's communications to be present within other political and media discourses. This paper aims to investigate the role of media and Congress as (de)securitizing actors in the framing of climate change through the influence of their discourse over the debate. The goal is to reveal a potential latent securitization frame throughout the media and Congression corpus between 2009 and 2016.

This project helps to build on previous interdisciplinary research which looks at the evolution of climate change debate focusing on issue framing dynamics. Most recently, research has focused on uncovering securitization framing patterns, both within the US and in a comparative perspective (Brown, 2007; Peters & Mayhew, 2016; Scott, 2012). The goal is to explain how actors try to highlight the crisis and life-threatening implications of climate change in order to motivate certain types of public opinion or policy petitions. Surprisingly, in contrast to the wealth on research on mass media communication, few studies have focused on how political decision-makers and institutions frame climate change (Schafer, 2011). In order to fully understand the evolution of the climate change debate in the US, and to what extent it has undergone a securitization process, first we need to explore the relationship between media and political elite discourse. Other fields of research have focused on this relationship based on how foreign policy is communicated to the larger public (Bennett, 1990; Baum & Groeling, 2010; Entman, 2004). However, till date no research has focused on the framing of the discourse between media and policy-makers in the context of climate change debate.

This project aims to identify a) the different frames and dimensions of the climate debate in the US media and Congress, b) identify a potential latent securitization frame in the Congressional and media discourse, c) identify which actor is influencing the rest of the actor’s issue attention on climate change. This is done by applying quantitative text analysis tools to a unique corpus of 5054 documents from newspaper articles, Congress Committee Hearings and Congress Floor speeches between 2008 and 2016.

The first section of the paper identifies the key topics around climate change, operationalized as issue frames, and their salience throughout the years. This is done by implementing an unsupervised Structural Topic Model (STM) on the media and Congressional corpus, controlling for covariates such as year, partisanship and media source. The second stage of the project implements a cosine-similarity analysis, along with a novel dictionary, to reveal the potential latent securitization processes within the issue frames identified by the STM. The third part of the paper explores if policy-makers and media are influencing each-others’ discourse, or if their issue attention to the topics around climate change is motivated independently. This is tested through a vector-autoregression with cumulative impulse response functions. This method shows the responsiveness of the different actors to the increase of issue attention or shifts in the topic salience of the other actors’ discourse. The paper concludes with a discussion of the findings and implications for future research.

2 Climate Change Topics as Indicators of a Securitization Process

Framing affects how an issue is placed in public agenda, how it is handled in the the policy-making process, and how the public perceives the urgency issue (Cobb & Elder 1983; Baumgartner & Jones 1993; Kingdon 1995; Jones & Baumgartner, 2005). Framing refers to “the process by which people develop a particular conceptualization of an issue or reorient their thinking about an issue” (Chong& Druckman, 2007). This process occurs when actors select some aspects of a perceived reality and make them more salient in a communicating context to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation for the item described (Entman, 1993). Therefore, the core element of framing is which aspects or issue domains of a topic are being highlighted

during the communication process. This project applies the issue framing framework to analyze the debate over climate change in the US Congress and media.

Many studies point that, since the mid-2000s, the issue of climate change has increasingly been framed in terms of a security threat (Gleditsch & Nordås, 2009). This led to some scholars to argue that climate change has undergone a securitization process, conceptualized as the strategic presentation of an issue as an existential threat in order to facilitate the endorsement of exceptional measures to deal with the identified threat (Buzan et al., 1998). In a securitization frame, the issue is dealt with as a crisis, as a serious threat to the basic structures of a social system, which requires taking critical decisions. Securitization Theory predicts that the framing of an issue as an existential threat opens a policy window that can be used to insert a certain agenda that would otherwise be hard to promote (Birkland, 2009; Lowry, 2006). A security frame involves a sense of danger and urgency "in which an issue is presented and dealt with as if being a matter of top security, which in turn legitimizes the breaking of rules that would otherwise bind" (Buzan et al., 1998).

A securitization process is only successfully launched if the security frame is reiterated and echoed to a point that resonates with the whole audience it is addressed to. This requires for the security frame to successfully gain discursive power over the different topics discussed around the issue to the point there is a larger consensus reached over the threat of the issue. The Government's communications around climate change during the Obama administration are found to fit the framing premises of the securitization theory (Peterson, 2016; Thomson, 2017). Nevertheless, in order to claim the debate over climate change has undergone a securitization process in US, we need to account for the dominant issue frames beyond the Government, such as the media and Congress. If there is a latent securitization process within the debate in the US, we would observe the following indicators:

Indicator 1: An increasing proportion of security related issues in the Congress and media corpus when addressing climate change.

Indicator 2: The proportion of topics related to security issues should eventually stand out from the rest of topics within the Congress and media corpus.

3 Key Actors' Issue Attention as Indicators of a Securitization Process

The second empirical motivation of this paper is to understand the role of media and policy-makers influencing the issue framing around climate change. According to the Securitization Theory, any topic that undergoes a securitization process requires for it to be placed and enforced from a position of legitimate authority (Buzan et al., 1998). Within this framework, the expectation is for the securitization frame to originate within the political elites' speech (Buzan, 1999) and for the media to have a functional role echoing the mainstream political discourse. Prior to the the November 2010 Midterms elections, the Democratic Party was in control of the Presidency and Congress, reason for which the expectation is that the media would echo the issue frame of the representatives of the Democratic Party. Since after the 2010 Midterm elections the Democratic Party loses majority in Congress, the expectation is that there would be less coverage of their discourse after this date. If there is a securitization process in the climate change debate, we would see the following indicator:

Indicator 3: The majority party in Congress influences the topics and issue attention of the media coverage.

Beyond the expectation for media to follow the issue attention of Congress, it is key to identify the role of the different political elites as securitizing or de-securitizing actors. Securitizing actors are those that hold the strategic interest in launching a security frame, while de-securitizing actors divert issue attention away from security and threat concerns. Previous research identifies the US Government as a securitizing actor under the Obama presidency, but it is unknown what was the role of elected representatives in Congress. The expectation is that the Representatives from the Democratic Party would echo the security frame of the Obama administration. Conversely, the expectation is that Representatives of the Republican Party would act as de-securitizing actors and divert the issue attention of climate change away from threat concerns. If there has been a strategic effort to securitize the climate change debate, we will observe the following indicators:

Indicator 4: Policymakers from the Democratic Party have the highest proportion of securitization topics in their discourse (securitization actors).

Indicator 5: Policymakers from the Republican Party have the least proportion of securitization topics in their discourse (de-securitization actors).

4 Data

The project runs the different analysis over a corpus formed by Congress Committee Hearings, Congress Floor speeches and newspaper articles. There were two selection criteria for the inclusion of documents in the corpus; that the texts/speeches contained specific mentions to "climate change" or "global warming", and that their time-frame was within the two presidential terms of Barack Obama (between January 2008 and September 2016). This period was chosen for analysis because it was the first time the US Government addresses issue of climate change as a national threat with policy implications.

At an international level, the US signed the Copenhagen Accord (2009), the US-China Climate Agreement (2014) and Paris UNFCCC Agreement (2016). Domestically, the Administration promoted regulations to reduce the impact of climate change, such as the American Clean Energy and Security Act (2009), the National Flood Insurance Program Extension Act (2012), the veto of the Keystone XL pipeline (2013), the Extension of renewable energy tax credits and Clean Power Plan (2015) and the Formation of the Climate Solutions Caucus (2016). Because of this, climate change was an active topic in the political agenda and media coverage during this time. The corpus is formed by the following:

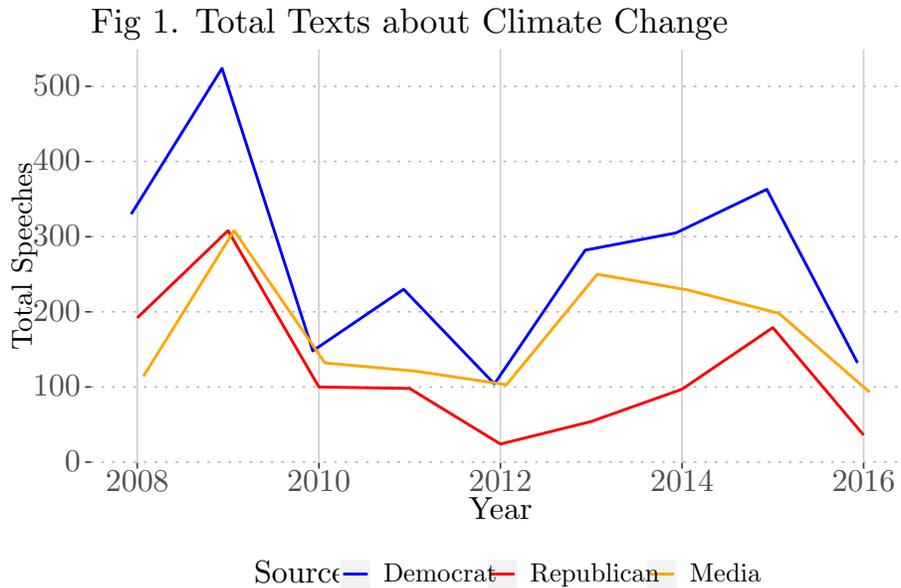
1. Congress Floor Speeches: Speeches from the House of Representatives and Senate from the Gentzkow, Shapiro and Taddy Dataset of Congressional Record for the 43rd-114th Congresses. The last observation is from the 6 of September 2016. The unit of analysis is unique speech by speaker per day and Chamber. The initial sample contained 3736 unique speeches.
2. Congress Committee Hearings: Committee Hearing political speeches in Congresses from 105th through 114th compiled by Ju Yeon Park (2019). The date of the different Committee Hearings was hand-coded for this project. The initial sample contained 1400 unique speeches.
3. Newspaper Articles: News articles from the *Washington Post*, *The New York Times* and *Wall Street Journal* since these are the most influential print news sources. The

unit of analysis is article per journal and day. The initial sample contained unique 4385 articles.

After the documents were gathered, through a qualitative assessment of their content, several texts were discarded when the mentions to climate change were spurious and not relevant to the overall content. An example of this was the mention of climate change as part of a political candidate’s agenda for the Midterm elections. Observations were also removed when a speech was present but the speaker was not identified in the dataset. This validation process is key to ensure the later validity of the topic model output in order to understand social phenomena (DiMaggio, Nag & Blei, 2013; Grimmer & Stewart, 2013). The final corpus used for the analysis contains a total of unique 5054 speeches/texts.

Source	Unique texts
Democrats in Congress	2418
Republicans in Congress	1088
Printed Media	1548
Total	5054

Table 1: Total texts by source/speaker in the sample



5 Methods

5.0.1 STM Topic Model

The content analysis of a corpus of 5054 is an extremely labor-intensive task, a limitation that can be overcome through computational methods such as unsupervised probabilistic machine learning structural topic models (STM). This method allows to identify topics within each text without the need of preselecting categories or training the model. STM operates based on a generative model of word counts based on the probabilities of words co-occurring together within the same text. This means that each document is assigned a different set of topic-proportions based on the mixture of the probabilities of each word of belonging to each topic.

In this regard, STM is similar to the popular Latent Dirichlet Allocation (LDA) model (Blei, Ng & Jordan, 2003; Barberá et al., 2019). The main improvement of STM over LDA is the possibility to fit into the model a selection of covariates that the researcher expects to influence the topic distribution. For this project, the modeled factored two covariates, namely, the year of the document and the source of the text, specifically, if the document is a newspaper article, a speech from a Democrat Representative or a Republican Representative.

When choosing a quantitative text analysis method to analyze a corpus, researchers can choose between supervised or unsupervised computational models. Supervised algorithms require the researcher to train the model based on a set of pre-labeled documents into topic categories. The algorithm is able to produce a data output from new documents based on its previous training following the label classification provided by the researcher. Conversely, unsupervised generative probabilistic models freely identify patterns in unlabeled data and generates topic categories based on meaningful clusters of terms. For the purpose of this paper, this is the most useful feature of unsupervised models such as STM. They offer the possibility to uncover latent themes and even unexpected topics within the corpus. I choose to use STM since it allows to organically identify topics around the climate change without me introducing an input bias by pre-labeling the themes expected to be present in the corpus.

5.0.2 Dictionary and Cosine-Similarity Analysis

Dictionary methods are a useful text mining tool that allows to classify documents when categories are known. This method facilitates the identification of specific topics within texts through the word count of a list of terms that correspond to each category. For the purpose of this paper, five dictionary categories were created to extract topics related to security threats, consensus over the existence climate change, the consequences of climate change, energy issues and policy terms. If securitization terms are not too frequent throughout the texts, the STM model might not create a specific topic output for this category. However, the dictionary method helps to reveal the presence of a securitization process through a word count of securitization terms.

This helps to reveal a possible latent securitization frame embedded within the other topic categories from the STM model. In this line, a cosine-similarity analysis can further identify those words within the corpus that are highly related to the securitization terms. Cosine-similarity calculates the angle of two non-zero vectors to determine how close the terms are related to their subject matter. The closer the angle between two terms reveals a similar positioning within the text, therefore indicating they tend to co-occur. An advantage of this cosine-similarity is that it can be measured irrespective of the size of the documents the terms appear in, which means it can be used in a heterogeneous corpus, such as the one used for this paper.

5.0.3 VAR Modeling and IRFs

The final section of the paper implements vector auto-regression model (VAR) to understand how media coverage and Congressional speeches are influenced by each other's shifts in issue attention. VAR is a random variable model that calculates linear inter-dependencies among multiple time series, providing evidence of Granger causality. "We say that Y_t is causing X_t if we are better able to predict X_t using all available information than if the information apart from Y_t had been used" (Granger, 1969). In other words, if there are changes in one variable that cannot be accounted by data from that same variable, then the change can only have been caused by another variable.

VAR modeling provides a strong control for autocorrelations through multiple simultaneous equations where "the endogenous variables in each equation form a regression with

the lagged values of all endogenous variables to estimate the dynamic relationships between all the endogenous variables” (Pervukhina, 2014). For this paper, the VAR dependent variables are the shifts in issue attention by the media and Congressmen.

VAR analysis has previously been used to study how does a climate problem indicator, high-profile international event, and climate science feedback influence media and congressional attention to global warming (Liu, Folberth, Yang & Zehnder, 2011). However, to the best of my knowledge, no study has used VAR to explore issue framing and agenda setting dynamics between the US media and Congressional elites. Following recent VAR modeling research, the paper introduces the use cumulative impulse response functions (IRFs) to ”indicate how an x-unit increase in attention to a given topic by a group predicts the cumulative attention that other actors dedicate to the same topic over time” (Barberá et al, 2019). This calculation is made over a 3-week period, given the reduced frequency of media articles, Congressional Committee Hearings and Floor Speeches around climate change

6 Results

6.1 Climate Change Framing

This first part of the results explores if Congressional and media discourse framing of climate change reveals a securitization process. An STM model analyzed the most salient themes within the corpus, identifying a total of nine topics that can be equated with issue frames. Since none of these revealed a security frame, a series of dictionaries were created to identify which documents contained securitization terms. Their term frequency and cosine-similarity were compared against the STM topics. This analysis finds that Democrats have a higher proportion of securitization references compared to the media and Republican corpus. Democrats are also more likely to address the negative consequences of climate change and the risks entailed by the phenomena. Overall, no indicators show a major securitization process is present within the corpus.

6.1.1 Uncovering Dominant Frames: Descriptive Results

Frames can be operationalized as topics (Ylä-Anttila, 2018; Bail, 2014; DiMaggio et al. 2013). This is done through key concepts which work in connection with each other in constructing a frame to the audience (Entman 1993, Nisbet 2009). To identify these term clusters, this paper analyses the Congressional and media corpus with a Structural Topic Model implementation package in the statistical software R. This model is able to identify the sets of words that tend to co-occur based on the researcher’s input of the number or topics that should be generated. Since there was no ex-ante expectation of the number of adequate topics for the corpus, several models were run and the final number was chosen based on the parameters of topic exclusivity and the semantic coherence.

Topic exclusivity narrows the topics of each text, but it also increases the number and fragmentation of themes within the corpus. In order to operationalize topics as frames, semantic coherence was favored over topic exclusivity when selecting the number of topics. Therefore, the optimal model produced an output of 9 salient dimensions around the climate change debate. These 9 main topics could be further "split" into smaller sub-dimensions as the topic exclusivity was increased, but the semantic coherence decreased to the point the topics could not be considered as frames given their great specificity (see Appendix). Table 2 shows a sample of those words with the highest probability of appearing for each topic and those words with the highest rank in terms of exclusivity and frequency (FREX).

	Topic	Probability	FREX
1	Consensus	scienc, climat, research, report	dr, ipcc, nasa, data
2	Energy	energi, gas, coal, carbon	nuclear, solar, electr, captur
3	Water	water, state, year, ocean	fish, arctic, speci, reef
4	Consequences	climat, chang, year, carbon	temperatur, extrem, weather, drought
5	Pipeline	oil, obama, pipelin, hous	keyston, pipelin, sand, xl
6	Executive	epa, regul, rule, air	epa, regul, rule, court
7	Economy	peopl, job, american, time	dont, tax, capandtrad, let
8	Programs	nation, energi, program, fund	program, educ, fund, ensur
9	International	emiss, climat, countri, china	negoti, india, pari, china

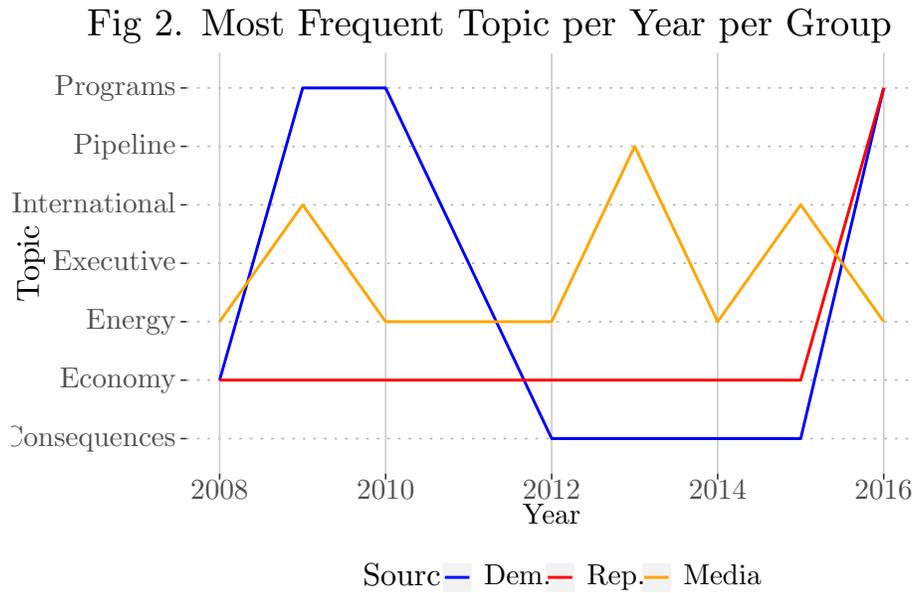
Table 2: Topics Identified: Probability and FREX

A qualitative assessment of the content of the documents showed topic 1 focuses directly

on the scientific debate of climate change and the consensus over the phenomena. These contain mentions the Intergovernmental Panel for Climate Change, NASA geographical reports or political speeches questioning scientific facts around the phenomena (i.e. if temperatures are even rising or if it is a human made phenomena, etc.). Topic 2 relates to those texts which address energy issues, such as transition to renewable energies, the independence from foreign oil, the cap on carbon emissions, etc. Topic 3 focuses on issues related to water. These texts refer to the increase in droughts, the melting of the Antarctic, the extinction coral reef, etc.

Topic 4 addresses the broader consequences of climate change, such as its effect on the ecosystem, the implications for farming, the animal species at risk, impacts on human health etc. Here we see many references to natural disasters. Topic 6 refers to Government's actions to tackle climate change, such as the policy agenda of the President and Agencies like the Environmental Protection Agency. Topic 7 reveals texts focused on economic issues, such as Federal Budget, concerns over unemployment, the raise of taxes, etc. Topic 8 focuses on secondary programs and legislation that refers in some aspects to climate change such as the National Environmental Education Act or Safe Drinking Water Act. Finally, topic 9 is related to international issues, such as international conferences, G20 meetings and agreements with other State actors, like the US-China Climate Agreement (2014).

An analysis of the most frequent topic per group per year shows that Republicans, Democrats and media do not systematically engage with one another in the same topic. Democrats focus mostly on the negative consequences of climate change and on programs/legislation that in some way are related to climate change. Republicans are mostly focused on an economic discourse where climate change is a secondary or tangent topic. Media's issue attention fluctuates greatly from the energy debate to the in the international arena (environmental agreements, actions and declarations by third countries, etc.).



Figures 3 to 5 desegregates the topic analysis of the corpus per group, showing the proportion of the topic evolution per year. In the case of the media corpus, the energy issue and the international coverage is present in 20% of the texts based on the topic proportion. The consequences of climate change increases its attention from 2010 on wards. In the case of the corpus of the Democrats in Congress, the consequences of climate constitute the topic of 38% of the texts in 2013. Bills and economic issues related to climate change also make up to 20% of texts. Finally, Republicans focus on economic aspects, such as taxation and public spending, for 40% and 30% of their topics.

Fig 3. Proportion of Topics for Media

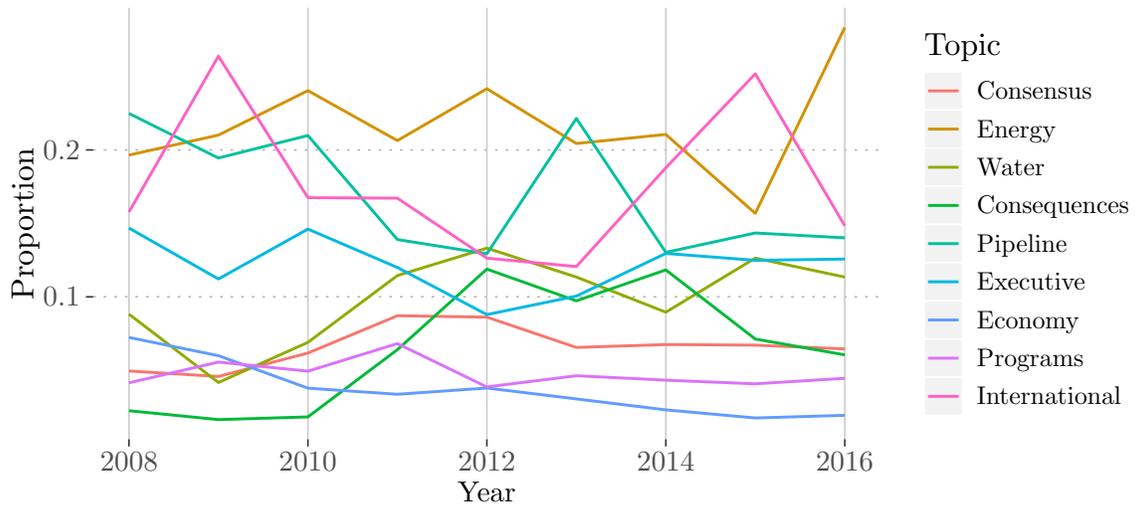


Fig 4. Proportion of Topics for Democrats

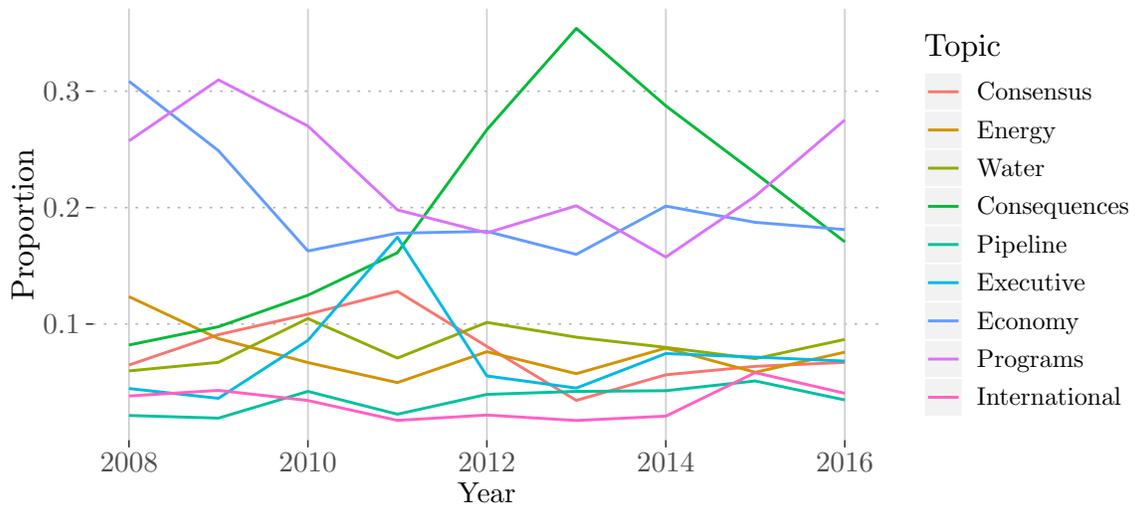
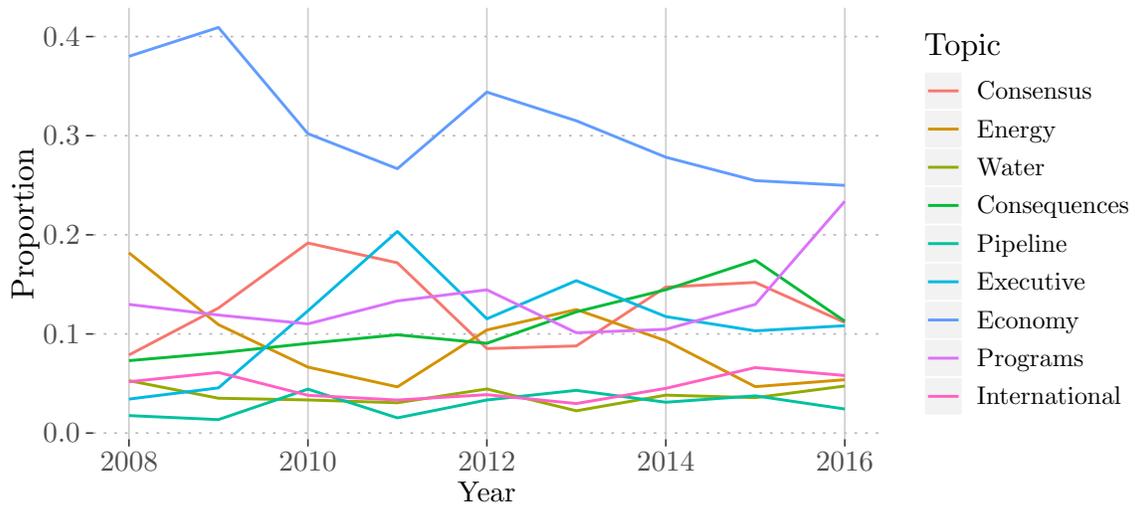


Fig 5. Proportion of Topic for Republicans



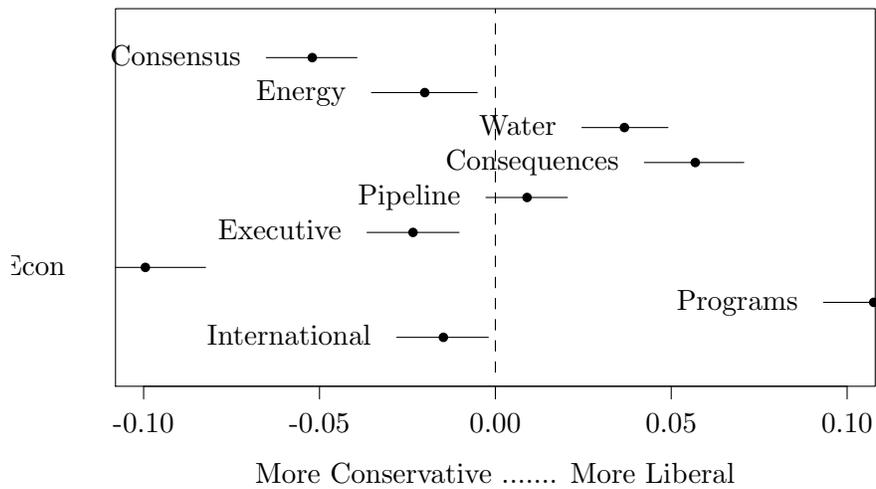
6.1.2 Uncovering the Securitization Processes

To claim an issue is undergoing a securitization process, it must be clear that it is presented and reiterated as a matter of top security, as an existential threat (Buzan et al., 1998). Following this definition, none of the nine dominant topics identified by the STM explicitly reveal a security frame. However, this does not mean the securitization process is not present within the media and Congressional discourses. There is a possibility that the securitization process is latent within the terms classified in each of the nine topics. For example, actors may use securitization concepts in co-occurrence with other terms that are clustered in other topics, such as the topic on consequences of climate change. If this is the case, references to the security risks of climate change could appear embedded within some of nine salient frames identified by the STM.

The securitization process has to be initiated through the discourse of political elites with the strategic goal to pursue new and urgent policies (Buzan et al., 1998). Within the scope of this study, if there was a securitization discourse in the corpus, the expectation is that it would appear in the Congressional speeches of the Democratic Representatives (securitizing actors), while Republicans would move away from the securitization framing (de-securitization actors).

To analyze the differences between the Democratic and Republican speeches, a conditional expectation of topic prevalence can be calculated based on the party covariate. This entails understanding which topics are more likely to be addressed by representatives of each party. The analysis of the topic predictive probabilities (Fig 6) reveals that Democrats are more likely to make their discourse about the negative consequences of climate change, its impact in the water supply, and the programs necessary to address the issue. Such finding is consistent with the expectation that Democrats in Congress are securitizing actors. Conversely, the most predictive topic of the Republicans is economics, which could point to a de-securitizing strategy.

Fig 6. Effect of Liberal vs. Conservative in Topic Predictic



6.1.3 Dictionary Analysis

The results of the STM do not reveal a securitization process in the US media and congressional corpus. However, there might be securitization terms embedded within the different topics, which could mean that the securitization process is latent within the corpus. To explore this possibility, this section of the project makes use of a novel dictionary with five categories designed to reveal the proportion of words referring to security frame, consensus frame, consequences frame, energy frame and policy frame (Table 3). The securitization

category is constructed based on terms from official documents linking climate change and security issues. These sources are the United Nations Security Council debate on climate change the 17th of April 2007, the 2011 NATO Security Report and the 2015 National Security Strategy. Here "the discussion was expected to focus on the security implications of climate changes, including their impact on potential drivers of conflict, such as access to energy, water, food and other scarce resources; population movements; and border disputes" (UNSC, 2007). For the other four categories uses terms based on the word-topic probability output of the STM model.

The categories for the dictionary were created for the following reasons. First, in addressing the consequences of climate change (drought, migrations, natural disasters, etc.), strategic speakers can build on these elements to argue how the consequences of climate change represent a threat for national security. Second, energy related issues (such as emissions, energy independence, etc.) are perceived as the key area that needs to be address to mitigate the effects on climate change. Third, securitization is a process that pertains the discussion and implementation of policies to tackle the threats. In this regard, the "Policy" dictionary identifies references to legislation as well as to the Environmental Protection Agency, which is discussed as a central actor in the implementation of climate change regulation. Finally, the "Consensus" dictionary focuses on the agreement reach both by the international and scientific community of the nature of climate change and the need to undertake mitigation policies. References to the inevitability to climate change and the overall agreement of its consequences is key to build a case for the need to implement security measures.

Figures 7 to 10 show the dictionary analysis of the media and elected representatives from the Democratic and Republican Party. After applying the dictionaries, the results show that the relative frequency of the securitization framing terms appearing is less than 0.1 of the overall corpus. Securitization Theory states that a security frame must be reiterated by political elites and media, dominating all other discourses in order for a securitization process to be successfully deployed. Given the results, it cannot be claimed that there was a major securitization process in the debate of climate change within the US between 2009 and 2016. However, one of the expectations was for the Democrats to behave as securitization agents by using the most the securitization terms. The results show that Democrats in Congress use of this framing in an increasing fashion throughout the years,

Dictionary	Key Words
Security	"risk", "security", "threat", "danger*", "shortage", "dependance", "resources", "hunger", "food", "irreversible", "hazard", "migration*", "desertification", "epochal", "catastrophic", "threatening", "crisis", "existential", "conflict*", "damage", "destruct*", "destruction", "devastation", "displacement", "emergency", "irreversible", "unsc"
Consensus	"real", "reality", "uncertainty", "certain*", "true", "consensus", "confirm*", "evidence", "consensus", "science", "scientists", "scientific", "anthropogenic", "agreement", "ipcc", "copenhagen", "kyoto", "paris", "united", "nations"
Consequences	"celcius", "degree", "degrees", "damage", "temperature", "atmosphere", "ozone", "species", "extinction", "warming", "nature", "flood", "biosphere", "animals", "melt", "artic", "antartida", "antartic", "pole", "melting", "weather", "displacement", "droughts", "drought", "huracain*", "animal*", "crops", "land"
Energy	"fossil", "fuel", "renewable", "coal", "emission", "emissions", "energy", "gas"
Policy	"bill", "legislation", "EPA"

Table 3: Dictionary to identify Security, Consensus and Consequences Framings

though its proportion compared to the overall terms in the dictionary is between 11% and 15%. On the other hand, for Republicans and media the security framing appears with a frequency of less than 10% of the dictionary terms. In this regard, Republicans behave as de-securitizing actors, along with the media.

Fig 7. Applied dictionaries: Media

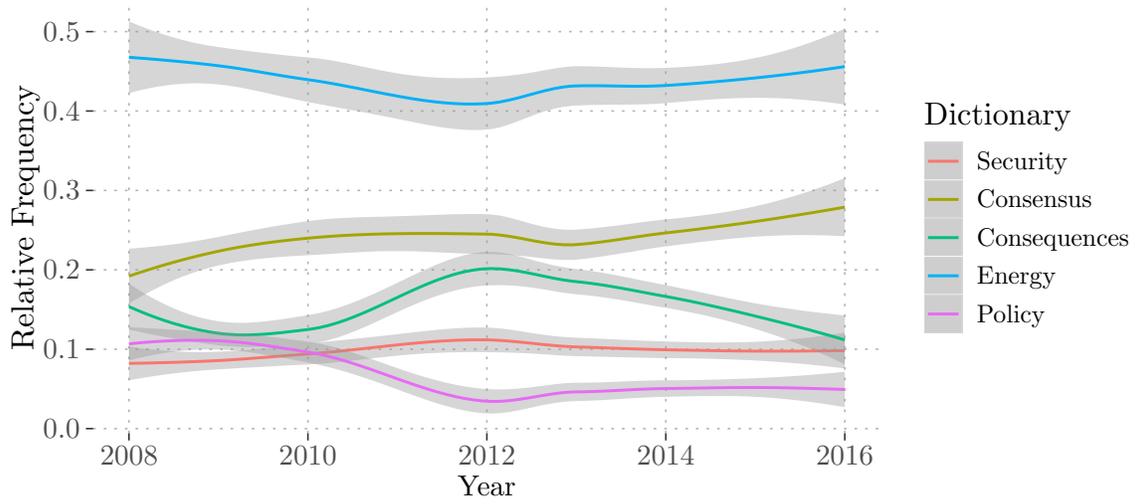


Fig 8. Applied dictionaries: Democrats

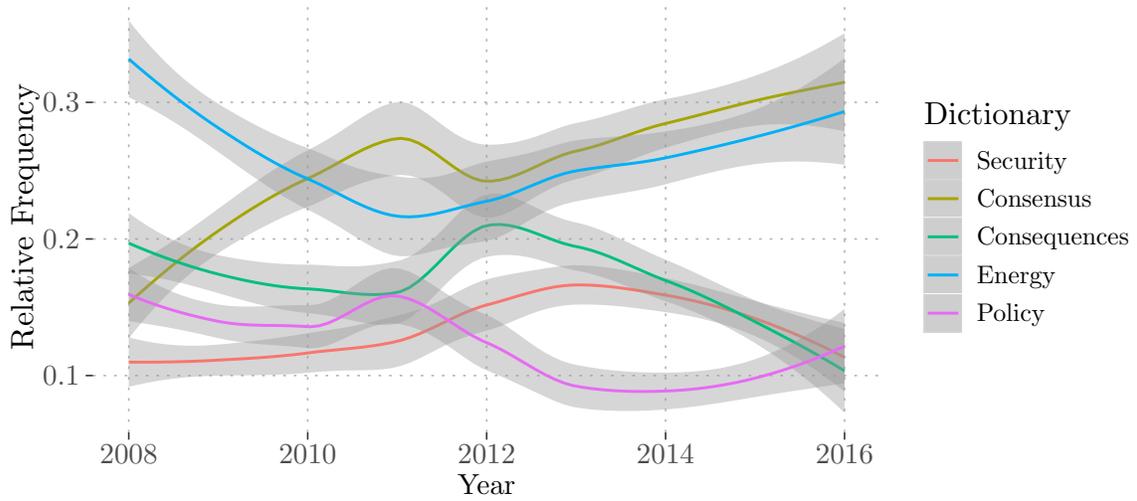
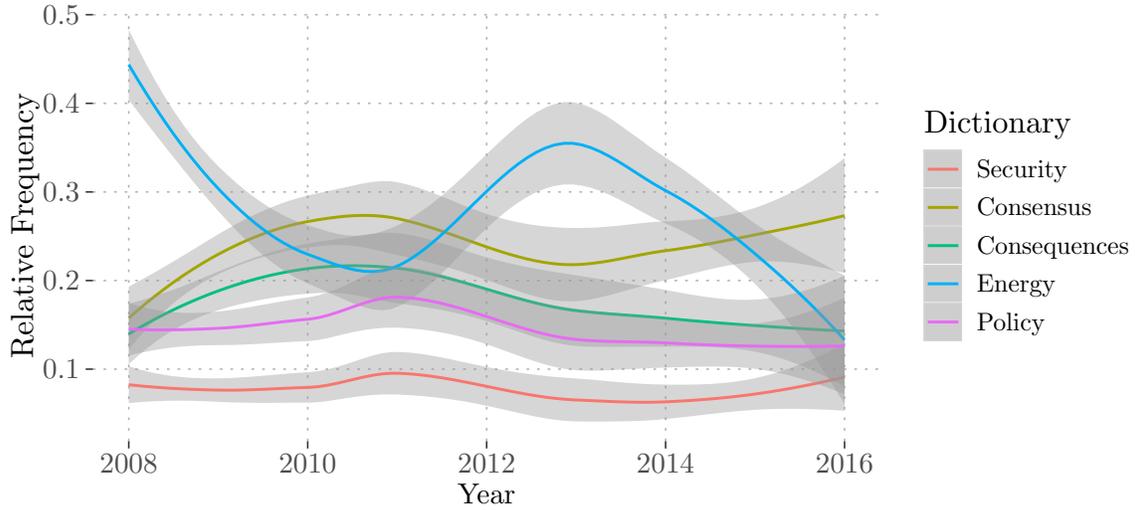


Fig 9. Applied dictionaries: Republicans



6.1.4 Cosine Similarity

The dictionary method shows that the proportion of securitization terms is too low compared to the proportion of other concepts associated with non-securitization frames. As such, we can reject the claim that there is a successful securitization process. However, even if there is not a dominant securitization frame within in the overall corpus, we see that the Democratic discourse presents some securitization efforts. This means that Democratic Representatives use more securitization terms in their discourse. In order to show if a securitization process is potentially being constructed, it is important to understand the semantic relationship between securitization terms and the rest of concepts within the corpus. This means revealing in which context do securitization terms appear and are frequently used.

A cosine-similarity analysis shows which terms in the corpus appear as co-occurring to the securitization terms of "Threat", "Security", "Risk" and "Danger". The Cosine-similarity calculation is based on the angle of two non-zero vectors to determine how close are the terms related to their subject matter. The closer the angle between them reveals the similarity between those terms and their position in the text. If the cosine similarity converges to 1 it means that the angle of the vector between the two terms is 0, which entails the two terms are placed in identical locations within the text. Another advantage

is that cosine similarity is able to measure the similarity between terms irrespective of the size of the documents they appear in. This allows to identify which terms appear close to each other irrespective of the number and heterogeneity of the texts.

When running the cosine-similarity analysis over the Democratic Party’s corpus (Table 4), the words ”threat”, ”security” and ”risk” relate to climate change with a cosine similarity of up to 0.42. This indicate that these are concepts that do appear with certain co-occurrence within the same document. From this it can be inferred that when Democrats talk about climate change, they are likely to mention security and risk concerns. This is consistent with the premise 3, which states the Democrats are the securitizing actors in the climate change debate. The same analysis with the Republican’s speeches in congress yields a cosine similarity of less than 0.05, which shows Republicans do not refer to climate change in terms of national security, therefore becoming de-securitizing actors, as proposed in premise 4. The cosine-similarity analysis of the media corpus (Table 5) show a weak relationship between the securitization terms and climate change. In the case of the media, ”threat”, ”security” and ”risk” are associated with military terms. Climate change appears to have a cosine similarity of 0.28, meaning when security issues are raised within media articles, climate change is not a frequent reference.

	threat	security	risk	danger
climate	0.42	0.33	0.38	0.18
change	0.41	0.32	0.36	0.16
action	0.35	0.22	0.24	0.12
time	0.32	0.32	0.25	0.16
congress	0.31	0.25	0.26	0.12

Table 4: Democrat Party Corpus:Cosine similarity between terms ”climate”, ”change”, ”global” and ”warming” to other words.

Overall the topic model, dictionary and cosine-similarity analysis results show that climate change debate in the US Congress and media during 2009 and 2016 has not undergone a mayor securitization process, according to the premises of the Securitization Theory. The STM model was not able to identify a specific Securitization topic based on the cluster of security terms within the document. However, the Democratic corpus

	threat	security	risk	danger
detonated	0.35	0.00	0.00	0.00
missile	0.33	0.00	0.00	0.00
hardening	0.28	0.00	0.00	0.00
climate	0.28	0.21	0.30	0.16
global	0.28	0.17	0.23	0.17

Table 5: Media Corpus: Cosine similarity between terms "climate", "change", "global" and "warming" to other words.

shows, compared to media and Republicans, does show a higher proportion of securitization terms in co-occurrence with references to climate change. This is points to the Democratic Representative's behaving as securitization actors, compared to the media nor Republican Representatives.

6.2 VAR Analysis: Actor's Role Influencing the Climate Change Debate

The first motivation of this project was to uncover the dominant issue domains that is driving the debate around climate change and how these relate to a securitization process. The second motivation of this paper was to understand the potential flow of these issue frames between the discourse of Congress Representatives and media. Is Congress managing to influence the content of the media articles? Or is media setting the terms of debate within Congress? How do Republicans or Democrat address their respective topics of interest?

Securitization Theory argues that securitization discourses need to be spoken from a position of authority, namely from political actors, and that the media should follow this influence (Buzan, Waever & de Wilde, 1998). Politicians can be categorized as securitizing and de-securitizing actors. The former portrays, as part of their strategic goals, an issue as a security risk. Conversely, the latter divert their discourse away from security considerations. Previously it was established that Democrat's discourse has indices of a securitization strategy and that Republican's speech is closer to a de-securitizing strategy. This section tests if any of these two key political actors influence the US media's framing of the issue of climate change. A simple correlation analysis shows that neither Republicans nor Democrats seem to cover or engage in the same topics as the media. However, through a vector autoregression (VAR) analysis it is possible to understand which actors (media, Republicans or Democrats) change their framing of climate change based on shifts on the

issue attention of the other speakers.

Source	Democrats	Republicans
Media	0.03	0.05

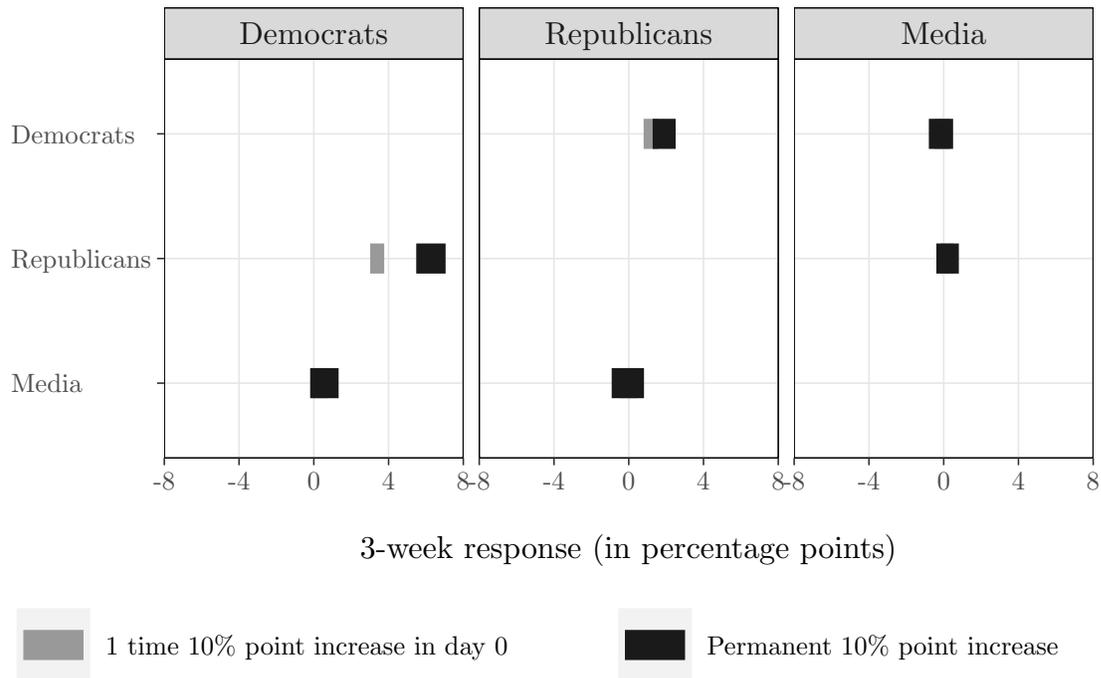
Table 6: Correlation of topic issue attention between media and Members of Congress

The VAR model estimates the Granger causality of political parties influencing the topics addressed by the media and vice-versa. Currently, many scholars focusing on agenda setting dynamics search for information shocks or events with the effect of raising awareness of the problem and making it a priority issue (Baumgartner and Jones 1993; Jones 1994; Birkland 1997). In order to artificially create this news shocks, VAR analysis can implement cumulative impulse response functions (IRFs) in the Granger causality estimation. "These cumulative IRFs indicate how an x-unit increase in attention to a given topic by a group predicts the cumulative attention that other actors dedicate to the same topic over time" (Barberá, Casas, Nagler & Egan 2018).

For this paper, the nine topics identified by the STM topic model are used to create cumulative effects in the changes of information that the actors pay attention to. These actors are the media, Democrats and Republicans. The VAR modeled cumulative effects in periods of three weeks. This period of time is chosen to ensure an effect because the texts on climate change in the dataset were not produced on a daily or even weekly basis. This is expected, given that the media does not cover the issue of climate change in every daily publication, or that Congressional Committee Hearings and Floor Speeches do not always cover the issue of climate change.

Following Securitization Theory, the expectation is for media to be influenced by the issue attention of the majority party in Congress. To explore this, the corpus was split in the 2010 and 2014 Midterm elections before running the VAR analysis. In the 2010 elections, Democrats lost their majority in the House of Representatives and some seats in the Senate. In the 2014 elections, Republicans won the majority of of both the Senate and the House. Thus, the first set of VAR analysis goes from 2008 till November 2010, where Democrats where in control of Congress as the majority party. The second VAR analysis uses the data from November 2014 till 2016, when Republicans where in control of Congress.

Fig 10. Pre-2010 Predicted Issue Attention by Groups in Panels



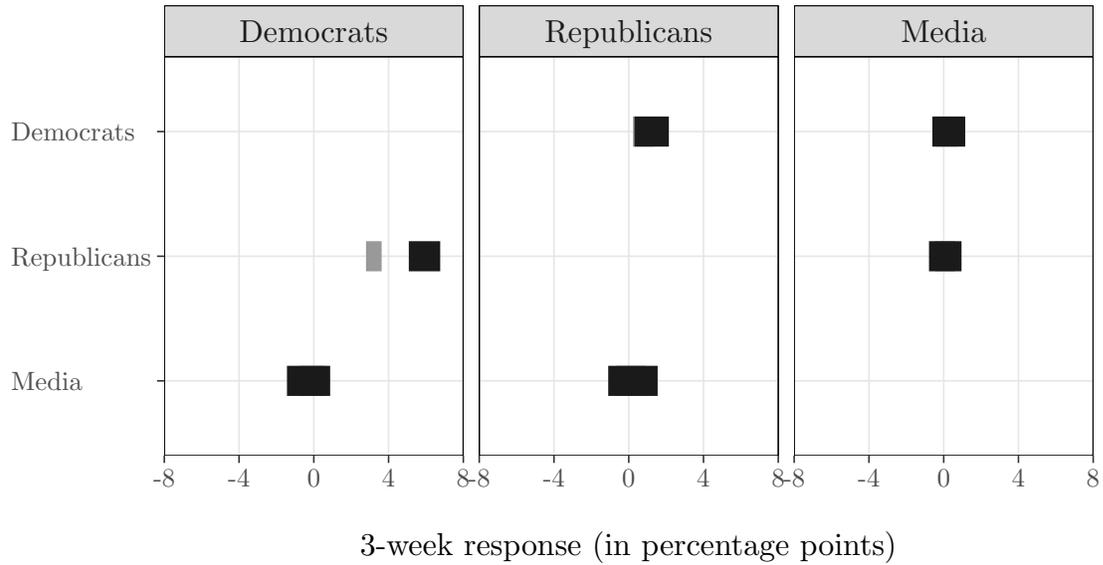
The VAR output is shown in Fig.10 and Fig.11. The groups heading each of the panels, are those actors whose issue attention potentially shifts based on the changes of the issue attention of the actors in the left (vertical) side. This increase in attention is measured as a one-time 10% point increase in attention or a permanent 10% increase. With this amount of increased attention of one actor (i.e. media or politicians) over one topic, the VAR identifies if the rest of the groups also shift they attention or not.

The following can be observed from the combined VAR and IRF analysis. First, the prediction that media will follow the climate change topic based on the majority party in Congress can be rejected. Likewise, nor Republicans nor Democrats increase their attention as a function of the media cumulative interest on an issue. This suggest that how the media or Congress address climate change is independent of how the other actors are covering the issue. Second, Democrats shift their issue attention based on what Republicans say, between 4 and 7 percentage points. Republicans only shift their issue attention by a 3 percentage points based on the Democrats discourse. This suggest that Democrats do

engage with Republicans issue concerns in the Congressional debates, however, Republicans avoid engaging with the Democrats' topics of interest.

Once again, these findings indicate there was not a major securitization process in the debate of climate change within the US between 2008 and 2016. First of all, the media is not following the issue attention of the political elites, which is one of the conditions stated by the Securtization Theory. From this corpus it is not possible to know if the media mostly follows the Government's framing or if they have their own agenda. However, the Democrats (securitizing actors) in Congress were not as successful as Republicans (de-securtizing actors) in influencing the conversation on climate change. This shows that, even if the media was following the Government's framing of climate change, Congress did not have a dominant securitization message in its topics.

Fig 11. Post-2014 Predicted Issue Attention by Groups in Panels



1 time 10 % point increase in day 0
 Permanent 10 % point increase in

6.3 Conclusion

Scholars have argued that the climate change debate within the US has undergone a major securitization process throughout the years. Specifically, this process started with the Government framing efforts during the Obama administration (Peterson, 2016; Thomson, 2017). Framing refers to “the process by which people develop a particular conceptualization of an issue or reorient their thinking about an issue” (Chong & Druckman, 2007). Securitization Theory stipulates that the framing of an issue as an existential threat opens a policy window that can be used to insert a certain agenda that would otherwise be hard to promote (Birkland, 2009; Lowry, 2006).

However, no study has looked at the securitization strategy outside the executive branch, specifically, the role of Congress and media in this process. This paper aimed to uncover the possibility of a latent securitization frame in media articles and Congressional speeches, and the role of these actors in (de)securitizing the debate. These questions were explored through a structural topic model (STM), a dictionary method, a cosine-similarity analysis and a vector auto-regression analysis on a corpus of unique 5054 news media articles and Congressional speeches.

The results failed to show indicators that would show that the Congressional and media debate over climate change experienced a securitization process between 2008 and 2016. The following indicators were used following the Securitization Theory were; 1. An increasing topic proportion of the security frame throughout the years; 2. A dominant securitization framing topic proportion compared to the rest of frames; 3. The majority party in Congress influences the type of issue attention of the media coverage.

In this line, the expectation was for the policymakers from the Democratic Party to have the highest proportion of securitization frame topic in their discourse, therefore revealing their role as securitization actors. Conversely the expectation was for the policymakers from the Republican Party have the least topic proportion of securitization frames in their discourse, therefore being the de-securitization actors.

The STM model identified 9 dominant frames surrounding the climate change debate in the corpus. These are the scientific consensus around climate change; energy and emission issues; water and drought issues; the broader environmental and human consequences of climate changes; debate over the XL Keystone pipeline; actions of the government and executive agencies; economic issues; secondary bills and programs which in some what are

framed as related to climate change; and international events such as accords or bilateral climate agreements. Since none of the topics reveal a clear security frame, a dictionary method was used to identify the proportion of terms that specifically addressed security concerns against terms referring to the policy, scientific consensus, consequences and energy implications of climate change.

The dictionary method revealed that there is no dominant or increasing securitization frame within the corpus. However, Democrats do have a higher proportion of securitizing terms than Republicans and media. Finally, the cosine-similarity analysis between the terms "Threat", "Risk" and "Danger" reveal that Democrats do talk of climate change in these terms, unlike the media or Republicans. All these results show that Democrats in Congress can be seen as greater securitizing actors of the climate change discourse within Congress.

A key indicator of a securitization process is the political elites influencing the media coverage of the issue as a security threat. The second part of the paper focused on understanding if Democrats or Republicans were able to influence media regarding the climate change debate. These influence dynamics were explored through vector autorregression analysis, which tested the changes in topic attention, separating the data based on which party had Congressional majority. The first VAR analyses the corpus between 2008 until November 2010, when Democrats had the majority seats in Congress. The second VAR analysis focuses from November 2014 till 2016, when the Republicans had the majority. The VAR analysis results show that Democrats do increase their issue attention by 4 percentage points based on the Republican's issue attention. Republicans react to Democrats issue attention by 2 percentage points. However, media issue attention does not shift, independent from which party is dominating Congress. This shows that the media does not report on climate change issue based on Congressional debates.

This project was a necessary first attempt to trace the evolution of the debate of climate change within the US. Overall, the Obama administration placed efforts in addressing climate change a security issue, but this framing did not trickle down to dominate the Congressional agenda. Future research would be necessary to explore what was the correspondence between the media, Congress and the Executive branch in influencing the debate over climate change.

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A Appendix

A.1 Validation Topics identified by STM

Structural topic model (STM) is an unsupervised generative probabilistic model that freely identifies patterns in unlabeled data and generates topic categories based on meaningful clusters of terms. Roberts (2013) introduced structural topic model (STM) as a general causal inference framework for premise testing for document covariates, which is a major improvement on the Latent Dirichlet Allocation (LDA) model. Roberts et al. (2016) analyze the estimation benefits of STM relative to LDA and find that for metadata-generated topic processes, STM outperforms LDA in covariate inference and out-of-sample prediction. For the analysis of the corpus, I used two key covariates of interest to assist the STM model in identifying the topic; year and source (media or political party). The STM was modeled assuming a non-linear relationship between the continuous covariates year and the source type.

In order to identify the adequate number on topics, I run a series of STM models and evaluated the output based on semantic coherence and exclusivity of the topics since a “topic that is both cohesive and exclusive is more likely to be semantically useful” (Roberts et al. 2016). Additionally, I searched for those topics with the highest held out likelihood, also known as perplexity, which measures the performance of the probability model predicting a sample. In choosing the number of topics there is a trade off between exclusivity, semantic coherence and held-out likelihood. It is for this reason that the qualitative assessment by the researcher has the last saying in topic selection.

For the purpose of this paper, I operationalize topics as frames (Bail, 2014; DiMaggio et al. 2013, Nisbet 2009) ”The continued habitual use of particular words together with each other shows that those words have meaning in relation to each other, together forming a cluster of concepts, which can be interpreted as a frame” (Yla-Anttila, 2018). In order to identify the frames, I had to identify the broader topics connecting the texts. This means favoring the semantic coherence parameter over text exclusivity when choosing the number of topics. The higher the topic exclusivity, the more the broader topics are atomized to a point they only address few texts. For example, within the topic of energy issues one can find the Clean Energy Act. A higher topic exclusivity in the STM output would create a topic just for the Clean Energy Act texts.

However, this topic would be too exclusive to be operationalized as an issue frame. After running a series of topic models and validating their output, I model with 9 topics since this number kept the highest semantic coherence with the highest held-out likelihood.

Figure A.1 shows the diagnostic values by the number of topics. As we see, semantic coherence decreases with topic exclusivity (held-out likelihood). Figure A.2. shows the STM output with 9 topics and the semantic and exclusivity values for each individual topic. For comparison, figure A.3. shows the STM output for 15 topics. Here the semantic coherence decreasing significantly as the topic exclusivity rises. This means a STM output of 15 topics is not useful for the issue frame analysis given I cannot retrieve meaningful topics that can be applied to a larger number of texts.

Fig. A.1. Diagnostic Values by Number of Topics

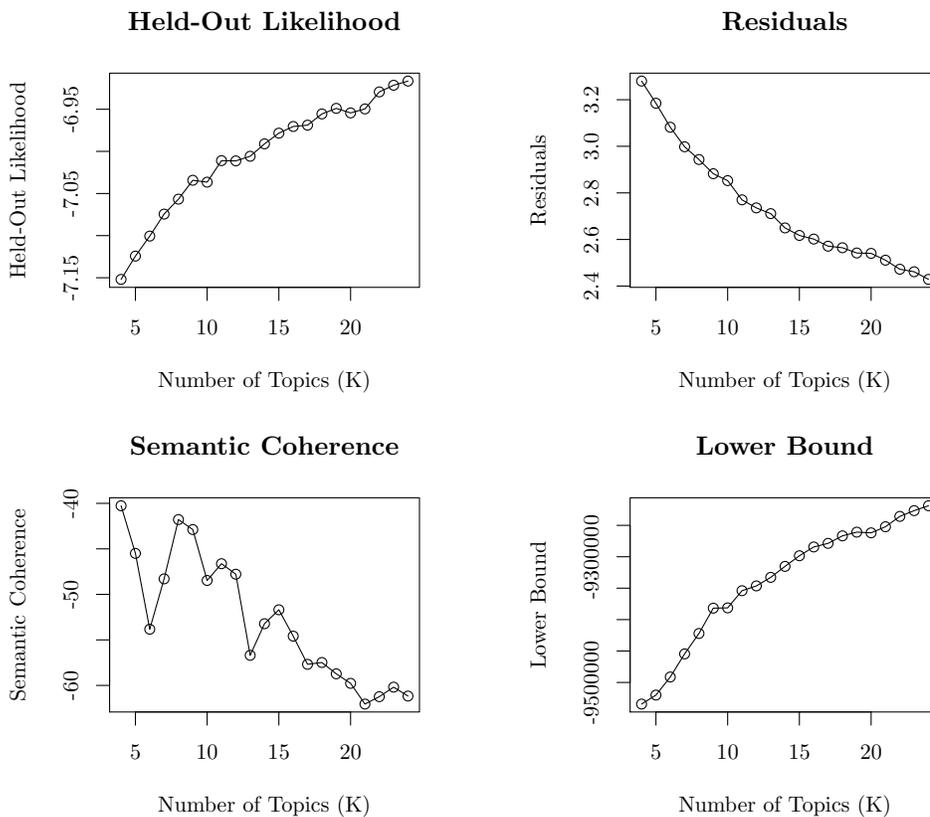


Fig. A.2. STM Output for 9 Topics

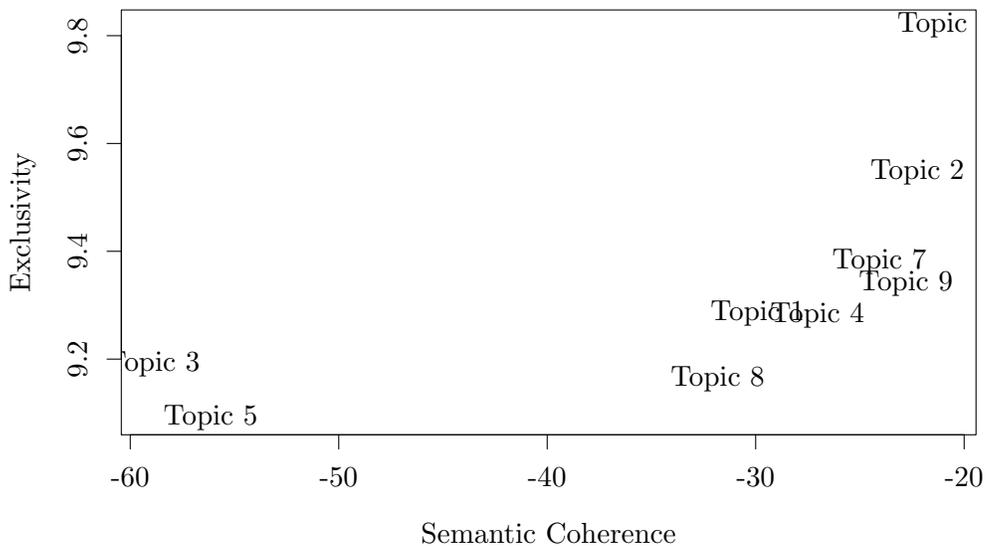
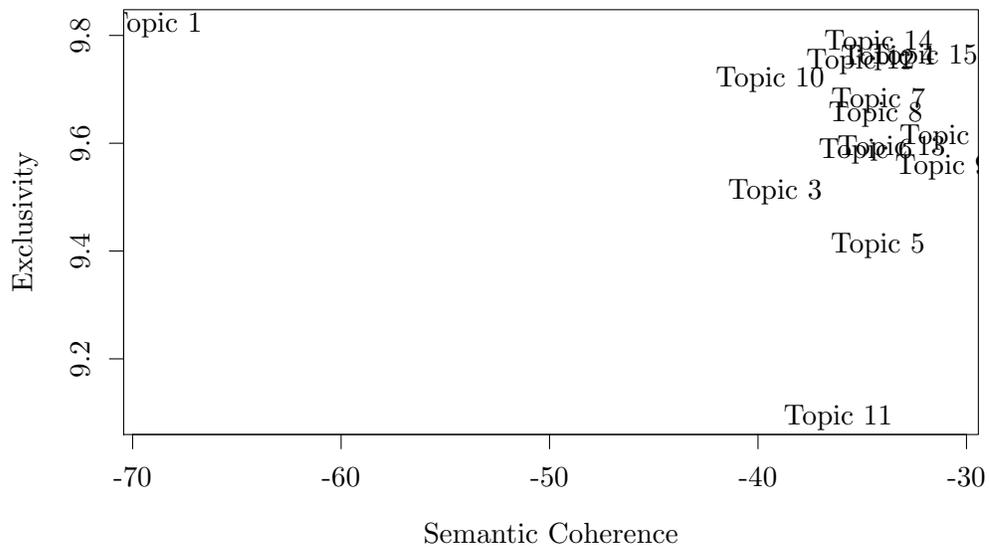


Fig. A.3. STM Output for 15 Topics



A.2 Topic labeling

In order to label the topics identified by the STM model into meaningful categories for the analysis I extracted a sample of 300 documents per topic and evaluated their content. I include a sample document belonging to each topic to illustrate the content of the corpus:

TOPIC 1 CONSENSUS *Madam Speaker. I debate throughout the world the concept of global warming. but I don't call it that any more. I call it climate change. All the big leaders of the world are in Denmark talking about how they can figure out a way to control man. to make sure that man. the evildoer. the polluter of the world. does not continue to pollute our wonderful climate. The consensus has been for some time that global warming. climate change. continues because man is the perpetrator. Now I are beginning to learn that may not be true. that there is not a consensus that there is global warming or climate change. I now have heard about Climate change. where the expert scientists hid emails in England that disagreed with the so called consensus that there is global warming and global climate change. I have heard now new evidence that even NASA is involved in not revealing evidence that contradicts climate change. I think a history lesson is in order....*
(15 Dec 2009, Rep. POE)

TOPIC 2 ENERGY

Cheaper oil has taken down the ruble, OPEC's credibility and may yet upend Venezuela's government. Might it also undermine renewable energy? Investors seem to think so: The WilderHill Clean Energy index has been sliding since September and is now decidedly negative for the year. Superficially, this makes sense, as cheaper fossil fuels tend to discourage efforts to use more renewable energy. Yet oil's impact on the renewables sector is more complex...(27 Dec 2014, WASHINGTON POST)

TOPIC 3 BIOSPHERE

Visitors to some of the oil fields that fringe Alaska's Beaufort Sea get this rather disturbing warning before venturing out into the Arctic cold: Look carefully under cars in the parking lot and the buildings on stilts. Why? Lurking there may be one of the world's largest land carnivores – the polar bear, which can actually track a man down. But who's to protect polar bears against humans? For the past few years, polar bears off the Alaskan coast were

observed drowning many miles out at sea. The suspected culprit: fewer ice floes upon which to hunt their favorite meal – seals – because of global warming. The plight of the polar bear, which became a world-wide clarion call to action on global warming...(5 Aug 2008, WALL STREET JOURNAL)

TOPIC 4 CONSEQUENCES

"They're not coming south because they're hungry. Every owl we've caught is fat, healthy," he said. Weidensaul said that a snowy owl he helped trap for removal from Philadelphia International Airport on Wednesday "looked like it was living very high on the hog." When snowy owls are away, lemmings play. Hidden under snow cover with few worries, they do what comes natural, giving birth to litters of six to eight. Lemmings mature sexually in a few weeks, allowing three generations to grow during a single winter, said Gilles Gauthier, a professor of biology at Laval University in Quebec City. But the population booms that feed the big snowy-owl irruptions might not last in an era of global warming. The Arctic landscape is changing, and there are early signs that it has caused lemming populations to dip in Scandinavia and Greenland...(17 Feb 2014, WASHINGTON POST)

TOPIC 5 PIPELINE

Madam Chair. I yield myself such time as I may consume. Climate change is the biggest energy challenge we face. so before approving a multibilliondollar energy infrastructure project that will last for decades. we need to evaluate its climate impacts. That is the standard the President rightly set last June but this test is a significant obstacle for tar sands pipelines because they would carry the dirtiest fuel on the planet [...] Even if you support the XL pipeline. this is a bad bill and I would urge all Members to vote against this legislation.....(24 Jun 2014, Rep.WAXMAN)

TOPIC 6 EXECUTIVE

Mr. President. I was disappointed last night to learn that the Supreme Court temporarily halted the implementation of President Obamas Clean Power Plan program. This was an especially stunning move by the Supreme Court. given that just weeks ago the DC Circuit Court of Appeals categorically rejected a halt in the Clean Power Plan and States do not need to start implementing the plan until 2022. This shortsighted decision by the Courts

five conservative Justices is an unfortunate setback. It unnecessarily puts into question a major part of our countrys effort to address climate change and protect our environment. Notwithstanding my amazement, I remain confident that the Obama administrations carbon rules are legally sound...(2 Feb 2016, Rep. REID)

TOPIC 7 ECONOMY

Mr.President. there are a number of huge issues facing our country. Our middle class is collapsing. Poverty is increasing. I are in two wars. I are concerned about global warming. the quality of our education. and massive unemployment. So this country today has its share of serious problems I have to address. Right now. a whole lot of attention. not inappropriately. is on our very large deficit and a \$4 trillion plus national debt. This is an issue which is perhaps going to come to a head over the next few months as it becomes tied to whether I raise the debt ceiling. I wish to say a few words on this issue....(9 JUNE 2011, Rep. SANDERS)

TOPIC 8 PROGRAMS

Mr. President. I fully support passage of H.R. 2095. a bill that will help move Americas railroads into the 21st century. The reauthorizations of the Federal rail safety programs and Amtrak are long overdue and this bill will give direction to Amtrak and the Federal Railroad Administration. FRA. to help them both better accomplish their missions. Given the higher price of oil, continuing climate change concerns and our challenging economic times. it is more important than ever that we ensure that our Nations passenger and freight rail systems are adequately prepared to safely accommodate our transportation needs. Safety is a key element if we are to continue to expand our Nations use of trains. H.R. 2095 will improve railroad safety and ...(1 Nov 2008, Rep. INOUE)

TOPIC 9 INTERNATIONAL

President Barack Obama met privately with the Dalai Lama at the White House on Wednesday, sparking anger from China. The two leaders discussed issues including human rights and climate change during what the White House called a personal conversation based on Mr. Obama's appreciation for the Tibetan spiritual leader's teachings....(16 Jun 2016, WASHINGTON POST)

A.3 Sentiment Analysis

Through sentiment analysis we are able to identify if the general sentiment around climate change is negative. Proving the overall discourse around climate change is negative helps to support the premise that climate change is accepted as a challenge for the US. Therefore, we know that the topics identified by STM have an overall negative tone. To this end, I run a sentiment analysis over the corpus with the Loughran-McDonald (2011) sentiment dictionary for positive and negative terms. This test confirms the expectation that climate change is addressed as negative issue.

Fig A.3: Frequency sentiment around Climate Change by Year

