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Exploring the Dynamics in the Environmental Discourse: The Longitudinal Interaction Among Public Opinion, Presidential Opinion, Media Coverage, Policymaking in 3 Decades and an Integrated Model of Media Effects

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ABSTRACT

Using data on environmental issues drawn from 41 series of poll questions and federal outlay in 43 years (1965-2007) and a content analysis of newspaper articles, television news summaries, and presidential documents in 28 years (1980-2007), with the multivariate Granger Causality test based on Vector Autoregression (VAR) models and bivariate Granger Causality (F and Chi-squire) tests, the study finds that public opinion has little influences on federal environmental expenditure in the past several decades. It also finds that for the presidents, the media, and the public, their agendas (volume of information) cause a change in their attitudes (tone toward the environment) and that the casualties in the agenda and frame building and setting processes are essentially confirmed by the multivariate test, but feedback influences are also identified through the bivariate tests. The multivariate test also shows an influence from the presidential agenda to the public agenda on environmental issues, with no influence identified the other way around. The implications of the proposed five-level integrated model of media effects are also discussed.

KEYWORDS

Environmental Discourse, Environment Policymaking, Public Opinion, the President, the Media Coverage

Exploring the Dynamics in the Environmental Discourse: The Longitudinal Interaction Among Public Opinion, Presidential Opinion, Media Coverage, Policymaking in 3 Decades and an Integrated Model of Media Effects

Environmental communication scholars have been trying to answer the question of whether the public, which usually does not have a lot of expertise in environmental science, is capable of making substantial contributions to the process of environmental policymaking (Fischer 2017). Jurgen Habermas, who believed that the public should be the decision-makers on any topics in his early ages, later agreed that decision-making on some issues, such as environmental protection, required expertise and most citizens were actually "unqualified to participate in" (Fischer 2000, p8). Some other scholars argued that the public ought not to have any impact on energy and environment policies, which should be left to technical experts (Morone and Woodhouse 1989). The current administration under President Donald Trump, who withdrew the U. S. from the Paris Agreement on carbon emissions reduction (Kim and Cooke 2018), seems to side with this line of argument..

Scholars on the other side of the argument, however, believe that the public should be and is the final decision-maker of environmental and energy issues (Smith 2002). The general public may lack the specialty to make important decisions on environmental issues, but they can obtain necessary knowledge from the media and interpersonal deliberation processes, if those processes are provided (Fischer 2000, 2017). Smith (2002) finds that the environmental policy development has followed a model: the expanded interest groups lobby Congress for new laws; when pollsters find public opinion supporting the new laws, Congress goes along. Smith (2002) illustrates this model with the passage of the *National Environmental Policy Act of 1970* and the *Clean Air Act of 1970*, the establishment of the Council on Environmental Quality in White

House, and the creation of the "environmental impact statement" (EIS) process, all of which followed that pattern. Presidents are also found responsive to the public's environmental demands in previous research. For instance, President Richard Nixon responded to the public call for a lower oil price with wage and price control, which might have made the energy situation worse in the long term but pleased the voters in the short term (Smith 2002); president Bill Clinton blocked Congress's drastic revision of the Clean Water Act in 1994 in response to public dissatisfaction with the bill (Vig 2013). Public opinion has also determined the fate of nuclear energy and offshore drilling in some cases (Freudenburg and Gramling 1994; Gramling 1996; Morone and Woodhouse 1989).

The environment has been a political issue in developed countries for decades (Hodgson 1976; Kim and Cooke 2018). A group of studies found that the presidents influence the media and the public and that the media influence the public on environmental issues (Gavin 2018; Kim and Cooke 2018). Researchers of agenda-setting (McCombs and Reynolds 2009; McCombs and Shaw 1972; Wanta and Alkazemi 2017), priming (Iyengar 1991; Iyengar and Kinder 1987; Wanta and Tarasevich 2019), and framing (Borah 2011; Cacciatore, Scheufele, and Iyengar 2016; Scheufele 1999; Tewksbury & Scheufele 2009), have also found in separate studies that the president or political establishments influence the media coverage, and that the media influence the public perception. So overall, in the intricate discourses on environmental issues, how have the presidents, the public, and the media interacted with each other to influence environmental policymaking?

This study uses accumulated yearly data from public opinion polls and federal environmental budgets from 1965 to 2007, a content analysis of presidential documents and media coverage of environmental issues from 1980 to 2008 on a quarterly base, and a yearly

dataset converted from the quarterly to connect the quarterly dataset of content analyses to the yearly data of public opinion polls, to explore how the public interacted with the president and the mass media on environmental policymaking . Longitudinal data, with their intrinsic temporal factors, can provide stronger evidence of causality than cross-sectional data (Liu 2015). Those three to four decades cover several presidencies and a variety of developmental stages of environmental issues (Kraft 2000). Knowledge of the interaction of the public, the presidents, the media, and policymaking in those decades can lend us deeper understanding of the dynamic discourses among the three parties, which is still a focus of academic discussion of media effects (Wanta and Alkazemi 2017). This inquiry is especially important now as environmental issues become more urgent (Kim and Cooke 2018).

Presidents, News Media and the Public on the Environment

Presidents have been a major factor shaping the policy and discourses of the environment in the United States (Yao, Liu and Reeves 2013). As early as the beginining of the 20th century, Theodore Roosevelt started to address environmental issues, which was later also added to the speeches and legislative programs of Kennedy and Johnson. Nixon was the first to formally put environmental issues on the political plan, establishing the Council on Environmental Quality (CEQ) and the Environmental Protection Agency (EPA) and setting up air and water quality control policies. In his brief tenure following Nixon's resignation, Ford passed the 1975 Energy and Conservation Act, loosening the control on domestic oil production. Carter, entered the White House with a goal of enhancing the US oil independence as a response to the 1973 Oil Crisis, established the Department of Energy (DOE). He also pushed the production and usage of alternative fuels (Smith 2002).

Reagan, according to Vig (2013), ended the environmental decade in the 1970s by weakening many policies of environmental regulation, appointing antienvironmental people to head the EPA, Secretary of Interior, or other environment-related agencies, and severely cutting their budgets. He also attempted to abolish the CEQ and the DOE, abandoned alternative-fuel programs, and increased off-shore drilling. His antienvironmental fame made his vice president and follower George H. W. Bush changed his policy when entering the White House, appointing environmental activists to EPA, CEQ, and other related positions, and passing the *Clean Air Amendments of 1990*, although Bush withdrew on environmental progress at the later period of his presidency, threatening to boycott the UN conference on Environment and Development and refused to sign a biodiversity treaty at the conference (Yao, Liu and Reeves 2013). Clinton took office with an environmentalist vice president, Al Gore, who were charged with the responsibility to coordinate all environmental policies and earned them the name of the "green administration" (Vig 2013). He reversed the Regan and Bush policies widely criticized by environmentalists, issued executive orders requiring federal agencies to select approaches not only economic but also environmental and healthy and pursue environmental justice (Yao 2011). He was also the president speaking for the environment with the highest volume, particularly in his second term (Yao, Liu and Reeves 2013). George W. Bush showed a pro-environmental stance when he first took office, with his EPA announced several major environmental decisions. But he soon changed his direction, cutting budgets for environmental agencies, criticizing environmental programs and undertaking, such as the Kyoto Protocol. But at the end of his presidency in 2009, he still established the Marine National Monument in the Mariana Trench to protect the ecological system (Yao, Liu and Reeves 2013).

The mass media are another major shaper of the public discourse and policy on the environment. When the 1969 Santa Barbara oil spill and the 1989 Exxon Valdez accident happened, the vivid images on TV and in newspaper pictures scared the public, imprinting in people's mind a strong association of the oil industry with environmental disasters (Smith 2002). A content analysis of TV news on the environment in 1991-1995, a mid-segment of the period for this study, revealed that politics, disasters, and unusual weather were the predominate themes (Shanahan and McComas 1999). Researchers also found that, in the 1970s-1980s, the public thought of environmental issues as more important when the mass media coverage of those issues increased, not when the environmental issues in the real world deteriorated (Ader 1995). The variation of public sentiment on the environment, overall rising significantly since the 1970s when environmental issues became conspicuous on the mass media, has associated with changes in environmental policy in the past four decades (Kraft and Vig 2013).

Theoretical Framework

In the existing literature, the popular theoretical tools that scholars use to examine the dynamic among the political establishments such as the presidents, the mass media, and the public are agenda setting (McCombs and Reynolds 2009; McCombs and Shaw 1972; Wanta and Foote 1994; Wanta and Alkazemi 2017), priming (Iyengar 1991; Iyengar and Kinder 1987), and framing (Borah 2011; Cacciatore, Scheufele, and Iyengar 2016; Edy and Meirick 2007; Scheufele 1999; Tewksbury & Scheufele 2009). Those three theories distinguish from but also intertwine with each other (McCombs and Shaw 1993; Moy and Bosch 2013; Scheufele 2000; Scheufele & Iyengar 2017; Scheufele and Tewksbury 2007).

Agenda Setting

Agenda setting essentially predicts that the media agenda leads the public agenda (McCombs and Reynolds 2009; McCombs and Shaw 1972; Wanta and Alkazemi 2017). The core concept, agenda, is generally conceptualized as salience (Edelstein 1993; McCombs and Shaw 1993), or, "the importance that media and audience accord to an event"(Edelstein 1993, p85; Kosicki 1993). Importance is operationalized as the hierarchy, or rank, of the issues (Sheafer and Weimann 2005; Wanta and Alkazemi 2017), measured by "the amount of space or time devoted to particular issues" by the media and either "the amount of attention people pay to issues" or "their judgments of the issues' importance" (Kosicki 1993, p105; Iyengar and Kinder 1987).

Some scholars have been concerned that agenda setting research has kept itself from making "more reliable and content-orientated observations" (Edelstein 1993, p86; McLeod, Becker, and Byrnes 1974; Winter 1981). The measurement of agenda bypasses the earlier scholastic focus of media persuasion (Moy and Bosch 2013) and skips the cognitive structuring of the issues (Lang and Lang 1982; Moy, Tewksbury, and Rinke 2016). Scholars, as Edelstein (1993) notes, call for a higher order of cognitive analysis. Partly responding to that concern of media effects research, agenda-setting research extended to the second level, in which the unit of analysis turns from the objects to the attributes of the objects (Craft and Wanta 2003; McCombs and Reynolds 2009; Wanta and Alkazemi 2017) and even the third level, in which (Cheng 2016; Guo and McCombs 2016; Vu, Guo, and McCombs 2014) the unit further turns into the information network, possibly having diluted the term and metaphor by equating it to the whole media effects in practice. The proposal of the second level of agenda-setting concept, however, created a contention with researchers of framing effects (Scheufele 2000; Tewksbury and

Scheufele 2009; Weaver, McCombs, and Shaw 2004), which will be discussed in detail later in this essay.

Priming

Priming holds that media agenda primes an issue and put it as a criterion for the public to evaluate a politician (Iyengar 1991; Moy and Bosch 2013) and is commonly seen as a temporal extension of the agenda-setting process (Iyengar and Kinder 1987; McCombs and Reynolds 2009; Scheufele and Tewksbury 2007; Sheafer and Weimann 2005; Wanta and Tarasevich 2019) or at least closely related to it (Moy, Tewksbury, and Rinke 2016). Iyengar and Kinder (1987, p70) argued that priming effects happen because "problems covered by television news become more accessible and therefore more important in the viewer's political calculus." Individuals tend to rely on memory-based processing of information and retrieve the most salient memory to make decisions (Moy and Bosch 2013). Sheafer and Weimann (2005) extended the priming research to electoral behavior because voters' higher evaluation would help the politicians be elected. Their data support this extension.

Psychologists tended to use behaviors or behavioral intentions as the independent variable of priming research, but also include "impressions, judgments, goals, and actions" as independent variables (Molden 2014). They found that viewing violent television programs increased aggression intentions and behaviors and that exposure to music videos portraying stereotypical images of men and women led to more stereotypical impressions of genders (Moy and Bosch 2013; Roskos-Ewoldson, Roskos-Ewoldsen, and Carpentier 2009). A synthesis review of priming studies, therefore, defined priming as "the effects of the content of the media on people's later behavior or judgments related to the content that was processed" (Roskos-Ewoldson, Roskos-Ewoldsen, and Carpentier 2009, p74-75).

Framing

Framing research is mainly conducted in two approaches: framing studies (what are the frames and how they are formulated) and framing effects studies (how message frames influence audience frames. Borah 2011; Cacciatore, Scheufele, and Iyengar 2016). Goffman (1974/1986) initiated the approach of framing studies. For him, frames are the "basic elements" used to define the situations, which are created by the society and to which people respond, usually unconsciously, in their lives (Goffman 1974/1986, p11). Gans (1979, p19) found that journalists always organized and interpreted news stories with the news categories that connected "a wide variety of once unrelated stories". Besides, a news story "contains values" and suggests "a picture of nation and society as it ought to be" (Gans 1979, p39). Gitlin (1980, p7) described media frames as "professional patterns of cognition, interpretation and presentation, of selection, emphasis and exclusion, by which symbol handlers routinely organize discourses, whether verbal or visual." Pan and Kosicki (1993) further identified four framing devices: syntactical structure, script structure, thematic structure, and rhetorical structure. The tone in the news stories, argues Iyengar (1991), is also an important format of political framing. Because researchers define "framing" in different ways (Borah 2011), there is also a call to narrow down the broad spectrum of definitions to produce a more precise one (Cacciatore, Scheufele, and Iyengar 2016).

The approach of framing effects studies is originated from the fields of psychology (Kahneman and Tversky 1984; Tversky and Kahneman 1981) and political science (Druckman 2001; Iyengar 1991). In a series of experiments Tversky and Kahneman (1981) consistently found that, when the same problems are framed in different ways, participants make significantly different decisions. Iyengar (1991, p3) found that thematic news reports increased "attributions of responsibility to government and society" whereas episodic reports have "the opposite effect."

Druckman and associates found that political elites' choice of frames, usually communicated through mass media, influences public opinion (Druckman 2001, 2004; Druckman and Nelson 2003). Studies also showed that different frames of the same information affected audience's decisions about reduction of university funding (Price, Tewksbury, and Powers 1997), audience's issue perception and consequent attitudes toward stem cells, the environment (Shen 2004), and welfare (Shen and Edwards 2005), and audience's personal framing of religion (Yao 2007). Framing inherent in media coverage and is about the content of the news (Moy and Bosch 2013; Moy, Tewksbury, and Rinke 2016).

Toward a Five-Level Integrated Media Effects Model

The relationship between agenda setting and framing, particularly framing effects, has been hotly discussed in the past two decades (Borah 2011; Moy and Bosch 2013). Agenda setting researchers believe that the framing effects studies are essentially the second-level of agenda-setting studies (Cacciatore, Scheufele, and Iyengar 2016; McCombs and Shaw 1993; Weaver, McCombs, and Shaw 2004), but framing researchers argue that agenda setting only addresses part of the complex interrelationship among media, public opinion, and public policymaking (Kosicki 1993) and that agenda setting and framing effects are processed with different psychological mechanisms (Scheufele 2000; Tewksbury and Scheufele 2009). The emotional tone, or valence, of the news stories and photos, Coleman (2010) believe, is affective framing as well as attributes, the independent variable of second-level agenda-setting. Agenda setting and framing effects are two closely related theories, both predicting how media influence the public, how media are influenced by social establishments (McCombs and Reynolds 2009; Moy and Bosch 2013; Scheufele 1999), and how those influences are based on "selection" and "salience" (Entman 1993; McCombs and Shaw 1993; Pan and Kosicki 1993; Soroka 2002). Their

independent variables and dependent variables, however, seem to be different. Agendas of objects or attributes are measured with the amount of media coverage ranking of importance in audience mind, but frames are measured by constructing the meaning and usually contain moral components (Entman 1993; Moy, Tewksbury, and Rinke 2016). Agenda setting research holds that "it is likely that increased salience of an issue will result in more public knowledge and stronger public opinions, but it is less certain what direction that opinion will take" (McCombs, Einsiedel, and Weaver 1991, p19). Framing research, however, explores how the media interpret an issue will influence the public's interpretation (knowledge, Edy and Meirick 2007), moral judgment (attitude), and remedies (behavior. Entman 1993).

Because agenda setting, priming, and framing seem to be so closely intertwined, it is nearly impossible to draw clear-cut lines between them and many researchers actually use those terms interchangeably (Borah 2011; Wanta and Tarasevich 2019); so other scholars have called for a convergence of the three lines of research (Aday 2006; Iyengar 1991). Given that the argument that agenda-setting and framing effects are media effects at different levels (Kosicki 1993; Edy and Meirick 2007), a five-level media effects model that integrates agenda setting, priming, and framing effects may help to understand how mass media can influence the audience. Such a multilevel media-effects model was also inspired by advertising effects research, which traditionally has been studied message effects at cognitive, affective, and conative levels (Lavidge and Steiner 1961; Leckenby and Wedding 1982; Yao et al. 2018). Media researchers have also proposed studies on media effects at different levels, such as at cognitive, affective, and behavioral levels (Mcleod and Reeves 1980). Communication researcher Everett Rogers' (2003) Diffusion of Innovation model has five steps of processing of

innovative information, and persuasion researcher William McGuire's (1989) domino model has twelve levels of message effects, ranging from exposure to post-behavioral consolidation.

Generally speaking, five levels — attention, agenda (issue importance), knowledge (information or cognition), attitude, and behavior — might be enough to summarize media effects documented in the literature of the three theories, agenda-setting, priming, and framing, and other attitude and behavior studies (such as Rogers 2003). The three theories mainly articulate the horizontal influences in the model, predicting that media contents at one level have a stronger influence on the audience at the same level than on other levels. Meanwhile, they also argue for the vertical influence, predicting that the accumulation of media effects at lower levels linearly procures media effects at higher levels (See Figure 1). The dynamic of this five-level media effects is clear in a hypothetic one-flow information situation. It should also be true in a two or multiple-flow information situation, where the media stimulus is the sum-up of the positive messages and negative messages.

[Insert Figure 1 about here]

Attention. Attention, for media, is the amount of coverage; for the audience, it is the amount of attentive media exposure. Attention is the lowest level of media effects. When the editor is producing something for people to read, watch, or listen, "he is thereby putting a claim on their attention," which may further influence people's decision what to think about (Cohen 1963, p13). Although some models include a level of exposure (e.g., McGuire 1989), Chaffee and Schleuder (1986) have shown that it is more meaningful to put attention as the initial level of the media effects model so that the inattentive media exposure won't be included, which is supported by later researchers (Drew and Weaver 1990; Slater and Rasinski 2005; Valkenburg and Peter 2013).

Agenda (importance). Although some researchers confuse media attention with media agenda, the two are actually different concepts (Becker 1982). Agenda refers to issue importance (Wanta and Alkazemi 2017). Media messages are always ranked in the order of importance by the journalists: As Gans (1979) notes, television news programs are structured like a newspaper, with the day's most important story being the lead and other important hard news filled in the first two sections, whereas news magazines put the most important stories in the weekly cover story section and national, international, and business sections in the front of the magazine. It is media agenda, not media attention, that is the strong predictor of audience agenda. Iyengar and Kinder (1987), for instance, found that stories at the top of the broadcast were more influential in setting the public's agenda. Once the effects of those important stories were controlled, it was hard to find any effects due to news stories that appear elsewhere. Some studies use the term "media attention," but actually also measure the prominence of media coverage (placing on the front page, longer than other articles, with pictures, or graphs, etc.), and so what is really tested in those studies is media agenda (Andrews and Caren 2010). Those indicator of prominence plays a key role to make the audience perceive the issue of coverage important (Holmqvist and Wartenberg 2005; Holsanova, Rahm, and Holmqvist 2006) and the audience can easily pick up those cues (Moy, Tewksbury, and Rinke 2016). Of course, most of the hundreds of agenda-setting studies conducted so far confirm the influence of media agenda on public agenda, with cross-sectional data at two points of the time (McCombs and Reynolds 2009; McCombs and Shaw 1972; Moy and Bosch 2013; Moy, Tewksbury, and Rinke 2016; Wanta and Foote 1994).

H1: Media agenda on environmental issues sets public agenda on environmental issues.

Knowledge (information or cognition). News stories and opinion pieces convey knowledge, maximizing "both information and drama" (McCombs, Einsiedel, and Weaver 1991, p34). That the public perceives some issues as important does not necessarily mean that it understands those issues. For instance, most people think of global warming as important, but they give wrong answers to knowledge test about global warming in the polls (Nisbet and Myers 2007; Smith 2002). The volume of the information in the media content determines public knowledge. Importance perceived by the public (public agenda) can also indirectly enhance public knowledge. Hutchings (2005) found that when citizens perceived a political issue as important, they gave more attention to it, gained more information about it from the media, and were more likely to attend legislative activities to solve it. Chaffee, Ward, and Tipton (1970) also suggested that Klapper (1960) would have found a strong media effect had he examined the audience's knowledge rather than attitude.

Attitudes. Media frames are constructed with value or attitude components (Entman 1993; Gamson and Modigliani 1989; Pan and Kosicki 1993). Just looking at the frequency that the attitude factors (positive or negative) appears and neglecting media agenda (importance) associated with these factors, cautioned Entman (1993), could generate a distorted measure of the media attitude in the original texts. Audience reactions to media contents also have attitudinal components, which should not be mixed up with other components in those reactions. Scholars, for instance, found a distinction between American people's emotional reaction to and their cognitive evolution of Congress (Hibbing and Theiss-Morse 1998) and between Chinese students' cognitive knowledge of and their political attitudes toward religion (Yao 2007). Audience's attitude, nevertheless, can be developed from the accumulation of s knowledge, as shown in Rogers' (2003) five-step model of adoption. Priming depicts that the media agenda,

through audience agenda, influences audience cognitive knowledge and hence attitude. It illustrates that "media emphasis on particular issues not only confers status (or increase salience), but also activates in people's memories previously acquired information about these issues," which "thus is then used in forming opinions about persons, groups, or institutions linked to these issues" (McCombs, Einsiedel, and Weaver 1991, p19).

H2: Public agenda on environmental issues influences public attitude on the environmental issues.

Several empirical studies reported that media attitude leads to changes in audience attitude. Page and Shapiro (1992, p344) found that, in the period of 1969-1983, "what appears on TV news," especially the attitude of news commentaries and reported expert opinions, "accounts in large part for the relatively short-term (neither instantaneous nor glacial) changes in public opinion." Chang (1992) found that, compared to news sorties, editorials, which had more attitudinal components, had a stronger positive correlation with public opinion six months late. Zaller (1992, p59) argued that media attitude could lead to change in the audience attitude because media coverage would make a particular consideration (containing both "cognitive elements" and "affect") more accessible in the audience's mind and easier to be expressed when the audience is asked to give an opinion or attitude. Attitude change, Zaller (1992, p266) concludes, "results from change in the mix of ideas to which individuals are exposed." Most framing-setting studies also confirm that media interpretation of an issue, cognitively, affectively, or behavior-relatedly, influence the public interpretation of that issue (Borah 2011; Edy and Meirick 2007; Scheufele 1999; Tewksbury and Scheufele 2009).

H3: Media attitude on environmental issues influences public attitude on environmental issues.

Behavior. Media frames, even those in printed stories, contain behavioral components, which can influence the audience's behavior. In Entman's (1993) oft-cited definition of frames, defining problems and diagnosing causes are at the cognitive knowledge level, making moral judgment involves attitudes, and suggesting remedies is apparently at the behavioral level. A large body of media violence literature also showed that viewing media violence increases subsequent aggressive behavior (Bandura, Ross, and Ross 1963; Berkowitz and Rawlings 1963). A meta-analysis of 217 studies, from 1957 to 1990, about the influence of violent television viewing on subsequent aggressive acts concludes that the amount of violent television viewing is positively associated with the degree of subsequent aggressive behaviors (Paik and Comstock 1994). Media sexuality literature also suggests that consuming sexual media contents has behavioral consequences (Harris and Barlett 2009).

Sources and Consequences of Media Effects. For a long time, agenda-setting research has identified social establishments as agenda setters of the mass media (Rogers, Dearing, and Bregman 1993). Framing research similarly maintains that social establishments set frames for the media (Cacciatore, Scheufele, and Iyengar 2016; Scheufele 1999). Zaller's (1992) RAS model also holds that political elites dominate public opinion through the media. Combining those findings and the five-level integrated model, we have

> **H4:** Presidential agenda on environmental issues sets the media agenda on environmental issues.
>
> **H5:** Presidential attitude on environmental issues influences media attitude on environmental issues.

Smith's (2002) argument that public opinion on environmental issues influences environmental policy is supported by some studies from other areas. Hartley (1995) found that public opinion was responsive to the news coverage of the strength of the Soviet military and it had a significant influence on the US military budget. Erikson, Mackuen, and Stimson (2002) found that lagged public opinion significantly influences the governmental policy activities, and there is no meaningful response of the public opinion on the policy activities. A time-series analysis of data from 1960-1998 (Agnone 2007) also finds increasing support of environmental issues in public opinion leads to the increase of passages of environmental bills in that year.

H6: Public attitude on environmental issues influences policymaking on environmental issues.

There could also be other relationships among those factors. For instance, a study finds that President Trump's announcement of withdrawing from the Paris Agreement made the following public discussion of the topic on Twitter more polarized, swaying the public agenda and attitude (Kim and Cooke 2018). This study also explores

RQ1: What are the other relationships among the media, the public, and the presidents on environmental issues?

Methods

Two sets of data were collected for the study first: media coverage and presidential documents on environmental issues from January 1, 1980 to December 31, 2007 (28 years). Searched with keywords "environment," "environmental," "environmentalist," or "environmentalism," 531 news articles (keywords in headlines) were collected from the A Sections of *The New York Times* and the *Washington Post,* oft-used as representatives of national newspapers on many issues (Chang 1992), including environment-related issues (Pan,

Opgenhaffen, and Van Gorp, 2019), through LexisNexis; 476 documents (keywords in all text) were selected from the *Weekly Compilation of Presidential Documents*, an oft-used source of presidential opinion (Domke, Graham, Coe, John, and Coopman 2006; Wanta and Foote 1994) through the HeinOnline database. With the keyword "environment," 327 summaries of evening news stories from ABC, CBS, and NBC were found from the Vanderbilt Television News Archive (Boykoff 2008; Wanta and Foote 1994). CNN, the cable TV that provided news content to about 1% of the adult audience in the study period (Althaus 2002), was not included in this data due to lack of access to its content or summaries. Online news sources were not included in the sample because they only started to pick up an audience since 2004 (Waldman 2011), near the end of the data collection period (1980-2007), and therefore do not provide rich longitudinal data. A content analysis was conducted to these pieces, and a randomly drawn sub-sample of 150 articles/summaries and documents was first coded by two of the researchers for coding reliability test. The intercoder reliability, Scott's *pi,* for the tone, the only subjective type of codes in the content analysis part of this study, was 0.836. Pieces containing the keywords that had meanings unrelated to the purpose of this study were removed from the sample and not included in the numbers reported above.

Next, the public opinion poll data were drawn from the "Public Opinion Location Library or Public Opinion Online" maintained by the Roper Center for Public Opinion Research (containing data from the polls by Gallup, Harris, Roper, ABC, CBS, CNN, NBC, *Los Angeles Times*, *New York Times*, *USA Today* and *Wall Street Journal* since 1935) and the Inter-University Consortium for Political and Social Research. Totally 47 series poll questions were found asking respondents how they would rate the importance of the environment, a classic way of measuring public agenda, and whether they thought more financial support should be granted

to environmental protection, a preferred way of measuring public attitude toward the environment (Johnson 2005), from 2 to 150 times during 1965-2007 (43 years). A quarterly and a yearly series measuring public agenda and a yearly series measuring public attitude (due to the lack of data points) were drawn from those questions with WCalc, a software tool to draw a latent series from a group of series measuring the same topic with missing time points among them (Baumgartner, De Boef, and Boydstun 2008; Erikson, Mackuen, and Stimson 2002; Jerit 2008; Stimson 1994; Stimson 1999; Voeten and Brewer 2006). To keep higher reliability, series whose correlations with the latent series were lower than 0.5 were not included in the analysis.

Variables

Media Agenda and Presidential Agenda. The monthly (or yearly) amounts of media articles/summaries and the amount of presidential documents appearing during a quarter (or a year) were calculated as the measures of media agenda and presidential agenda for that particular quarter (or year. Page and Shapiro 1992; Yao, Liu and Reeves 2013).

Media Attitude and Presidential Attitude. Media attitude and presidential attitude of a month (or year) were operationalized with the sums of the tones of media articles/summaries and the presidential documents toward the environment during the quarter (or year). Tone was measured by a five-point scale adopted from Page and Shapiro's (1992) study, in which 2 = highly supportive (no negative words), 1 = supportive, 0 = neutral or balanced, -1 = unsupportive, and -2 = highly unsupportive (no positive words). To decide the tone of the news stories, the quantity of pro-con quotes, title, lead, and narrative wording was examined; to decide the tone of the opinion pieces (including presidential speeches), the authors' overall attitude was assessed.

Public Agenda and Public Attitude. From 1965 to 2007, the Gallup poll asked the respondents 150 times: "What do you think is the most important problem facing the country today?" Similar questions were also asked consecutively in many years by other poll houses such as Harris and the Pew Center. Twenty-five of those questions were chosen to draw the quarterly and yearly latent series of public agenda. Sixteen other questions inquiring respondents' attitude toward environmental expenditure were used to draw the yearly latent series on public support to the environment; there was not enough information in the sixteen series to draw a quarterly latent series of public attitude.

Policymaking. Scholars believe that "[g]overnment spending is the most obvious and easily accessible empirical measure of the policy agenda"(Soroka 2002, p56). The data of U.S. government spending for natural sources and the environment from 1965 to 2007, available from Table 3.1 in the historical table at the end of the 2009 federal budget, were used to measure the policymaking on environmental issues.

This study is therefore based on three sets of data. A yearly dataset (1965-2007) from the poll and budget data contains the variables of public agenda, public attitude, and policymaking. A quarterly dataset (1980-2007) mainly gained from the content analysis contains the variables of presidential agenda, presidential attitude, media agenda, media attitude, and the quarterly public agenda. The third dataset, yearly (1980-2007) is constructed to connect the previous two datasets and analyze the relationship between media attitude and public attitude. This approach of examining the relationships among the importance of a single issue across the media, public and the president is the second type in the typology of agenda-setting studies, natural history (Wanta and Alkazemi 2017)

Vector Autoregression (VAR) modeling is powerful to capture the dynamics and causalities among several time series and is becoming popular in longitudinal studies in social science (Freeman, Williams, and Lin 1989) and communication research (Groschek 2011; Meraz 2011). After testing the unit roots and detrending the series (see Table 1) to meet the assumptions of the modeling, three VAR models were built for the three datasets based on the pretest and posttest model-choosing information criteria and the model-fitness indicators. However, since VAR coefficients of the lags greater than one are mixture of the direct and indirect effects produced in the previous lags (McCarty and Schmidt 1997), we formally tested our hypotheses and research question with the multivariate Granger Causality tests based on the VAR models (Freeman et al. 1989; McCarty and Schmidt 1997) as well as the two types of bivariate Granger Causality (F and Chi-square) tests (Hamilton et al. 2011). Since the multivariate Granger Causality test examines relationships among multiple variables at the same time, it is considered more conservative, and providing stronger evidence, than the two bivariate direct Granger Causality tests. Among the two bivariate tests, the F test is more often used, and the Chi-square test is an alternative for reference when the F test loses its power in cases with long-lagged data (Kirchgassner, Wolters, and Hassler 2013).

All Granger Causality tests gauge if the historical data of the independent variable make a statistically significant difference in predicting the data of the dependent variable at a time point (Groschek 2011). Although Granger Causality test can still not intrinsically meet all the requirements of a causality test, it is far better than any other methods that social scientists have so far (Groschek 2011; Meraz 2011) because it examines causality with longitudinal data of dynamic processes and examines the temporal factor (Soroka 2002).

[Insert Table 1 about here]

Results

The data showed that environmental agenda and attitude changed among the presidents, the media and the public. During an average quarter, Clinton talked about the environment for 7.61 times with an positive tone of 6.9, peaking the presidential discourses on the environment, while Reagan addressed the environment for only 1.45 times with a lukewarm tone of 0.55. Reagan was also the only president talking about the environment with a negative tone (mentioning negative points more than positive points) in two quarters, the third quarter of 1985 and the fourth of 1988. Only better than him was George W. Bush (agenda, 2.96, attitude, 2.22), followed by Carter (agenda, 3.5, attitude, 3.25), and then George H. W. Bush (agenda, 5.4, attitude, 4.87). Media agenda and attitude (data started in 1980) peaked in 1990, which could be partly resulted from the unusual hot summer of 1989, and spiked again in 2000, when Al Gore was campaigning against George H. W. Bush. Public agenda on the environment rose to the first height in the 1970s, possibly triggered by the Santa Barbara oil spill, then peaked also around 1990, and then generated the third spike in around 2000. Federal outlay in natural resources and environment in general iincreased from 1965 to 2007, but dropped in 1981 when Reagan took office, and did not catch up the 1980 spending until 1988, when his presidency was about over. The outlay dropped slightly again in 1996 and 1997 and significantly in 2005 and 2007.

The results of the hypotheses and research question testing are presented in the order of the datasets, from the quarterly dataset to the yearly datasets, instead of the order of the hypotheses.

Quarterly Dataset

A VAR(8) model was built for the quarterly data to test H1, H4, H5, and the RQ (see Table 2 and Figure 2). H1 stated that media agenda would set public agenda, which was partly

supported. Whereas the multivariate Granger Causality test ($\chi^2(8) = 39.67$, $p < .001$) and the bivariate F test ($F(8, 95) = 3.03$, $p = .005$) significantly supported the hypothesis, the bivariate Chi-square test failed to reject the null. Considering that the multivariate test represented the real-life dynamic better, the evidence to support H1 was still strong. Both of the bivariate tests ($\chi^2(8) = 27.95$, $p < .001$; $F(8, 95) = 7.90$, $p < .001$) also showed that public agenda on the environment caused changes in media agenda on the environmental issues. Hence, media agenda and public agenda on environmental issues showed a feedback relationship, in which the two variables caused changes in each other.

[Insert Table 2 & Figure 2 about here]

H4 hypothesized that presidential agenda would cause changes in media agenda, which was supported by the multivariate test ($\chi^2(8) = 18.94$, $p = .015$) and the bivariate F test ($F(8, 95) = 3.34$, $p = .002$) but not the bivariate Chi-square test. The bivariate F test suggested that, on environmental issues, media agenda also caused presidential agenda ($F(8, 95) = 3.69$, $p < .001$).

H5 predicted that presidential attitude on the environment would be a cause of media attitude on the environment, which was again supported by the multivariate test ($\chi^2(8) = 17.51$, $p = .025$) and the bivariate F test ($F(8, 95) = 2.08$, $p = .045$) but not the bivariate Chi-square test. Evidence also suggested that media attitude caused changes in presidential attitude (for the multivariate Chi-square test, $\chi^2(8) = 19.56$, $p = .012$; for the bivariate F test, $F(8, 95) = 2.80$, $p = .008$).

The research question asked if there would be any other interactions in the dynamics of the environmental discourse. In addition to the aforementioned relationships, all three tests also supported that media agenda was a cause of media attitude (for the multivariate test, $\chi^2(8) = 36.59$, $p < .001$; for the bivariate tests, $\chi^2(8) = 17.08$, $p = .029$, and $F(8, 95) = 4.83$, $p < .001$), and

two tests showed that media attitude caused media agenda (for the multivariate test, $\chi^2(8) = 40.01$, $p < .001$; for the bivariate F test, $F(8, 95) = 4.17$, $p < .001$). Meanwhile, all three tests supported that presidential agenda caused changes in presidential attitude (for the multivariate test, $\chi^2(8) = 99.39$, $p < .001$; for the bivariate tests, $\chi^2(8) = 17.08$, $p = .029$, and $F(8, 95) = 4.83$, $p < .001$), whereas only the two bivariate tests suggested that presidential attitude also caused changes in presidential agenda ($\chi^2(8) = 59.95$, $p < .001$, and $F(8, 95) = 16.95$, $p < .001$).

Yearly (43-obs) Dataset

For the 43-observation yearly dataset, all indicators supported a VAR (3) model, which was used to test H2 and H6 (see Table 3 and Figure 2). H2 predicted that public agenda on the environment would cause public attitude on the environment to change, which was supported by all three tests (for the multivariate test, $\chi^2(3) = 14.65$, $p = .002$; for the bivariate tests: $\chi^2(3) = 13.97$, $p = .003$; $F(3, 36) = 3.90$, $p = .016$). Meanwhile, the bivariate tests suggested that public attitude also caused the public agenda to change ($\chi^2(3) = 14.28$, $p = .003$; $F(3, 36) = 3.98$, $p = .015$). H6, which stated that public attitude would cause policymaking ot change, was not supported by any of the tests. The bivariate tests, however, showed that public agenda caused changes in policymaking ($\chi^2(3) = 16.63$, $p < .001$; $F(3, 36) = 4.64$, $p = .008$).

[Insert Table 3 about here]

Yearly (28-obs) Dataset

A VAR(1) model was selected for this dataset to test H3 (see Table 4 and Figure 2). H3 predicted that media attitude on the environment caused changes in public attitude on the environment. It was only supported by the bivariate Chi-square test ($\chi^2(1) = 5.49$, $p = .019$). The multivariate Granger Causality test showed that public attitude caused media attitude to change ($\chi^2(1) = 5.10$, $p = .024$).

[Insert Table 4 about here]

Discussion and Conclusion

Has the public influenced the federal environmental outlays in the past decades, as expected by advocates of citizen participation in environmental democracy, like Fischer (2000, 2017)? With a substantial amount of reliable data, this study seems to answer maybe. The public's willingness of spending more money on the environment, however, has no influence on the policy making. The bivariate Granger tests show that the policymaking is responsive to the public agenda, but this causality disappears when the presidents and the media are also considered in the picture. The VAR(3) model shows that policymaking has a statistically significant negative influence on both public agenda and public attitudes at lag three, which suggests that the public closely watches and responds to the federal environmental outlays in three years. The political authorities' irresponsiveness to the public on environmental issues is even more apparent when the presidents' relationship with the public is examined. The multivariate Granger test supports that the presidential agenda influences the public agenda, whereas the other way around has no supporting evidence. The VAR(8) model also shows that the presidential agenda has influences on the public agenda, first negative and later positive, whereas public agenda has no input in the presidential agenda. Findings of previous research on public's influence on environmental policymaking (Agnone 2007; Erikson, Mackuen, and Stimson 2002; Hartley 1995; Smith 2002) is not solidly confirmed in this study when the president and the media are also considered in the analysis.

The dynamics among the presidents, the media, and the public (Scheufele 1999; Wanta and Alkazemi 2017) in the environmental discourse found in this study is consistent with Habermas' (2006) idea of "media society," which argues that the media are at the center of the

public spheres in developed societies, mediating the communications between the political elites and the public, as the size of modern society makes it impossible for political elites to communicate with the public personally. The mediation, however, usually distorts the messages. This is probably why we found the environmental policy and the presidents unresponsive to public opinion on environmental issues and why scholars call upon cautious readers to deliberate even when consuming information from credible media (Page 1996).

This set of environmental data also provides supporting evidence to the five-level integrated media effects model, both horizontally and vertically, at the levels of agenda and attitude. Horizontally, agenda (volume of information; McCombs and Reynolds 2009, McCombs and Shaw 1972;) and frame (tone toward the environment; Borah 2011, Scheufele 1999) building and setting processes are all supported by the multivariate tests, except for the hypothesis of media attitude's leading the public attitude. The president's agenda leads the media agenda, which further lead the public agenda; the president's attitude leads the media attitude, which further leads the public attitude (although with weaker evidence). A school of media sociologists argues that mass media may have little influence in the modern area (Klapper 1960; Perse and Lambe 2016), the results of this study indicate otherwise. The processes, nevertheless, are more complex than discussions in the literature. The VAR models show that the lagged effect can be mixed, not just purely positive or negative. For example, statistically significant VAR coefficients show that presidential attitude on environmental issues in the first quarter influence the media attitude positively in the third and fourth quarters but negatively in the fifth and sixth quarters.

The study also reveals the other side often ignored by media effects researchers (Cacciatore, Scheufele, and Iyengar 2016; Wanta and Alkazemi 2017): the agenda and frame

building and setting processes may not be unidirectional but reciprocal, at least on the topic of the environment. Evidence for the causal relationships from public agenda and attitude to media agenda and attitude and from media agenda and attitude to presidential agenda and attitude is as strong as, or sometimes even stronger than, that for the causalities in the agenda and frame building and setting processes. The positive causal relationship from the public to the media is actually more evidential than the other way around, which echoes Novic and Sandman's (1974) argument. The media not only influence the public but also follow the public when its agenda and attitude on the environment change. When the presidents address the environmental issues, the media also follow; at the same time, the presidents also listen to the media possibly for feedback. Those findings remind us to view mass media effects in a more dynamic way.

Vertically, the study also provides evidence for the internal relationships among two of the five levels of media effects in the integrated media effects model. Within each of the three subjects, the president, the media, and the public, although some evidence shows that their attitude on the environment causes their agenda on the environment to change, all Granger Causality tests support that their agenda causes changes in their attitude. This suggests that, as Mcleod and Reeves (1980) speculated, media effects linearly go from a lower level to a higher level. The linearity of the media effects also helps to explain cultivation researchers' claim that long-term media exposure changes audience knowledge, attitude, and behavior to the direction led by the mass media.

Despite its solid longitudinal data and advanced analytical techniques to catch the temporal factors, this study has its limitations that need to be kept in mind while interpreting its findings. First, the data, although covering three to four decades, do not cover recent development, and the latest changes in the dynamics among the president, media, and public may

be missed. Second. The keywords to search the texts for content analyses, although seemingly comprehensive, may miss some texts, and the public opinion poll to measure public agenda and attitude may contain public bias also. Third, different news stories or presidential texts may have different influences, which is uncontrollable in this study. Also, other sources and forms of communication, such as personal communication, radio news programing, CNN news (only covered around 1% of the adult population in the study time, Althaus 2002), and the internet communication emerging in the 1990s (although at the early stage most of its contents were mainly from the newspapers and TVs, Kawamoto 2003) but only starting to pick up a news audience since 2004 (Waldman 2011) are not included in this study. Those factors, however, could have some impacts on the public opinions and attitudes and should be considered in applying the findings of this study to understand the dynamics of environmental discourse among the president, the media, and the public and the public's influence on policymaking as measured by the federal environmental spending. Finally, only two levels of the integrated model are tested and supported with data in this study, and other levels of the model are in need to be tested in future research.

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Table 1 The DFGLS Unit Roots Tests

	Min MAIC			Min SBIC			Opt Lag		
Series	Lag	Test Statistic	Critical Value	Lag	Test Statistic	Critical Value	Lag	Test Statistic	Critical Value
Yearly									
Public-Agenda	2	-2.424	-3.230	1	-3.922*	-3.293	3	-2.989	-3.156
D. Public-Attitude	4	-1.940	-3.079	1	-3.274	-3.314	7	-2.894*	-2.825
D.Log(Policymaking)	2	-2.986	-3.770	1	-3.433*	-3.303	6	-3.911*	-2.906
D.Media-Attitude	1	-3.860*	-3.485	1	-3.860*	-3.485	0	--	--
Quarterly									
S4.Media-Agenda	6	-2.831	-2.922	4	-3.566*	-2.968	7	-3.495*	-2.898
S4.Media-Attitude	10	-2.091	-2.817	3	-5.274*	-2.988	7	-3.155*	-2.898
DS4.Presidential-Agenda	10	-1.944	-2.817	3	-6.617*	-2.988	11	-2.440	-2.789
D4S4.Presidential-Attitude	4	-1.633	-2.972	8	-4.740*	-2.870	12	-2.736	-2.753
S4.Public-Agenda	1	-4.313*	-3.024	1	-4.313*	-3.024	8	-3.011	-2.872

Notes: 1. Min AIC stands for the minimum modified Akaike's information criterion. Min SBIC stands for the minimum Schwarz's Bayesian information criterion. Opt Lag stands for the Ng-Perron's *t* statistic criterion.

2. For the operators, D stands for the first difference, and S4 stands for the first seasonal difference. Log stands for a Logarithm transformation.

3. * means that the test statistics is less than the 0.05 level critical value, and the null hypothesis that the series has at least one unit root can be rejected. The rejection is made based at the lag that is recommended by at least one of the three criteria. The critical values in the table are for the 0.05 level.

4. Public agenda and media attitude both have a yearly form and a quarterly form.

Table 2 Granger Causality Tests on the Quarterly Data

	VAR Granger Causality Test		Bivariate Granger Causality Test			
Direction	Chi-square (*df*)	*p*	Chi-square (*df*)	*p*	*F* (*df*1, *df*2)	*p*
S4. Media-Agenda → S4.Media-Attitude	36.59 (8)	<.001*	17.08 (8)	.029*	4.83 (8,95)	<.001*
S4.Media-Attitude → S4.Media-Agenda	40.01 (8)	<.001*	14.74 (8)	.065	4.17 (8,95)	<.001*
S4.Presidential-Agenda → S4.Media-Agenda	18.94 (8)	.015*	11.83 (8)	.159	3.34 (8,95)	.002*
S4.Media-Agenda → S4.Presidential-Agenda	9.37 (8)	.312	13.04 (8)	.111	3.69 (8, 95)	<.001*
S4.Media-Attitude → D4S4.Presidential-Attitude	19.56 (8)	.012*	9.89 (8)	.273	2.80 (8,95)	.008*
S4.Presidential-Agenda → D4S4.Presidential-Attitude	99.39 (8)	<.001*	17.08 (8)	.029*	4.83 (8,95)	.001*
D4S4.Presidential-Attitude → S4.Presidenital-Agenda	5.87 (8)	.661	59.95 (8)	<.001*	16.95(8,95)	<.001*
S4.Public-Agenda → S4.Media-Agenda	12.27 (8)	.140	27.95 (8)	<.001*	7.90 (8,95)	<.001*
S4.Media-Agenda → S4.Public-Agenda	39.67 (8)	<.001*	10.70 (8)	.219	3.03 (8,95)	.005*
S4.Public-Agenda → S4.Presidential-Agenda	5.87 (8)	.661	3.93 (8)	.863	1.11 (8,95)	.363
S4.Presidential-Agenda → S4.Public-Agenda	31.60 (8)	<.001*	8.87 (8)	.354	2.51 (8,95)	.016*
D4S4. Presidential-Attitude → S4. Media-Attitude	17.51 (8)	.025*	7.37 (8)	.497	2.08 (8,95)	.045*

Notes: 1. In the table, D stands for the first one-lag difference, and S4 stands for the first seasonal difference. The variable before the arrow is the independent variable, and the one after the arrow is the dependent variable. * means significant at the 0.05 level.

2. The bivariate Granger Causality tests also have eight lags.

3. See Table 4.2 Notes for a tentative explanation of the difference between the results of the multivariate and the bivariate Granger Causality tests.

Table 3 Granger Causality Tests on the Yearly Data (43-obs)

	VAR Granger Causality Test		Bivariate Granger Causality Test			
Direction	Chi-square (*df*)	*p*	Chi-square (*df*)	*p*	*F* (*df*1, *df*2)	*p*
Public-Agenda → D.Public-Attitude	14.65 (3)	.002*	13.97 (3)	.003*	3.90 (3,36)	.016*
D.Public-Attitude → Public-Agenda	4.16 (3)	.245	14.28 (3)	.003*	3.98 (3,36)	.015*
Public-Agenda → D.Log(Policymaking)	1.47 (3)	.689	16.63 (3)	<.001*	4.64 (3,36)	.008*
D.Log(Policymaking) → Public-Agenda	6.28 (3)	.099	3.61 (3)	.307	1.01 (3,36)	.401
D.Public-Attitude → D.Log(Policymaking)	0.72 (3)	.869	6.74 (3)	.081	1.88 (3,36)	.15
D.Log(Policymaking) → D.Public-Attitude	7.72 (3)	.052	4.58 (3)	.205	1.28 (3,36)	.296

Notes: 1. For the operators, D stands for the first one-lag difference, and Log stands for a Logarithm transformation. The variable before the arrow is the independent variable, and the one after the arrow is the dependent variable. * means significant at the 0.05 level.

3. Bivariate Granger Causality tests are also run with three lags.

4. Usually the results of VAR Granger Causality test and the Bivariate Granger Causality tests are very similar.[1] But here in some of the tests the VAR Granger tests are dramatically different from the bivariate tests. A tentative explanation is that the presence of some variables significantly influences the relationship among other variables.

Table 4 Granger Causality Tests on the Yearly Data (28-obs)

	VAR Granger Causality Test		Bivariate Granger Causality Test			
Direction	Chi-square (*df*)	*p*	Chi-square (*df*)	*p*	*F* (*df*1, *df*2)	*p*
D.Public-Attitude → D.Media-Attitude	5.10 (1)	.024*	3.09 (1)	.079	0.92 (1,25)	.347
D.Media-Attitude → D.Public-Attitude	2.87 (1)	.091	5.49 (1)	.019*	1.64 (1,25)	.213

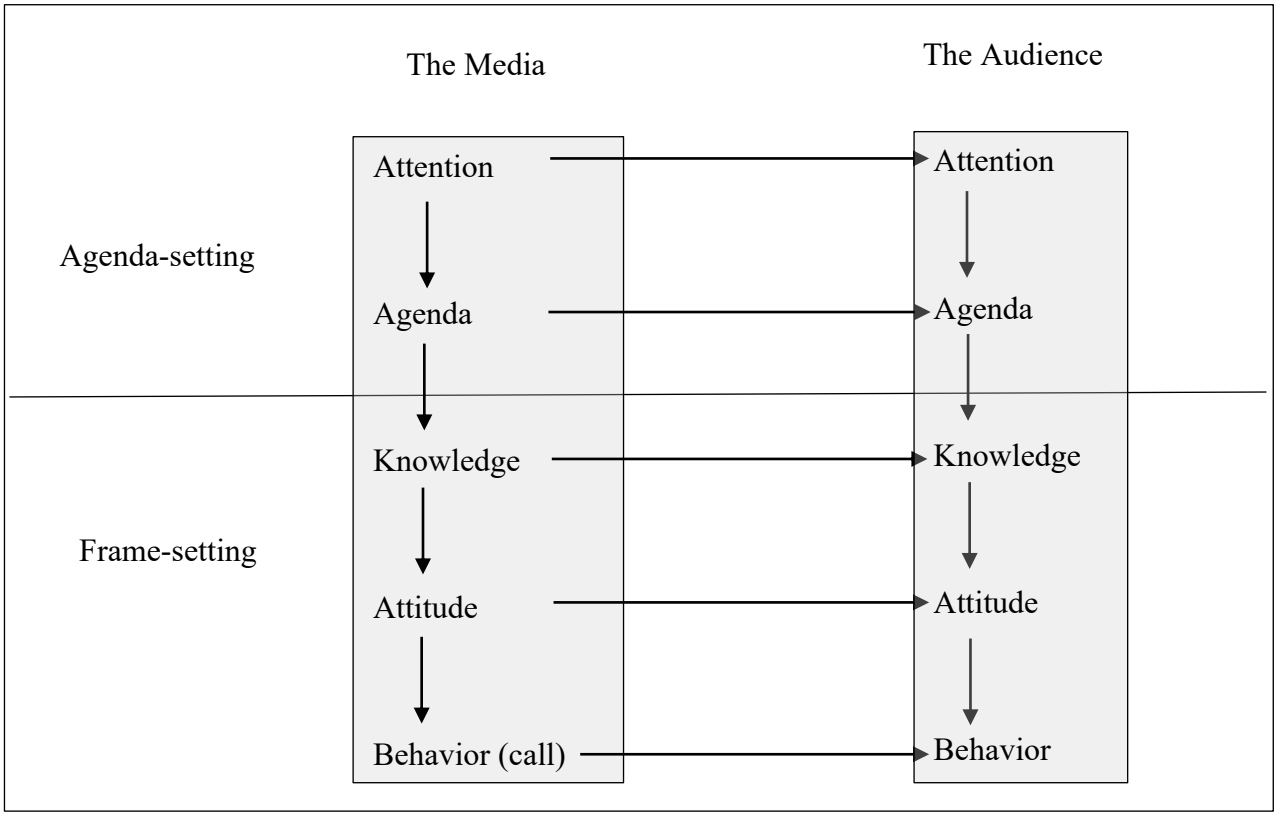
Notes: 1. For the operators, D stands for the first one-lag difference.

2. The variable before the arrow is the independent variable, and the one after the arrow is the dependent variable. * means significant at the 0.05 level.

3. Bivariate Granger Causality tests are also run with one lag.

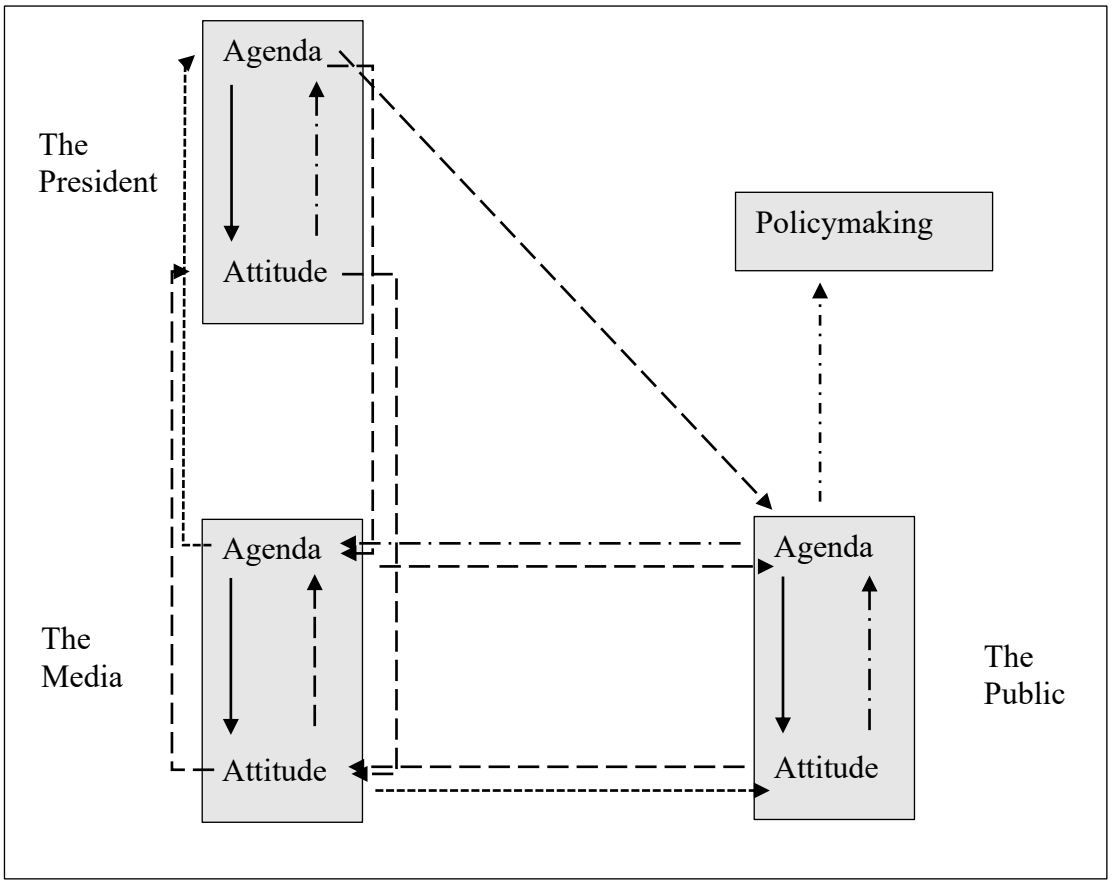
Figures:

Figure 1: The Integrated Model of Media Effects



Note: Information flow from the media to the audience and within each entity can be analyzed five levels: attention, agenda (importance), knowledge, attitude, and behavior (for the media, is the behavioral calls). The traditional agenda-setting research studies information flow from the media to the audience at the first two levels, while the frame-setting research studies the rest of the three levels. Political priming research traditionally studies the process from media agenda to audience knowledge or even attitude, although later studies extend the dependent variable to audience behaviors. Psychological priming research studies the process from media behavioral description to audience behaviors. The processes from the media to the audience can be moderated by factors such as media credibility, mess quality, audience mood, and the nature of the topic.

Figure 2: Causal Relationships among the Media, the Public, the Presidents, and Policymaking



Notes: ——→ means the causality is supported by all three Granger causality tests; – – → means the causality is supported by the multivariate Granger causality test; —·—·► means the causality is supported by both bivariate Granger causality test; and -------► means the causality is supported by one of the bivariate causality tests.