Media Attention for Climate Change around the World: A Comparative Analysis of Newspaper Coverage in 27 Countries

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Abstract

Climate change is a global phenomenon, and its outcomes affect societies around the world. So far, however, studies on media representations of climate change have mostly concentrated on Western societies. This paper will go beyond this limited geographical scope by presenting a comparative analysis of issue attention in 27 countries worldwide. The sample includes, among others, countries that have committed themselves to greenhouse gas emission reductions under the Kyoto Protocol such as Germany as well as countries that are strongly affected by the consequences of climate change like India. In a first step, it describes the development of media attention for climate change in these countries from 1996 to 2010. Second, it compares the amount of media attention and explores whether it corresponds with indicators measuring the relevance of climate change and climate policies for a country. The analyses show that climate change coverage has increased in all countries. Still, the overall media attention levels, as well as the extent of growth over time, differ strongly between countries. Media attention is especially high in carbon dependent countries with commitments under the Kyoto Protocol.

Keywords

media attention; issue attention cycles; climate change; climate politics; longitudinal study; cross-country comparison

Highlights

- > Large-scale analysis of climate change media coverage in countries from all continents
- > Climate change receives considerable media attention in all countries under study
- > Issue attention rose significantly between 1996 and 2010
- > It is particularly high in countries with tough Kyoto emission targets

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1. Introduction: Media Coverage of a Global Problem

Anthropogenic climate change is a global problem. It is caused by various human activities around the world, like transportation, electricity consumption and livestock breeding . The greenhouse gases produced by these activities, no matter if in Texas or in Beijing, contribute to an increase in average temperatures on all continents and to global changes in climatic conditions that have impacts on both the natural and social world (IPCC, 2007, p. 10ff; Dryzek et al., 2011). Accordingly, political responses and solutions are sought globally. Political institutions worldwide and on the international level are concerned with the mitigation of and adaptation to climate change. The international level is of special relevance for mitigating climate change, because the problem poses a social dilemma, a "drama of the commons" on a global scale (Dietz et al., 2003). Actors profit individually from greenhouse gas-producing activities, whereas they would gain only a fraction of the benefits from unilateral mitigation efforts causing abatement costs. Even worse, "their sacrifice may be futile if other actors do not exhibit similar restraint" (Harrison and Sundstrom, 2007, p. 1). The United Nations Framework Convention on Climate Change from 1992 and the resulting international process with regular international climate summits (the so-called Conferences of the Parties, COP) represent an attempt to tackle this situation by international coordination – with 194 of the world's 206 states participating (Gupta, 2010).

The news media are the central "interpretative system" of modern societies (Peters and Heinrichs, 2005, p. 2), and thus crucial for the societal uptake of climate change and climate politics. Firstly, they are central agents for *awareness rising and information*. As global climate change lies beyond the life-world and biographical horizons of most people (Moser, 2010; Neverla and Schäfer, 2012), knowledge about it is mainly disseminated via public communication. Due to their high circulation and general audience, mass media are pivotal in this latter regard. Correspondingly, several studies have shown that the "public draws most of its knowledge" (Anderson, 2011, p. 535) about the issue from the mass media (e.g. Schäfer, 2012; Ryghaug et al., 2011). Secondly, mass media constitute a central forum for the *discussion and legitimation of climate governance* (Schneider et al., 2007, p. 136; Nanz and Steffek, 2004, p. 321). Mass media debates represent an important element of political opinion formation in which various societal actors like environmental organizations, business associations, party and government representatives take part (Steffek, 2009, p. 315). Ideally, such a public, communicative exchange may facilitate balancing different interests and reaching an understanding on the objectives of (global) climate governance and the different ways of pursuing them (Bovenkerk and Brom, 2012, p. 96). Conflicts may, however, also persist. In this case, mass media coverage at least helps making transparent the various positions on the issue (Peters, 2008, p. 131). For decision makers, mass media debates constitute one important indicator for the importance of a topic and for related societal views and preferences (Kriesi, 2001, p. 3; van Aelst and Walgrave, 2011, p. 298f). Mass media coverage of climate change may therefore create a situation "where it is conducive for governments to act, or hard for them not to act in the face of perceived pressure to initiate a policy response" (Newell, 2000, p. 94).

However, has the global phenomenon of climate change been taken up in mass media of countries around the world, and if so, to what extent? This question cannot yet be answered sufficiently. There is "a growing literature investigating climate change and the media" (Doulton and Brown, 2009, p. 191) and the "last decade […] has seen an expansion of approaches, methods and research questions explored under this umbrella of media and climate change" (Boykoff, 2011, p. 50). Nonetheless, there are still gaps in the literature, which make claims about global media coverage of climate change difficult. This article addresses some of these gaps by providing a comparative study on media attention in countries around the world and over a time period of 15 years.

2. Conceptual Framework: Analyzing Issue Attention in 27 Countries

2.1. Gaps in existing research

Although a number of studies have explored media attention for climate change (see Table 1 for an overview), most of these are single-case studies (see Schäfer et al., 2012). They provide data for certain countries such as Australia (Farbotko, 2005), Canada (Ahchong and Dodds, 2012; Young and Dugas, 2011), Finland (Lyytimäki and Tapio, 2009), Germany (Weingart et al., 2000), India (Jogesh, 2012), Switzerland (Besio and Pronzini, 2010), the UK (Boykoff and Mansfield, 2008; Carvalho and Burgess, 2005) and the United States (Boykoff and Boykoff, 2007; Liu et al., 2011). However, as a result of their different analytical perspectives, research questions, analyzed time frames and media, data and methods, their results are difficult to compare. Comparative research, in turn, is missing, even though it has been described as particularly necessary in climate change communication (Anderson, 2009, p. 176f).

Moreover, these studies focus almost exclusively on industrialized countries (exceptions include Jogesh, 2012; Takahashi and Meisner, 2013; Reusswig and Meyer-Ohlendorf, 2012). Even most of the existing *comparative studies* only include industrialized countries (e.g. Boykoff, 2007; Boykoff and Rajan, 2007; Brossard et al., 2004; Uusi-Rauva and Tienari, 2010) – only very few studies ,such as Boykoff and Mansfield (2013), Eide et al. (2010), Schäfer et al. (2011), Shanahan (2009), and Painter/Ashe (2012), include emerging economies like as Brazil and India, or non-industrialized societies such as Namibia.

An additional problem in the few existing comparative studies is the often missing "functional equivalence" of the measurements (Wirth and Kolb, 2012). Some studies compare factors that do not actually correspond with one another; limiting the comparability of their findings. Absolute numbers of newspaper articles on climate change (as used in Eskjaer, 2010), for example, not only indicate different national attention levels to the issue, but are also influenced by the size of a given newspaper and other factors. This is problematic in that newspapers around the world differ measurably in their scope, due to differences in journalistic culture or financial limitations. This problem also diminishes the informative value of the otherwise pioneering data collection by Boykoff and Mansfield (2013), which includes 50 newspapers from all continents. It is difficult, for example, to determine whether the extent of the reported differences in coverage between Asia and Europe is caused by varying newspaper sizes or by a differing relevance that is assigned to the topic by the respective media.

Table 1

2.2. Research Approach and Questions

The general value of comparative research is well established. Comparisons are central for assessing how universal certain findings are, and for discovering relationships between social phenomena (Esser and Hanitzsch, 2012). Given that climate change poses a global problem and given that nation states play a crucial role in tackling it, a cross-nationally comparative perspective seems especially valuable for the issue at hand. Still, several different strategies for such a comparison exist. On a general level, a case-oriented and a variable-oriented approach can be distinguished. Case-oriented studies are characterized by a small number of cases which are compared in order to identify the case-specific configuration of factors responsible for the particular shape of the research object. A variable-oriented approach, in contrast, typically includes a larger number of cases and investigates the relationship between descriptive findings and a few explanatory factors across the sample of cases (Wessler and

Brüggemann, 2012, p. 29ff). We follow the second approach and present a comparative study including 27 countries across the world. While such a large number of countries puts a limit on the depth of our analysis, we contend that we can make a valuable contribution to the research field. Firstly, the broad empirical basis enables generating evidence for regions and countries which have been (almost) completely neglected so far. Secondly, it allows for systematically investigating factors which have been hypothesized to influence media coverage of climate change. As a complement to existing research – which typically compares only a few countries – we aim at a greater degree of generalization.

We will concentrate here on a relatively simple – but not trivial – measure of climate change media coverage: issue attention. Because the "carrying capacity" (Hilgartner and Bosk, 1988, p. 58f) of news media is limited due to finite numbers of newspaper pages or airtime minutes, they can only give attention to a small number of issues at any point in time. Different social problems and the respective actors promoting them compete for this limited space. Media professionals act as gate-keepers and select – on the basis of specific criteria – what they perceive to be newsworthy or appealing to the targeted audience (Koopmans, 2004, p. 373; Hilgartner and Bosk, 1988, p. 61ff). Media attention measures the outcome of this competitive selection process, i.e. the amount of attention given to one issue in relation to the amount of attention given to other issues at the same time. Therefore this basic quantitative measure is a critical indicator for social problem construction – even though it does not reveal how climate change is framed or what actors are involved in the media debate, it may still have important repercussions on different societal spheres: the amount of space the mass media devotes to information and debate about climate change signals the issue's relevance and likely affects the problem awareness of the general public and the priority politicians give to it. While these relationships are neither deterministic nor unidirectional (Hilgartner and Bosk, 1988, p. 67), empirical studies have found clear signs of such media effects. In particular, varying extents of information on climate change in the media have proven to affect the awareness and knowledge of the general public (Sampei and Aoyagi-Usui, 2009, p. 210; Stamm et al., 2000, p. 230f). Moreover, it has been shown that media attention influences the activities of parliaments and governments (Newig, 2004, p. 151). Several studies have demonstrated that this is especially true for "unobtrusive" issues like environmental problems and climate change in particular. For example, Soroka (2002) and Walgrave (2008) have found political agenda-setting effects in the environmental issue area for Canada and Belgium, respectively. More specifically, Dolšak and Houston (forthcoming) show that varying degrees of legislative activity on climate change in a sample of U.S. states can be partially explained by the preceding amount of issue-specific media coverage.

Therefore, we will first ask:

RQ 1: How extensive is media attention for climate change in different countries and how did it develop?

In a second step, we will relate the cross-national similarities and differences we found in media attention to indicators characterizing the relevance of climate change and climate governance for a country. Concretely, we consider a country's susceptibility to the consequences of climate change, its responsibility for greenhouse gas restrictions under the Kyoto Protocol, as well as the degree of carbon dependency. This focus on macro-level factors represents an additional particularity compared to other studies of the research field: These factors have been repeatedly described as probably influencing media coverage – and societal reactions to climate change in general. Research on national climate policies, for example, has shown that such variables can explain cross-national differences (e.g. Buys et al., 2009). Most studies on climate change communication, however, are primarily preoccupied with identifying relevant factors on the meso-level of journalistic news production, i.e. the media system, journalistic cultures or resources for environmental

journalism (e.g. Friedman, 2004). Therefore, and given the restrictions of the large case number which practically forecloses the inclusion of variables on a deeper level, we will concentrate on the mentioned macro-level factors. Accordingly, our second research question is:

RQ 2: Do differences in media attention levels correspond with cross-nationally varying relevancies of the issue?

2.3. Hypotheses

In light of a quickly expanding social scientific literature on societal involvement with climate change, we are able to formulate a number of hypotheses as to how media attention might develop in different countries.

Regarding *RQ 1 - How extensive is media attention for climate change in different countries and how did it develop? –* we *hypothesize that climate change is a relevant topic in all countries and that issue attention has increased between 1996 and 2010 (H1).* This assumption rests on a number of developments. First, the climate-related efforts of various actors in different public arenas outside the media have increased. Over the 15 years analyzed here, the number of scientific publications mentioning climate change mushroomed (Weingart et al., 2000), climate science became increasingly institutionalized (Schützenmeister, 2008), new political institutions and national climate policies or strategies were established (Townshend et al., 2011, p. 5), many environmental NGOs made climate change their focal issue (e.g. DeLuca, 2009; Hopf, 2012), and celebrities took public stances on it (Anderson, 2011). These activities in different societal spheres have made it easier and more relevant for the media to cover climate change. Other developments might have furthered climate change's media appeal: The certainty about climate change and its anthropogenic causes – at least in mainstream climate science – was pointed out (Oreskes, 2004), making it a more robust case on which to report (e.g. Evans and Pearson-Merkowitz, 2012, p. 6) as well as interesting when a deviant position arose. Furthermore, more negative diagnoses about the problem and its consequences were published in the IPCC's Assessment Reports (Duffey and Dincer, 2010). Such negative consequences are particularly likely to bring environmental issues to the mass media (Brossard et al., 2004; Newig, 2004, p. 164). In addition, existing data also point to a rising trend in several countries and regions, such as Boykoff and Mansfield's data on the number of articles written about climate change by continent from 2004 onwards (Boykoff, 2011, p. 20f; Boykoff and Mansfield, 2013, see also table 1). Still, the existing evidence has, as mentioned, weaknesses and, furthermore, cannot be simply transferred to countries that have not been under study yet. Therefore, we test whether the theoretically and empirically grounded expectation holds across our diverse country sample.

Notwithstanding these hypothesized commonalities, however, we expect different national levels and developments of media attention. After all, national societies are affected in very different ways by both the *consequences of climate change* and by *climate policies*. Domestic affectedness has also been proven to be a main factor ("news value") in driving media attention for any given issue. Therefore, for *RQ 2 - Do differences in media attention levels correspond with cross-nationally varying relevancies of the issue? –* we developed two hypotheses :

H2: Issue attention is higher in countries affected by negative consequences of climate change. Some countries, especially such of the global South like India or Papua New Guinea but also several industrialized countries like Spain, are rather susceptible to the negative effects of climate change like flooding of coastal areas or water and food shortages. This is due to geographical conditions, but also infrastructural factors and monetary or institutional capacities to accomplish adaptation measures play a role (Füssel, 2010; Tol et al., 2004; Nath

and Behera, 2010). Given the more direct and severe effects of climate change, one expects media attention to be higher in these especially vulnerable countries. Firstly, this might be triggered by weather extreme events and the personal and material damage they cause (as for example measured by the Climate Risk Index, see below). Although a causal link between climate change and a specific weather event cannot be established scientifically, many societal actors, including the media, frequently at least speculate about this link – or use the opportunity for climate change awareness rising activities (Schäfer et al., forthcoming). Secondly, climate politics might receive more attention in vulnerable countries, because both adaptation and mitigation measures are especially pressing (Brossard et al., 2004; Newig, 2004, p. 164). For example, as an adaption to climate change institutions in Papua New Guinea since 2009 carry out a large-scale resettlement program for the inhabitants of one group of islands – which is expected to be rendered uninhabitable by rising sea levels (Sherbinin et al., 2011). Moreover, given the high stakes involved, political and other societal actors of vulnerable countries should also attach greater importance to international climate talks, for example by sending high-ranking officials. Susceptibility to the negative consequences of climate change thus likely increases the (prominence of) climate-related activities in a country and the issue should therefore more frequently be perceived by journalists as worth of media coverage (Boykoff and Yulsman, 2013).

H3: Issue attention is higher in countries facing pressure to pursue mitigation efforts.
Industrialized nations like the United States, Australia, and Germany have contributed high levels of man-made greenhouse gases. Therefore, they are often expected to shoulder the brunt of efforts to tackle the problem. This is evident, for example, in the "differentiated responsibility" principle of the Kyoto Protocol, which only requires action from industrialized countries listed in Annex B of the treaty (Moellendorf, 2009). Given that "the causes of […] climate change are deeply embedded in the socio-economic fabric of modern society" mitigation policies go "right to the heart" of economic and welfare policy (Lidskog and Elander, 2010, p. 32f; see also Büchs et al., 2011). It is thus likely that international obligations lead to domestic debate and possibly conflict over options to reduce greenhouse gas emissions. This produces newsworthy occasions for media to report on the issue, which is why we *assume media attention to be higher in Annex B states than in other countries (H3a).*

Nonetheless, Annex B countries "face different economic and political costs and benefits of implementing emission reduction policies" (Dolšak, 2009, p. 552), for example, because of a varying importance of carbon-intensive industries in the national economy. This, we expect, affects the domestic climate debate: the more a national economy is dependent on carbon-intensive industries and products, the greater the number of actors affected by carbon regulation policies and the greater the potential for conflict. Harrison and Sundstrom (2007, p. 6), for example, show that "the degree of business and labor opposition" in different Annex B countries "was consistent with the magnitude" of the reduction challenge prescribed by the Kyoto targets. Likewise, various accords on (media) communication about climate change describe that industrial actors from comparatively carbon-dependent countries, like the United States and Australia, have invested large amounts of resources in publicly questioning the problematicity of climate change and highlighting the costs of climate policies (for an overview, see Schlichting, forthcoming; also McCright and Dunlap, 2003). On the other hand, environmental organizations, churches and global justice groups, among others, mobilize for ambitious policies and particularly address the biggest climate culprits (for an overview, see Schmidt, 2012a; also Dawson, 2010). Consequently, the public climate debate in more carbon-dependent countries should be more conflictive and comprise a larger set of actors. Both factors have been shown to influence media attention – because of the journalistic norm of dramatization and a related focus on controversies (Boykoff and Boykoff, 2007; Boykoff, 2011, p. 104) and a greater amount of agenda-building efforts by societal actors influencing

the input side of news production (Waldherr, 2012, p. 26, 212). Thus, *we expect media attention to rise with carbon dependency (H3b).*

3. Data and Methods

We analyze media attention for climate change in 27 countries' leading media from 1996 through 2010. For these countries comparable data were acquired, which will be studied with similar research methods – thereby we ensure valid and informed comparisons.

Concerning case selection, we have sampled countries representing different degrees of vulnerability to the consequences of climate change (e.g. extreme weather events, like floods, cf. Harmeling, 2011), as well as varying levels of responsibility for action (i.e. obligations under the Kyoto Protocol) and carbon dependency (e.g. different degrees of carbon intensity and fossil fuel exports, cf. World Bank, 2012; Baettig et al., 2008, p. 485). According to our hypotheses, these factors should lead to differentiated media attention patterns; they potentially provide occasions for journalists to report on the topic and trigger activities by social actors, which in turn might influence media attention. Finally, in order to account for the global character of the issue, we selected countries from all continents. The subsequent sample includes industrialized countries, emerging economies and developing countries: Algeria, Australia, Brazil, Brunei, Canada, China, France, Germany, India, Indonesia, Ireland, Israel, Jordan, Malaysia, Mexico, Namibia, the Netherlands, New Zealand, Papua New Guinea, Russia, Singapore, South Africa, Spain, Thailand, the United Kingdom, the United States, and Yemen.

We chose leading print media from each country for the analysis, which we defined as media that have a "guiding societal function" (Wilke, 1999, p. 302). This was based, for example, on their circulation, reputation or quality of journalism. Print media were selected, since they offer a simpler means of methodically collecting and analyzing data regarding the geographic and temporal reach of the study (Doulton and Brown, 2009, p. 192). However, in some countries, print media may have a smaller influence than television, for example. Using reputable sources (e.g. Hans-Bredow-Institut, 2009), leading print publications were selected for each country, which a) are preferably published daily, b) have a universal and national coverage, c) a large circulation, and d) high journalistic standards ('quality newspapers'). We aimed to sample two such newspapers per country in order to represent different political positions and "ideological cultures" (Carvalho, 2007, p. 223) that are represented in most national media systems. In some countries, however, sampling two newspapers over such a relatively long time period was not possible and consequently only one publication was included. This can be justified by the fact that newspapers with different ideological positions have proven to exhibit very similar issue attention patterns (Sampei and Aoyagi-Usui, 2009; Ahchong and Dodds, 2012; Aykut et al., 2012; Lyytimäki, 2011; Carvalho and Burgess, 2005, p. 1462; Besio and Pronzini, 2010, p. 289; Schäfer et al., forthcoming), even though they may differ in content. Also our own results – especially Fig. 1 – show very similar issue attention levels and developments of different media in one country.

The basic population of this study was defined as all articles of these newspapers that explicitly mention climate change (even without climate as the main focus of the article). A reference to climate change exists when: a) the keyword 'climate' appears in connection with words indicating change (i.e. change, development, warming, cooling); b) the article includes words synonymous to climate change, such as 'greenhouse effect' or 'global warming'; or c) when a global change of temperature is discussed. These conditions were operationalized by broadly-defined search strings, which were developed, repeatedly controlled and validated by native speakers in Chinese, Dutch, English, French, German, Portuguese, Russian, and Spanish. In English, it reads as follows:

(climat* W/5 (chang* OR catastroph* OR disaster* OR transform* OR adjust* OR trend* OR warm* OR heat* OR cool* OR variab*)) OR
(greenhouse* W/3 effect*) OR
((global* OR earth* OR world* OR international* OR hemisphere*) W/5 (warm* OR heat* OR cool* OR chill*)) OR
((temperature* W/5 (global* OR earth* OR world* OR international* OR hemisphere*) W/8 (increas* OR rising* OR rise* OR decreas*)).

This complex search string enables better coverage of the targeted basic population than many other studies, which work with fewer and less-detailed search terms such as "climate change" and/or "global warming" (e.g. Grundmann, 2006, p. 86; Krosnick et al., 2000, p. 258; Boykoff and Boykoff, 2007, p. 1194; Olausson, 2009, p. 434). The search string was subsequently employed for full-text searches in electronic databases. In doing so, we had to restrict our search to coverage from 1996 onwards, that is, from the year in which most newspapers in question were made available electronically. The period under study ends in 2010 as we have done a good part of the data collection in this year. All articles containing positive search hits were downloaded. Non-relevant articles were later eliminated by employing corpus linguistic techniques, an automated check for duplicates, and extensive manual checks. The final sample contains 152,125 articles.

To ensure cross-country and longitudinal comparability, the total number of articles that appeared per month in each newspaper was also counted. The number of articles referring to climate change was then related to the absolute number in order to calculate coverage of climate change as a proportion of the absolute number of articles by month in percent. By this means, we aim to achieve "functional equivalence" (Wirth and Kolb, 2012, p. 469) of the measurements, which other comparative studies often miss.

Table 2

In order to test the hypotheses on the differentiated levels and developments of media attention, additional data were collected characterizing a country's vulnerability, responsibility for action and carbon dependency. Concerning vulnerability, two alternative measurements were considered: The Climate Risk Index (CRI), compiled by the NGO Germanwatch, and the insurance company Munich Re (Harmeling, 2011) is based on relative and absolute personal injury and property damage due to *past* extreme weather events (1991-2010). Accordingly, the CRI is a measure of risks that have already manifested themselves and may have triggered corresponding media reporting during the period of investigation. An assessment of *future* risks, which increases the relevance of adaptation and mitigation policies for a country, is provided by the Climate Vulnerability Monitor (CVM, DARA and Climate Vulnerable Forum, 2010, 2012). The CVM evaluates climate change impacts for various dimensions and condenses them into a vulnerability factor for the year 2030.

The pressure to act that different countries are facing is operationalized with the status a country has in the Kyoto Protocol (UNFCCC, 2012). According to the "differentiated responsibility" principle of the Framework Convention on Climate Change, only countries listed in Annex B of the Protocol bear limitations to their greenhouse gas emissions. They are obliged to report regularly on their emissions and, in most cases, to reduce the emissions in comparison to a business-as-usual scenario (cf. Harrison and Sundstrom, 2007, p. 6). The United States and Russia are special cases in this regard: the former never ratified the Kyoto Protocol and is therefore not officially affected by the emission reduction commitments mentioned in Annex B. The "differentiated responsibility" principle, however, is of general relevance in international climate politics, and the non-ratification did not prevent considerable domestic discussion about the country's responsibility to act on climate change (Harrison, 2007, p. 99f). Russia, in contrast, is an official Annex B party to the protocol. However, the country has negotiated very generous conditions that do not restrict economic development and have practically no domestic effect (Henry and Sundstrom, 2007, p. 57). As

we will see, this diverts the hypothesized effect of the Annex B status on media attention (see also online supplementary material).

Two indicators were considered for a country's carbon dependency:

1. The carbon intensity of the economy (CO2 emissions in kg per 2005 PPP $ of GDP from the World Bank, 2012) is a measure of how carbon-dependent the economic welfare of a country is. The more carbon dioxide emissions are caused by producing one dollar of added value, the more difficult and welfare decreasing it is for a country to lower emissions and the bigger the challenge of de-carbonization (Böhringer and Löschel, 2002, p. 5).
2. Furthermore, a measure on the trade balance of fossil fuels was included. Countries with net exports of fossil fuels, in addition to domestic carbon dependency, rely in their external trade relations on carbon-intensive goods that might lose value in a low-carbon future sought by (international) climate policies. This industry is, moreover, typically dominated by large companies with many resources to mobilize for interventions in the climate debate. Countries with net imports, in contrast, may profit from positive side effects when pursuing de-carbonization policies in the energy sector: they lower their dependency from energy imports (including the related costs) and increase domestic value creation. Concretely, the 1996-2008 average percentage value for the net exports in relation to GDP was computed, thereby accounting for the relevance of these exports to the national economy, from World Development Indicators data (World Bank, 2012).

4. Results

4.1. Level and development of media attention

The results show, first of all, that climate change is a relevant media topic in all countries. This is in line with hypothesis 1. On average, climate change coverage accounts for 0.62 percent of all articles published between 1997 and 2009 in the 37 newspapers under study. This amount may appear to be low at first, but it is still considerable. Other frequently discussed scientific themes in the media, such as stem cell or human genome research, which were even deemed to be receiving "hype" coverage in the media (Racine et al., 2006), obtained significantly less media coverage in Germany, France, and the United States (comparision based on Gerhards and Schäfer, 2006; Schäfer, 2007; for aggregated numbers see Schäfer et al., 2012, p. 126).

But how did media attention develop between 1996 and 2010? We hypothesized that issue attention has increased in all countries. Indeed, and again corresponding with hypothesis 1, one can see that media coverage on climate change has risen over time. Issue attention in the 1990s was at a relatively low level (in most countries around or below 0.2% of total coverage). However, it expanded, sometimes drastically, in all countries in the course of the following years (for similar results cf. Boykoff, 2010, p. 22; Carvalho and Burgess, 2005, p. 1462; Liu et al., 2008, p. 383; Sampei and Aoyagi-Usui, 2009, p. 205; Holt and Barkemeyer, 2012, p. 9). Comparing the 1997-2000 with the 2006-2009 period highlights this (see Table 3). The level of attention in most countries rose in late 2006/early 2007 and remained at a clearly higher level through the end of 2009, when growth had seemingly come to a halt. That is, media attention for climate change has not only evolved cyclically with ups and downs; rather, a clear shift in attention levels is evident (Holt and Barkemeyer, 2012, p. 13). This expanding media attention corresponds with increased activities in different societal realms. Among others, Al Gore launched his movie *An Inconvenient Truth* (for which he was awarded the 2007 Nobel Peace Prize, together with the IPCC) in 2006, the IPCC released the Fourth

Assessment Report, and Sir Nicholas Stern published a study, commissioned by the British government, on the economics of climate change (Boykoff, 2011, p. 20f; Gupta, 2010, p. 646). Moreover, most of the national climate legislation existing so far has been drafted since 2007/2008 (see the 15-country study by Townshend et al., 2011, p. 5f). Reusswig (2010, p. 45) argues that the greater amount of climate change-related activities since 2006 is also due to the "mainstreaming" of climate change to other domains: it has "evolved as a cross-cutting policy issue," which has been taken up, for example, by existing institutions and organizations in the economic policy domain (see also Lyytimäki, 2011, p. 657f).

Figure 1

Media attention, however, did not develop in a linear way – it fluctuates and peaks around specific events in all countries. This is typical for media reporting; attention for one topic peaks for rather short periods of time, after which it subsides (Luhmann, 1971; Nisbet and Huge, 2006; Rödder and Schäfer, 2010). This alternation of up- and downturn in media attention might occur repeatedly over time (see Newig, 2004, p. 158). In the case at hand, we particularly see peaks during COPs – probably because of the high stakes and the prominent political actors involved in the international negotiations. Additionally, actors from civil society concentrate a considerable part of their mobilizing efforts to these periods (Benford, 2010, p. 77f). This might also contribute to high media attention. The clearest example is the 2009 climate summit in Copenhagen (COP 15), which coincides with one of the highest issue attention peaks, if not the highest (see country studies in Eide et al., 2010; also Schäfer et al., 2011). Other global climate conferences have had similar cross-country effects, such as COP 3 in Kyoto, COP 6 in The Hague and Bonn, and COP 13 in Bali. Moreover, attention peaks occur after the publication of IPCC assessment reports (Hulme, 2009). Elsewhere (Schäfer et al., forthcoming) we investigate the effect of such climate change related events and activities in more detail. Based on time series analyses for the Australian, German and Indian cases we show, among others, that the UNFCCC conferences trigger increased media attention in all three countries. Weather extreme events, in contrast, play only a subordinate role in driving issue attention – only in Germany we found an effect.

To sum up, issue attention is characterized by considerable ups and downs, although climate change remains an important topic over a long time period. Generally, we can show that climate change receives comparatively much attention in the media, and that this attention has increased markedly in all countries, that is, we can confirm our first hypothesis. There are some signs, however, that attention has decreased after 2009, maybe partly due to the frustration of many actors (including journalists) with the slow progress in international climate politics, exemplified by the outcome of the Copenhagen Climate Conference (Lyytimäki, 2011, p. 657), and a shift of political attention towards the financial and debt crisis (Gupta, 2010, p. 650; Djerf-Pierre, 2012). Boykoff and Yulsman (2013, p. 8) attribute the decline moreover to shrinking personnel in newsrooms due to the crisis of newspapers and also Hansen (2011, p. 11f) portrays economic pressures and a decrease of specialist environmental journalism in mainstream media organizations. It is unlikely, however, that the presented long-term increase in media attention, as well as its considerable short-term peaks coinciding with major climate-related events, are primarily driven by the newspapers' resources for environmental journalism. Furthermore, as we show the extent of climate change coverage as a proportion of the absolute number of articles published in the same month, overall shrinking newspaper sizes do not affect our results.

4.2. Cross-national differences in media attention levels

There are noticeable country differences despite the aforementioned general trends. While all countries exhibit growing media attention, they did so to varying degrees. For example, the

growth is very strong in Australia and Indonesia (climate change coverage increased in the second half of the 2000s compared to the 1997-2000 period in those countries by a factor of 10.5 and 16.4, respectively), whereas in India, attention has only expanded by a factor of 2.9. In most other countries, media attention to climate change expanded by a factor of 4 to 8. Moreover, the height of coverage peaks around the aforementioned events differs between countries. For example, media attention for climate change in Indonesian newspapers was 3.2 times higher during the climate conference in Bali than in the six months preceding and following the event. Media attention in other countries also increased in this time, on average, however, only by a factor of 1.4. During other climate-related events, media attention increased only in specific countries, such as Ireland, and not, or much less so, in other countries. This differentiated development, together with some variation in the baseline levels of 1997-2000, leads to varying overall levels of media attention. In Israel, Mexico, Brunei, and India, climate change accounts for only one-quarter or one-third percent of the total media coverage. In contrast, Australia, Indonesia, and Great Britain have particularly high levels of media attention, with 1.4, 1.0 and 1.0 percent of total media coverage, respectively (see Table 3).

Table 3

Do these different levels of media attention correspond with the different degrees of affectedness from climate change or climate policies, as hypothesized?

When we compare less and more affected countries according to the Climate Risk Index (CRI), only slight differences are visible. However, at least for the time period 2006-2009, the attention level in countries that experienced significant damages (half a standard deviation greater than the average) due to extreme events is approximately 15 percent higher than in less affected countries. Regarding projected vulnerability, as expressed by the DARA Vulnerability Factor (DVF) 2030, we do not see higher attention levels in countries where vulnerability is high, severe or acute – in comparison to such that are assessed to have low or moderate vulnerability. Conversely, media attention, on average, is even slightly lower in particularly vulnerable countries. One initially plausible explanation of this result has to do with the resources for environmental journalism and for covering international climate-related events which likely differ between the compared country groups: most of the countries with high projected vulnerability are situated in the developing world where such resources are often lacking (Harbinson, 2006; Saleh, 2012, p. 49f). Consequently, high vulnerability might not be translated into media coverage as hypothesized because journalists in these countries do not have the (material, time, knowledge) resources to report on climate-related activities which, from an outsider macro-perspective, seem newsworthy.

To investigate the potential relationship between vulnerability and media attention further, we subsequently consider Annex B and non-Annex B countries separately – which makes the compared cases also more homogenous with regard to their level of development. This reveals that highly affected Annex B countries (according to both the CRI and DVF) exhibit lower attention levels than those affected less by weather-related damages and projected negative impacts. In contrast, for non-Annex B countries – mainly developing nations –, we find a relation in the expected direction; on average, media attention for the years 2001-2009 (for which data for most countries are available) in those countries with significant damages (CRI) is approximately 25 percent higher, and for the time period 2006-2009 even 36 percent higher compared to the other non-Annex B countries. The same is true for future climate risks: non-Annex B countries with high to acute vulnerability show clearly higher attention levels. On average, attention between 2001 and 2009 is 1.5 times greater than in countries with a low or moderate vulnerability assessment.

Consequently, we can partly confirm our second hypothesis: high vulnerability, especially *anticipated* climate change risks, and high media attention only coincide in non-Annex B countries, which are mainly located in the global South. The existing literature suggests that the impacts of climate change are indeed a major focus of the media in developing countries. Studies on India, one of the most vulnerable countries in the sample, show that media devote quite a lot of space to information about (possible) consequences for India. The discussion of political responses, however, is limited – including adaptation measures – and not characterized by major controversies (Billett, 2010, p. 7ff; Jogesh, 2012, p. 272ff). Similar findings are reported for China (Shanahan, 2009, p. 148) and Mexico (Gordon et al., 2010, p. 165). Given this major focus on the consequences of climate change in this country group, it is plausible that the cross-nationally varying degrees of affectedness from climate change have some influence on issue attention levels, whereas media attention in Annex B states is driven by other factors such as policy aspects.

When comparing countries with different responsibilities for action, the variation corresponds to hypothesis 3a: media attention in non-Annex B countries for the years 2001-2009 amounts to, on average, 0.62 percent, whereas it is approximately 1.5 times higher (0.91%) in countries with emission targets under the Kyoto Protocol.

Nonetheless, issue attention in the group of Annex B countries is highly differentiated. How closely do the differences correspond with a country's degree of carbon dependency? As outlined above, a great economic relevance of carbon based industries should mobilize a larger set of actors engaging in the debate about climate policies and make it more conflictive. This in turn should increase the newsworthiness of the topic and lead to more media coverage. More specifically, we hypothesized that a high carbon intensity of economic development (GDP) as well as a high relevance of net fuel exports correspond to higher media attention levels.

Indeed, the extent of media attention in Annex B countries generally concurs with their varying carbon dependency. When we plot countries according to their carbon dioxide emissions per unit of GDP and their media attention levels, the majority of the countries are located in the lower left or upper right corner of the matrix. This means that a high carbon intensity typically corresponds to above average media attention and vice versa (see Figure 2).

The prime example of a carbon-intensive economy is Australia, which at the same time shows the highest media attention in the sample. Most of the European Union countries, in contrast, are characterized by both a lower carbon intensity of the GDP and lower levels of media attention. Nevertheless, the relation is obviously not clear-cut and the United Kingdom deviates considerably from the expectation. The more important outlier, however, is Russia: its economy is very carbon-intensive, but issue attention is comparatively low. This is probably due to the generous Kyoto target of the country, which did not prescribe, in contrast to all other countries, emission reductions in comparison to a business-as-usual trajectory (Harrison and Sundstrom, 2007, p. 5). Consequently, no domestic efforts were required (see online supplementary material for a more detailed discussion and an alternative carbon intensity indicator).

Figure 2

Figure 3

Additionally, we found a notable correspondence between the relevance of fuel imports and exports for the domestic economy and media attention for climate change; media attention is especially high in countries for which fuel exports are an important contribution to economic wealth. This might be because companies from the fossil fuel sector are particularly active in

voicing their position. Ambitious climate policies would complicate or even undermine earning money from oil and coal exploitation, as energy production from these sources causes high greenhouse gas emissions. Depending on the strength of the sector in a country, jobs in mining, oil drilling, refineries, etc. and the contribution to economic wealth can serve as weighty arguments and therefore mobilize resistance by a number of directly or indirectly affected actors.

Overall, the relation between the degree of carbon dependency and the level of media attention are broadly in line with hypothesis 3b. The climate debate in particularly carbon-dependent Annex B countries seems to be very intensive. We assume that this is due to a conflictive debate between actors with competing interests – which is attractive for media to cover. The existing literature on Canada (e.g. Young and Dugas, 2011, p. 15; Greenberg et al., 2011) and especially Australia, the world's largest coal exporter (Howarth and Foxall, 2010, p. 167), also points to this interpretation: the climate change debate in Australia is characterized by a significant politicization, with two camps fiercely competing (Chubb and Bacon, 2010, p. 51f; Bulkeley, 2000, p. 740). Actors from the fossil fuel and energy industry, politically conservative and (neo-)liberal actors form one coalition. It first focused on the uncertainties in climate change science, and later pointed to the unreasonably high costs of greenhouse gas regulations for the Australian economy (Kurz et al., 2010, p. 611; Stevenson, 2008, p. 8f). In contrast, environmental groups, the Greens and parts of the Labour party highlight the expected dramatic social and environmental consequences of climate change and push for ambitious climate policies (Hall and Taplin, 2007; Kurz et al., 2010, p. 615f). The Kyoto Protocol has been ratified only after a long and conflictive discussion. And in both the 2007 and 2010 national election campaigns, domestic climate policy has been a major issue (Rowe, 2011, p. 76f; Rootes, 2011). Consequently, there have been many relevant occasions for Australian media to report on climate change and policies. In contrast to that, the climate debate in Germany – a country with a relatively low level of carbon dependency – is much less conflictive. German governments have early accepted international obligations and never questioned the need to reduce domestic emissions – so no conflicts with international expectations arose (Cass, 2006, p. 222). Although the commitments under the Kyoto Protocol are comparatively high, the economic effects were very limited so far – given that the breakdown of East German industry following unification has provided for a large share of the required emission reductions. Historically, coal was an important domestic energy resource but the costs of its extraction are not competitive internationally and a phase out of related subsidies has drastically downsized the coal mining sector. In line with this, domestic resistance against further international agreements or national measures aiming at further expanding renewable energy production is very limited. Also many industry and business organizations perceive de-carbonization as rather providing economic opportunities than disadvantages (Weingart et al., 2000, p. 274f; Grundmann, 2007, p. 419; Engels et al., 2013; Schmidt and Schlichting, forthcoming). This situation, we suggest, has less often produced newsworthy occasions related to climate governance and might thus partly explain the below-average issue attention in the analyzed German newspapers.

5. Conclusion

Comparative studies on climate change communication are paramount to further our understanding of how societies take up, and subsequently react to, this global problem. Our study provides comparable data on the media attention for climate change over 15 years and in 27 countries, thereby going beyond small-N analyses, which dominate the research field. Accordingly, it provides new insights concerning (developing) countries so far neglected as well as concerning a longitudinal and cross-national perspective. It hence considerably expands the evidence on media communication about climate change.

We have argued that climate change is a major societal problem with global causes and consequences. Media coverage may increase societal awareness and knowledge of the issue, ideally fostering informed individual and collective actions. Concerning political decisions, mass media constitute an important forum for opinion formation and legitimation. The study shows that newspapers around the world devote a considerable share of reporting space to climate change. Moreover, climate change has remained on the news agenda for a long time and has become even more important over time. Accordingly, media have at least indicated to their audience that the topic is relevant and have provided possibilities for opinion formation.

Besides these commonalities, we have highlighted several cross-national differences in the development and overall level of media attention. From a country comparative perspective, we have explored whether varying attention levels correspond with factors hypothesized to influence the extent of media coverage. In this regard, we have presented several instructive findings: Firstly, we found that media attention in particularly vulnerable countries at first sight does not differ much from the average. However, when limiting the focus to non-Annex B countries – where media coverage is generally less extensive –, we can see differences between less and more vulnerable nations; issue attention is on a clearly higher level in those countries with significant (projected) climate impacts. Although the media space for information on and discussion about (potential) risks and adaptation options is not (much) greater in those countries that are probably most affected, we therefore cannot substantiate a general "information gap" described by Boykoff (2011, p. 24).

Secondly, we found a quite strong correspondence between the pressure to engage in climate action and media attention; media coverage in countries with obligations under the Kyoto Protocol is, on average, more extensive than in others. In addition, Annex B countries with a high carbon dependency exhibit a particularly high issue attention. It seems that carbon-intensive societies – which are under particular pressure to change lifestyles and the modes of economic welfare generation – extensively debate climate change and politics. The existing literature suggests that in these countries a large number of actors from various societal spheres, such as industry associations (Levy, 2005), environmental groups (Bryner, 2008), religious groups (Kearns, 2011; Wardekker et al., 2009) and labor unions (Daub, 2010) participate in public debates about climate governance. From the perspective of normative theories of democracy, especially deliberative democracy (Habermas, 2001, e.g. p. 304), such a broad discussion is advantageous; it ideally allows for comprehensive discussions of all relevant arguments, gives those affected by political decisions the opportunity to participate in its realization, and therefore fosters public legitimation of the legislative output. In this sense, high media attention levels in those countries with the greatest responsibility for climate action can be interpreted as a positive sign for international climate politics. Moreover, the example of Australia shows that an intensive, conflictive media debate can indeed eventually lead to the adoption of relatively ambitious greenhouse gas regulations (Jotzo, 2012). Nonetheless, there is certainly no simple relation between the amount of media coverage and the legitimation or implementation of ambitious climate policies (Sampei and Aoyagi-Usui, 2009, p. 211).

For future studies, it would be desirable to go beyond issue attention and account more comprehensively for the role of mass media debates in shaping societal reactions to the challenge of climate change. In this regard, both comparative studies categorizing large text corpora by employing text mining and corpus linguistic tools (Koteyko, 2010) and conventional content analyses for specific samples are conceivable. Such studies could reveal how the issue is framed and evaluated in the respective coverage, what policy options are presented as being preferable, and to what institutions or countries responsibility for action is attributed (Schmidt, 2012b). The data presented here may guide selecting instructive cases for further analyses taking up these and other descriptive research questions.

Moreover, although we have discussed several factors that potentially influence the media coverage of climate change, it would be informative to expand on this. In particular, it is recommended to set up a multivariate explanatory framework, thereby evaluating the influence of different factors in combination. For a country-comparative, medium-N study, the Qualitative Comparative Analysis approach, originally developed by Ragin (1987), seems especially appropriate (Wagemann and Schneider, 2010).

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Table 1: Overview of studies on climate change communication that address issue attention

Study	**Case**	**Media** (newspapers, unless otherwise stated) **and article sample**	**Results**
Farbotko, 2005	Australia 1990-2004	Media: *Sydney Morning Herald* Search keywords: "Tuvalu", then manual check for climate change N = 38	Biggest share of articles in 2001, followed by 2002; all other years with only minor attention
Miah et al., 2011	Bangladesh 2006-2009	Media: *The Daily Prothom Alo, The Daily Ittefaq*, *The Daily Star* Search keywords: ? N = 1992	Fluctuating attention, gradual increase from the beginning of 2009
Ahchong and Dodds, 2012	Canada 1988-2007	Media:*Toronto Star, Globe and Mail* Search keywords: "greenhouse gas" or "climate change" or "global warming" N = 2893	Overall increasing attention, peaks in 1990, 2002 and 2007 coincide with international events (COPs); similar distribution in both newspapers
Young and Dugas, 2011	Canada 1988-2008	Media: *The Globe and Mail*, *The National Post* Search keywords: ''climate change'' or ''global warming'' or ''greenhouse effect'' or ''greenhouse gas'' N = 897	Overall increasing attention in both newspapers; peak in 2007/2008
Schreurs et al., 2001	Canada, Germany, Hungary, Japan, Mexico, Netherlands, UK, US 1970-1992	Media: CAN: Globe, Mail; DE: Bild der Wissenschaft, Spielgel, Zeit; HU: Népszabadság; JP: Asahi Shimbun; MX: El Dia, Excelsior, La Jornada, Novedades, El Universal, Uno mas Uno; NL: De Telegraaf; UK: The Times; US: New York Times Search keywords: ? N = ?	Little attention prior to 1988, quite sharp rise in 1988/89, decline in some countries in 1991, high attention level again in 1992
Dotson et al., 2012	Chile 2003, 2005, 2007	Media: *El Mercurio, La Nación* Search keywords: "cambio climático" OR "calentamiento global " N = 269	Increasing media attention from period to period
Yang, 2010	China 2000-2007	Media: *Chinese Core Newspapers Database containing 1000 national and provincial newspapers in mainland China* Search keywords: "pollution", "air pollution", "water pollution", "noise pollution", "global warming", "animal protection" N = ?	Low but overall growing media attention for environmental issues, no significant peaks
Lyytimäki and Tapio, 2009	Finland 1990-2009	Media: *Helsingin Sanomat* Search keyword: "ilmastonmuutos" N = 44238	Relatively stable distribution in the 1990s, increase since 2000, esp. since 2004, peaks in 1997, 2001, January 2007 and February 2008
Lyytimäki, 2011	Finland 1990-2010	Media: *Helsingin Sanomat,Keskisuomalainen, Aamulehti, Ilta-Sanomat, Iltalehti, Maaseudun Tulevaisuus* Search keyword: "ilmastonmuutos" N = ?	Modestly rising attention until 2006, sharp increase in 2007, decline since 2009; peaks coincide with international events; similar patterns in national and regional broadsheet newspapers
Aykut et al., 2012	France 1986-2006	Media: *Le Monde, Sud-Ouest*, *L'Express* Search keywords: "changement(s) climatique(s)" or "effet de serre" or "réchauffement global" or "réhauffement de la planéte" N = ?	Overall increasing attention, moderate attention before 2000, then marked increase; peaks coincide with international events, domestic weather events and national political events; similar distribution in all three newspapers
Grundmann and Krishnamurthy, 2010	France, Germany, UK, US 1980-2007	Media: full text search in database Nexis; Search keywords: "climate change" or "global warming" or "greenhouse effect" (and German and French equivalents) N = 599361	Rising issue attention in all countries; exponential rise after 2005, and peak in 2007
Grundmann and Scott, 2012	France, Germany, US, UK 2000-2010	Media: *10 newspapers per country* Serach keywords: "climate change" or "global warming" or "greenhouse" (and German and French equivalents) N = 44874	Upward trend over all countries and media, with early peaks in 2000 and 2001, and central peak in 2005. Germany: high peak in 2007, Germany and the UK: equally high peaks at the end of 2009. Peaks coincide with international and national political events and natural hazards. International decrease in attention by the end of 2009.
Brossard et al.,	France, US	Media: *Le Monde, New York Times*	France: attention cycles with peaks in

2004	1987-1997	Search keywords: “global warming” or “climate change” or “greenhouse effect” N = 530	1989/1997; US: many peaks coincide with political events, with the highest: in1997
Weingart et al., 2000a	Germany 1975-1995	Media: *Der Spiegel*, *Süddeutsche Zeitung, Frankfurter Allgemeine Zeitung* Search keywords: ? N = 478	Low attention until 1987, then rise, and peak in 1992 (Rio Earth Summit); afterwards attention remains at a higher level
Grundmann, 2006	Germany, Switzerland (German language papers), US 1985-2002	Media: *New York Times, Washington Post, Wall Street Journal; Der Spiegel, Die Tageszeitung, Focus, Frankfurter Allgemeine Zeitung, Neue Zürcher Zeitung, Süddeutsche Zeitung* Search keywords: “greenhouse effect OR climate change OR globalwarming”; “Treibhauseffekt OR Klimawandel OR Klimakatastrophe OR globale Erwärmung” N = ?	German language coverage: peak in 1995 (COP 1) and 1997 (COP 3), significant rise in attention from late 1999 US coverage: 1988 (heat wave in US), 1997 (COP 3), 2001 (unilateral withdrawal of the US from the Kyoto process)
Jogesh, 2012	India 2004-2009	Media: *The Indian Express, The Hindu, Hindustan Times, The Times of India* Search keywords: “climate change” or “global warming” or “greenhouse gas emissions” or “IPCC” or “Copenhagen” N = 1938	Steady rise of attention until 2009, with a sharp rise in December; peaks coincide with international events
Pasquaré and Oppizzi, 2012	Italy 2007-2010	Media: La Repubblica, Corriere della Sera Search keywords: “climate change”, “global warming”, “greenhouse effect” N = 818	Highest peak in 2007 with sharp decline from 2008 to 2010; smaller peak in 2009 (COP 15)
Sampei and Aoyagi-Usui, 2009	Japan 1998-2007	Media: *Yomiuri, Asahi*, and *Mainichi* Search keywords: “chikyu ondanka” (global warming) or “kiko hendo” (climate change) N = 25532	Overall increasing attention; peaks coincide with international political events, and sometimes also with domestic events
Gordon et al., 2010	Mexico 2004-2006	Media: *Reforma* Search keywords: “calentamiento global” or “cambio climático” (in headline or first paragraph) N = 144	Cyclical nature of coverage; peaks coincide with international events (COPs); greatest peak in 2006
Batta et al., 2013	Nigeria 2007-2009	Media: *ThisDay*, *Daily Trust, The Guardian,The Punch* Search keywords: ? N = *134*	Highest spike in 2009, lowest level in 2008
Takahashi and Meisner, 2012	Peru 2000-2010	Media: *Correo, El Comercio, El Peruano, Expreso, La Primera, La Razon, La Republica, Gestion, Ojo, Peru21* Search keywords: “climate change” or “global warming” or “greenhouse effect” or “greenhouse gases” N = 459	Low attention until 2006, then rising attention, with peaks in 2007 and 2008; decrease in 2009 and 2010
Lee et al., 2013	South Korea 2009 - 2011	Media: *Chosun Ilbo*, *Dong-A Ilbo*, *Hankook Ilbo*, *Hangyoreh Shinmun*, *Joongang Daily*, *Korea Economic Daily*, *Kukmin Ilbo*, *Kyunghyang Shinmun*, *Maeil Business News* Search keywords: English and Korean-language terms for carbon dioxide, global warming, out-of-oil energy measures, abnormal climate, meteorological disaster, conventions on climate change N = 2064	Slightly rising attention from January 2009 onwards, spike in December 2009; afterwards slightly lower level than before
Yun et al., 2012	South Korea 2007-2008	Media: *Chosun Ilbu, Hankyoreh, Maeil Business* Search keywords: “climate change”, “global warming”, “Kyoto protocol” N = 925	More articles mentioning climate change in 2008 than in 2007, but less solely dedicated to it
Kleinschmit and Sjöstedt, 2013	Sweden 1992-2009	Media: *Dagens Nyheter* Search keywords: ‘‘climate change’’ and ‘‘forest” N = 394	Peaks in 1997 (Kyoto), 2001 (US withdrawal from Kyoto Protocol), 2007 (IPCC) and 2009 (COP 15).
Shehata and Hopmann, 2012	Sweden, US 1998-2007	Media: *Dagens Nyheter* and *Svenska Dagbladet, New York Times, Washington Post* Search keywords: “kyoto*” or “klimatför*”or “växthuseffekt*” or “växthusgas*” / “Kyoto” or “climate change” or “global warming” N = 1781	Overall increasing attention in both countries, esp. since 2005; more attention in US than in Sweden, with a similar distribution of ups and downs

Besio and Pronzini, 2010	Switzerland 1987-2006	Media: *Neue Züricher Zeitung*, *Tages-Anzeiger* Search keywords: ? N = ?	Overall increasing attention, with peaks in 1990, 1992, 1995, 1997, 2001, 2005 and 2006; coincide with national and international political events; similar distribution in both newspapers
Boykoff and Mansfield, 2008	UK 2000-2008	Media: *The Sun, Daily Mail, Daily Express*, and *Mirror* Search keywords: "climate change" or "global warming" N = 974	Trend shows increasing attention, with three peaks: November/December 2000, June/July 2005 and September/November 2006
Carvalho and Burgess, 2005	UK 1985-2003	Media: *The Guardian, The Independent, The Times*; Search keywords: "climate change" or "global warming" or "greenhouse effect" N = 5913 articles	First increase in 1990, and then decline 1991-1996; another rise from 1997, and peak in 2001; similar distribution in all newspapers
Doulton and Brown, 2009	UK 1997-2007	Media: *The Guardian, The Independent, The Telegraph*, *The Times* Search keywords: ? N = 158	Overall rising attention, with peaks in 2000/20001 (*Guardian*: 2001/2002) and 2006/2007; decline around 2003
Shaw, 2013	UK 2000-2012	Media: *12 UK national newspapers, BBC News online* Search keywords: "two degrees" N = 301	Rise of attention in 2005-2007 (IPCC) and highest peak in 2009/2010 (COP 15)
Nerlich et al., 2012	UK, US 2000-2009	Media: *London Times and New York Times* Search keywords: "carbon" N = 9821	Steadily rising attention from 2000 to 2007, with high peak in 2007, afterwards slight decrease of yearly newspaper articles
Boykoff and Boykoff, 2007	US 1988-2004	Media: *New York Times, Los Angeles Times, Washington Post, Wall Street Journal*; *ABC World News Tonight, CBS Evening News, NBC Nightly News* (TV); Search keywords: "global warming" or "climate change" N = 4887 articles, 293 segments (TV)	Overall increasing attention within five time periods with the most coverage: 1990, 1992, 1997, 2001–2002, and 2004; peaks coincide with major international events (reports and conferences)
Boykoff, 2008	US 1995-2004	Media: *ABC World News Tonight, CBS Evening News, NBC Nightly News*, *CNN WorldView, CNN Wolf Blitzer Reports, CNN NewsNight* (TV); Search keywords: "global warming" or "climate change" N = 213	Low attention in 1995 and 1996, with an increase in 1997, where the biggest share of segments occurs; decline and rise to another peak in 2000, another decline (lowest point 2003) and small rise in 2004
Elsasser and Dunlap, 2012	US 2007-2010	Media: *www.townhall.com, a self-proclaimed conservative website that posts op-eds from approximately 850 syndicated U.S. columnists* Search keywords: "global warming", "climate change", "anthropogenic global warming", "anthropogenic climate change" N = 203	Fair amount of attention during 2007-2010, attention spiked in accordance with important events: February and March 2007, November 2007, February 2008 with most significant peak in December 2009 (Climategate and COP 15).
Liu et al., 2011	US 1969-2005	Media: *New York Times*; Search keywords: "climate change", "global warming", "greenhouse gas" N = 4197	Overall rising attention, with very little coverage pre-1980s, steep increase in 1988, fluctuations in 1990s, and highest attention in 2000s
McComas and Shanahan, 1999	US 1980-1995	Media: *New York Times, Washington Post*; Search keywords: "climate change" or "global warming" or "greenhouse" N = 376	Very low attention until 1987, with a sharp increase in 1988 and peak in 1989; afterwards decline until 1994, and small rise in 1995
Nisbet, 2011	US 2009-2010	Media: *New York Times*, *Washington Post*, *CNN. com*, *Politico* and *Wall Street Journal* Search keywords: "climate change", "global warming" in headline or lead paragraph N = 1862	Low attention, rising from mid 2009 with remarkable peak in December 2009 (COP 15)
Trumbo, 1996	US 1985-1995	Media: *New York Times, Washington Post, the Los Angeles Times, Christian Science Monitor, Wall Street Journal* Search keywords: "global warming" or "greenhouse effect" or "climate change" N = 252	Low attention until 1988, then increase with peaks that coincide with Rio Earth Summit; decline after 1992

Holt and Barkemeyer, 2012	39 countries, seven languages (English, Spanish, Italian, German, Dutch, French, Portuguese) 1990-2008	Media: 112 Broadsheet newspapers Search keywords: terms related to climate change and sustainable development N = 24,000,000	Continuous, incremental increase from mid/end of 1990s onwards; peak in 1997 (Kyoto); level change (large upsurge) mid 2006/early 2007
Corfee-Morlot et al., 2006	World 1993-2006	Media: *"major global newspapers"* Search keywords: ? N = ?	Upwards trend with peaks in 1997/1998, 2000/2001 and general rise since 2004
Boykoff and Mansfield, 2013	World (organized by continent) 2004-2013	Media: *50 newspapers* Search keywords: "climate change", "global warming" N = ?	Europe and North America: rising attention with peak in 2007, then decrease, except for remarkable peak in 2009 (COP 15), Oceania: similar trend with more peaks, also after 2009; South America, Africa and Asia: less attention, later rise, quite constant level after 2009

Table 2: Overview of analyzed countries and newspapers

Country	*Newspaper*	*LMI*	*Time period*	*N articles*	*% of total N*
Algeria	El Watan	4	07/04 - 06/10	549	0.36%
Australia	The Australian	4	01/96 - 05/10	13,892	
	Sydney Morning Herald	4	01/96 - 06/10	9,534	15.40%
Brazil	Folha de São Paulo	4	09/97 - 06/10	3,617	2.38%
Brunei	Borneo Bulletin	3	07/97 - 06/10	590	0.39%
Canada	Toronto Star	4	01/96 - 06/10	7,773	
	The Globe and Mail	4	01/96 - 06/10	8,350	5.66%
China	People's Daily	4	01/96 - 08/09	2,575	1.69%
France	Le Figaro	4	01/97 - 06/10	4,218	2.77%
Germany	Süddeutsche Zeitung	4	01/96 - 06/10	6,899	
	Frankfurter Allgemeine	4	01/96 - 06/10	5,861	8.39%
India	The Hindu	4	01/96 - 06/10	5,710	
	Times of India	4	04/97 - 06/10	2,553	2.05%
Indonesia	Jakarta Post	4	01/96 - 06/10	2,492	1.64%
Ireland	Irish Times	4	01/96 - 06/10	6,151	4.04%
Israel	Jerusalem Post	4	01/97 - 05/10	742	0.49%
Jordan	The Star	2	09/03 - 06/10	101	0.07%
Malaysia	New Straits Times	4	01/96 - 06/10	1,757	1.15%
Mexico	Reforma	4	01/96 - 06/10	4,061	2.67%
Namibia	The Namibian	4	01/04 - 06/10	801	
	Allgemeine Zeitung	4	06/01 - 06/10	134	0.61%
Netherlands	De Volkskrant	4	01/96 - 06/10	2,652	1.74%
New Zealand	New Zealand Herald	4	01/96 - 06/10	4,961	
	The Press	4	06/96 - 06/10	1,955	4.55%
Papua New Guinea	PNG Post Courier	4	11/01 - 06/10	838	0.55%
Russia	Izvestija	4	01/96 - 06/10	496	0.33%
Singapore	Straits Times	4	01/96 - 06/10	2,497	1.64%
South Africa	Sunday Times	3	06/01 - 06/10	383	
	The Star	4	01/07 - 06/10	1,066	0.95%
Spain	El Pais	4	04/96 - 06/10	6,787	4.46%
Thailand	Bangkok Post	4	01/97 - 06/10	1,542	
	The Nation	4	06/98 - 06/10	1,275	1.85%
United Kingdom	The Times	4	01/96 - 06/10	9,946	
	The Guardian	4	01/96 - 06/10	12,484	14.74%
USA	New York Times	4	01/96 - 05/10	8,676	
	The Washington Post	4	01/96 - 06/10	8,095	11.02%
Yemen	Yemen Times	3	04/03 - 10/09	112	0.07%
Total				**152,125**	

The Leading Media Index (LMI) was constructed from the sum of four dichotomous variables. A score of 4 refers to a *national quality daily* newspaper with *high-circulation*. One point is deducted if a publication fails to meet any of the four criteria (Brunei: circulation; South Africa and Yemen: daily publication; Jordan: both).

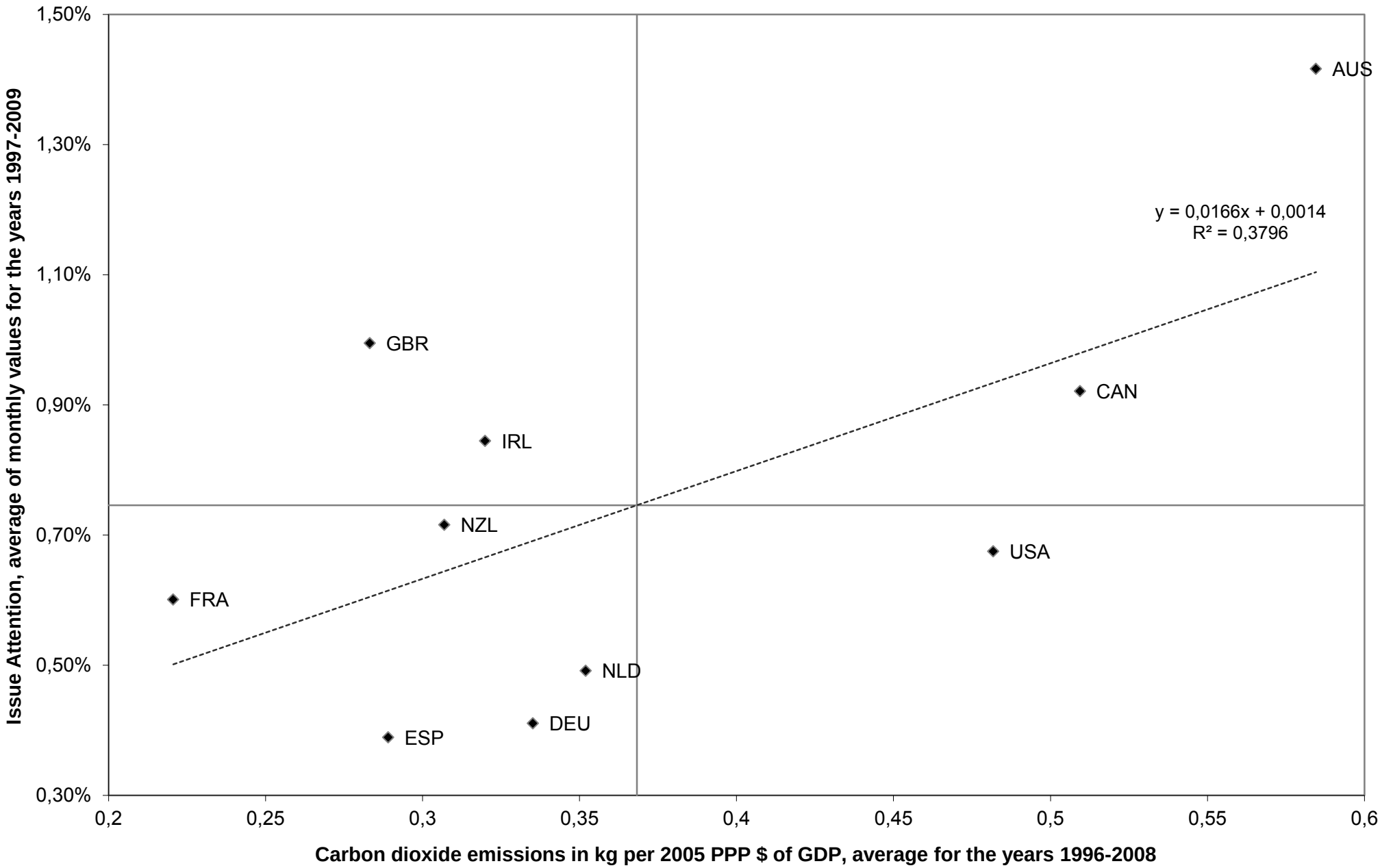
Fig. 1. Media attention for climate change across the world (Graphs show percentage of the respective newspapers' coverage that refers to climate change; gaps in graphs are due to missing data).

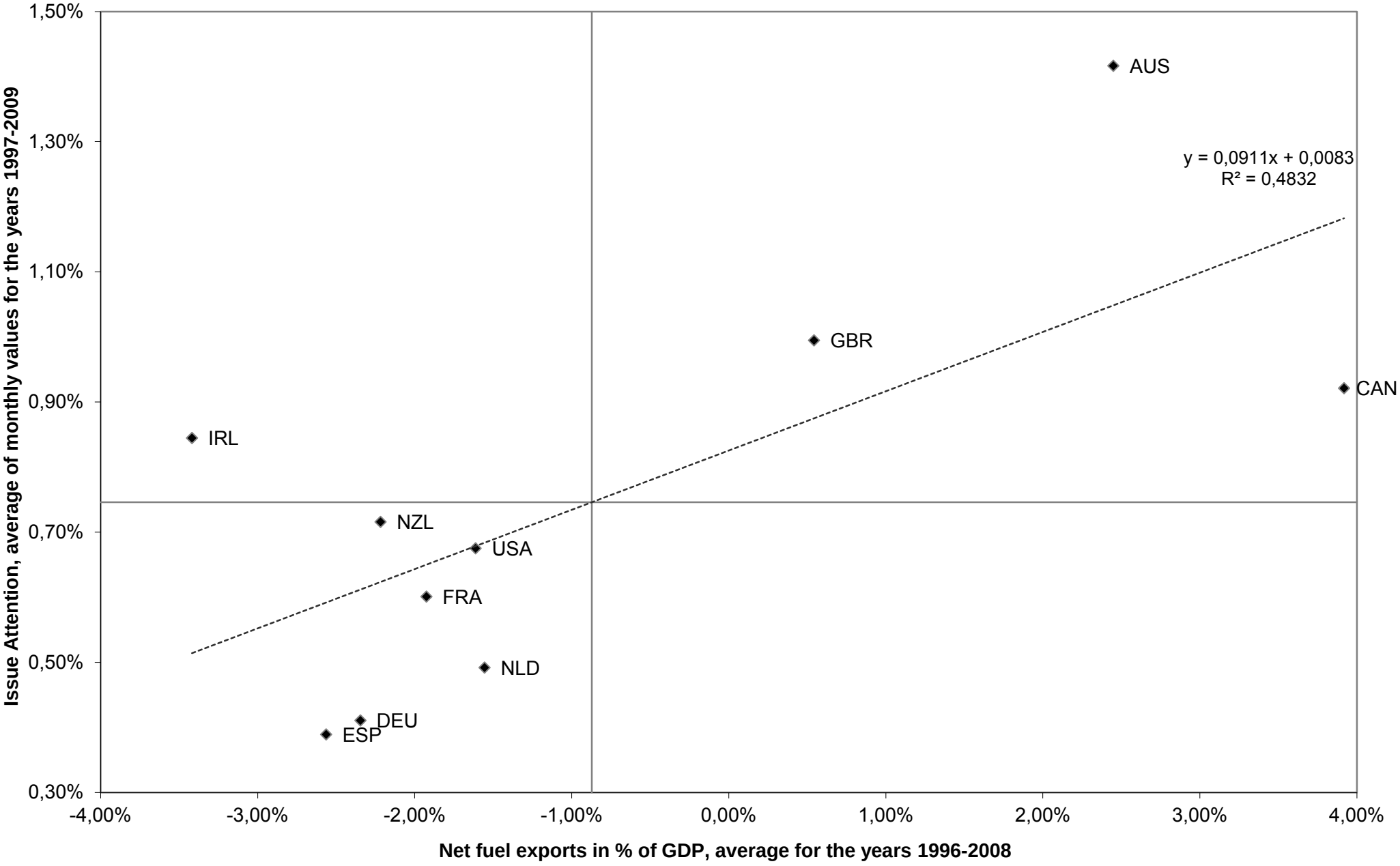
Table 3: Level of attention to climate change (percentage of the respective newspapers' coverage that refers to climate change)

	Media attention levels				Relevance of climate change and policies				
	1997 -2000	2001 -2005	2006 -2009	Overall	CRI	DVF 2030	CI	EKEI	Net fuel exports
Australia	*0.34%*	*0.52%*	*3.61%*	*1.42%*	*54,5*	*1*	*0,58*	*0,07*	*2,45%*
Canada	*0.36%*	*0.59%*	*1.90%*	*0.92%*	*100,67*	*1*	*0,51*	*0,07*	*3,92%*
France	*0.17%*	*0.47%*	*1.20%*	*0.60%*	*42,67*	*0*	*0,22*	*0,48*	*-1,92%*
Germany	*0.14%*	*0.23%*	*0.90%*	*0.41%*	*48,5*	*0*	*0,34*	*0,62*	*-2,35%*
Ireland	*0.27%*	*0.51%*	*1.82%*	*0.84%*	*122,17*	*0*	*0,32*	*0,24*	*-3,42%*
Netherlands	*0.25%*	*0.33%*	*0.94%*	*0.49%*	*74,33*	*0*	*0,35*	*0,23*	*-1,55%*
New Zealand	*0.22%*	*0.43%*	*1.57%*	*0.72%*	*80,17*	*0*	*0,31*	*0,27*	*-2,22%*
Russia	*0.13%*	*0.39%*	*0.54%*	*0.36%*	*37,5*	*2*	*1,13*	*0,59*	*17,00%*
Spain	*0.17%*	*0.23%*	*0.80%*	*0.39%*	*43,67*	*2*	*0,29*	*0,30*	*-2,56%*
United Kingdom	*0.41%*	*0.73%*	*1.91%*	*0.99%*	*68,67*	*0*	*0,28*	*0,47*	*0,54%*
USA	*0.31%*	*0.42%*	*1.37%*	*0.67%*	*48,83*	*2*	*0,48*	*0,11*	*-1,61%*
Algeria	n.a.	0.15%	0.42%	0.34%	90,5	3			
Brazil	0.13%	0.21%	0.91%	0.41%	91,17	1			
Brunei	0.10%	0.07%	0.92%	0.35%	160,33	1			
China	0.17%	0.27%	1.36%	0.55%	39,83	2			
India	0.20%	0.12%	0.58%	0.28%	55,17	4			
Indonesia	0.17%	0.30%	2.76%	1.02%	38,33	2			
Israel	0.11%	0.15%	0.72%	0.31%	101,5	1			
Jordan	n.a.	0.11%	0.96%	0.65%	129,83	2			
Malaysia	0.11%	0.15%	0.65%	0.29%	85	1			
Mexico	0.11%	0.15%	0.74%	0.32%	58,17	1			
Namibia	n.a.	0.20%	0.93%	0.52%	81,5	4			
Papua-NG	n.a.	0.19%	1.25%	0.71%	54,67	4			
Singapore	0.12%	0.17%	1.27%	0.49%	166,83	1			
South Africa	n.a	0.22%	0.73%	0.49%	82,67	3			
Thailand	0.16%	0.28%	1.91%	0.78%	60,17	2			
Yemen	n.a	0.26%	1.41%	0.89%	62,33	4			
Average (all countries)	0.20%	0.29%	1.26%	0.60%					
Average CRI ≤ 59.7	0.19%	0.30%	1.37%	0.61%					
Average DARA Vuln. Factor 2030 ≥ 2	0.19%	0.24%	1.15%	0.59%					
Average Annex B	0.25%	0.44%	1.51%	0.71%					
Average non-Annex B	0.14%	0.19%	1.09%	0.53%					
Average non-Annex B CRI ≤ 59.7	0.16%	0.21%	1.34%	0.58%					
Average non-Annex B DARA VF 2030 ≥ 2	0.17%	0.21%	1.23%	0.62%					

Attention levels are reported as means of monthly values. Due to missing data for the years 1996 and 2010 for several countries, these numbers were only calculated for the years 1997 through 2009. Compare Table 2 for details on data availability.

Annex B countries are highlighted in italics; this category includes the United States (although this country did not ratify the Kyoto Protocol). The Climate Risk Index (CRI) indicates the extent of relative and absolute personal injury and property damage due to extreme weather events in the years 1991-2010 (Harmeling, 2011). The lower the value of the CRI, the more weather-related damages a country experienced. Countries with a value equal to or lower than 59.7 were classified as especially affected because this value is half a standard deviation smaller than the average. The DARA Vulnerability Factor (DVF) 2030 is based on estimations concerning the impact of climate change on social and ecological systems, including damage to the economy, death toll, and species loss (DARA and Climate Vulnerable Forum, 2012). It varies between low (0) and acute (4). Carbon intensity of the economy (CI): CO_2 emissions in kg per 2005 PPP $ of GDP, average values for the years 1996-2008 (World Bank, 2012). The Environmental Kuznets Emission Indicator (EKEI) evaluates the carbon intensity in relation to that of other countries with the same level of economic development. Values close to 0 indicate a strong carbon dependency, whereas countries with values above 0.8 are rated as the best low-carbon performers (Baettig et al., 2008). Net fuel exports: Exports minus imports of fuels (SITC section 3) in percent of GDP; average values for the years 1996-2008 (World Bank, 2012).


1,50%
1,30%
1,10%
0,90%
0,70%
0,50%
0,30%
Issue Attention, average of monthly values for the years 1997-2009
0,2
0,25
0,3
0,35
0,4
0,45
0,5
0,55
0,6
Carbon dioxide emissions in kg per 2005 PPP $ of GDP, average for the years 1996-2008
y = 0,0166x + 0,0014
R² = 0,3796
AUS
CAN
USA
GBR
IRL
NZL
FRA
NLD
DEU
ESP


1,50%
1,30%
1,10%
0,90%
0,70%
0,50%
0,30%
Issue Attention, average of monthly values for the years 1997-2009
-4,00%
-3,00%
-2,00%
-1,00%
0,00%
1,00%
2,00%
3,00%
4,00%
Net fuel exports in % of GDP, average for the years 1996-2008
AUS
GBR
CAN
IRL
NZL
USA
FRA
NLD
DEU
ESP
y = 0,0911x + 0,0083
R² = 0,4832

Media attention for climate change around the world: A comparative analysis of newspaper coverage in 27 countries

Andreas Schmidt, Ana Ivanova, Mike S. Schäfer

Supplementary material: Additional considerations on carbon dependency

As both mentioned in the *Data and Methods* and the *Results* sections, Russia is a special case. The country is listed in Annex B of the Kyoto Protocol and has ratified it. In contrast to all other Annex B parties, however, Russia's emission target is not below a business-as-usual trajectory. Consequently, no domestic efforts are necessary (Harrison and Sundstrom, 2007, p. 5; Henry and Sundstrom, 2007, p. 57).

To account for this special situation when investigating the relationship between carbon dependency and media attention, we considered an alternative indicator for the carbon intensity of the economy. Namely, we have adapted the emission indicator from the Cooperation Index developed by Baettig et al. (2008, p. 485, Appendix A). This indicator evaluates the level and trend of GDP-dependent CO2 emissions per capita in comparison to the development path (Environmental Kuznets curve) of 13 EU countries. The reason is that "per capita CO2 emissions [...] develop differently depending on the economic situation of a country". This assumption is also reflected in the differentiated responsibility principle of the UNFCCC and the emission targets of the Kyoto Protocol. Baettig et al. (2008) developed this indicator to measure the extent of a country's compliance with the UNFCCC objective of achieving lower global emission levels, while acknowledging that emissions from less developed countries "will grow to meet their social and development needs" (1992, p. 2). In turn, this adjusted emissions indicator may more accurately account for the burden of implementing the Kyoto Protocol and the respective potential for conflict. Both the low need for climate action in Russia, given the current state of economic development, and the comparatively low-carbon performance of countries like Germany and France are reflected in this indicator. And indeed, the rather low attention levels in these countries correspond quite well to the relatively small carbon dependency measured in this way (see Table 3).

Russia's economy, however, also relies quite heavily on exports of fossil fuels: the net fuel exports of the country for 1996-2008 average 17 percent of GDP (World Bank, 2012). We argued that fossil fuels might lose value in a carbon-restricted future prescribed by (international) climate policies and that a high relevance of such exports should therefore mobilize domestic actors and trigger a conflictive and intensive climate debate. Russia's fuel exports, however, comprise a high share of natural gas which is comparatively "clean." Therefore, they are much less problematic than those of Australia, for example, and may even increase due to efforts of European Union countries making the fuel mix less carbon-intensive (Dudek et al., 2004, p. 138f).

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