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Ink And Influence: The Role of Media On Climate Policy Understanding

Nezahat Doğan, Arkin University of Creative Arts and Design, nezahat.dogan@arucad.edu.tr
İbrahim Dalkılıç, Arkin University of Creative Arts and Design, ibrahim.dalkilic@arucad.edu.tr

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Abstract

The main purpose of this study is to investigate the role of media (including cinema) on the CO2 emission levels of The United States of America (USA). Employing three co-integration methods, namely Canonical Co-Integrating Regression (CCR), Dynamic Least Squares (DOLS), and Fully Modified Least Squares (FMOLS), within the framework of Environmental Kuznet Curves (EKC) theory, we unravel the impact of media coverage on the USA's carbon footprint. Utilizing Climate Policy Uncertainty index (CPU), extracted from prominent USA newspapers as a main concern, the analysis reveals a noteworthy outcome indicating media coverage pertaining to environmental issues, pollution, and climate changes emerges as a contributing factor in the reduction of CO2 emissions. The study also uses income per capita, renewable energy consumption and foreign direct investment as additional metrics of air pollution. The findings not only shed light on the influential role of media in shaping environmental outcomes but also offer valuable insights to policy makers and governors.

Keywords: cinema; media; newspaper; CO2 emission; climate policy; EKC

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Nezahat Doğan and Ibrahim Dalkılıç

Introduction

As a mass communication medium, the media, including newspapers, films and television journalism provides an arena for discourses, ideas and ideologies to be discussed, negotiated and responded to. The act of communication, which should be considered as the basis of human existence, has played a key role in the transfer of information, gathering individuals around certain beliefs, and spreading ideologies to different classes of society, even though the form of the media medium has changed throughout history. The media can create a desired ideology by framing any issue and specifying that some answers are possible, and others are not possible (Lindgren et al., 2022). Therefore, the media has a significant impact on the public's perception of the discourse. Likewise, the climate change issue has been a trend topic in the media either for the public and the policymakers (Loiselle & Maclean, 2023).

'The media' is a key institution in modern democracies, with millions of people turning to it daily for news. By framing events and issues in particular ways, the media can impact public opinion in a significant direction. An issue is presented and defined by a communication source as part of framing. The idea of framing has gained traction in the communication disciplines,

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providing direction for both studies of the relationship between media and public opinion and inquiries into media content. In the literature, the use of the term "framing" is markedly inconsistent. Media framing on critical events is not only influence the volume of coverage, but they also affect how topics are framed. Media outlets utilize frames to highlight different facets of the "causes, consequences, and solutions to a policy problem" or topic. Frames can be described as "diagnostic" when they state a specific solution to a problem, "prognostic" when they state the meaning of the problem, and "motivational" when they seek to elicit a certain response from the audience (Stoddart et al., 2021).

The public's view of issues and problems is inextricably related to the mass media, while researchers disagree on the nature of this link and the influence it has. For instance, despite decades of research, it is still unclear if the public worries about crime and terror are a "cause" or "effect" of television and newspaper reporting about crime and fear. Researchers examine whether news broadcasts can "cause" or "lead" individuals to focus on and dread crime from the perspective of media content as "cause," including the degree to which pertinent values and perspectives may be "cultivated". According to this viewpoint, the mass media significantly shape public agendas by influencing what people think (Ericson, 1993; Gerbner & Gross, 1976; Gunter, 1987; Hirsh, 1980; Katz, 1987; Schlesinger et al., 1991; Skogan & Maxfield, 1981; Sparks, 1992). A similar process is undoubtedly going on in the process of public understanding of climate policies. In other words,

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whether humans, which we can consider as one of the main factors of climate change, will be the "cause" or "lead" of climate policy understanding due to the influence of the media or how the media handles the news.

When covering a particular topic, the mass media may be influenced by social, economic, and political factors. In the globalized landscape, media and its information are produced according to capitalist market conditions and delivered to the masses with the same approach. According to Sönmez (2013), the existence of the capitalism approach is based on its ability to reproduce itself, as in every other mode of production. The continuity of the world order envisaged by capitalism is possible through reproduction at economic, political and cultural levels. Throughout this historical process, the media has become a very important institution within the capitalist order and has emerged as an important ideological actor in the formation of the political economy of communication. Herman and Chomsky (2002), in their book *Manufacturing Consent*, make in-depth evaluations on the political economy of mass media and present a propaganda model. Herman and Chomsky focus on and evaluate the US mainstream media in their works. According to them, although the main function of the mainstream media is to convey the events to the masses in an impartial manner, the mass media acts in the interests of the dominant political power or the business world that is their financial source.

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In comparison to many other topics, climate change is an "unobtrusive" subject. This is due to the difficulty of directly observing changes in the climate in the past, present, or future. To give an example, the statistical averages of meteorological variables, such as temperatures, precipitation, wind, and time of day, are referred to as "climate" in films and other media[1]These indicators must be tracked and described on broad time and space scales in order to talk about climate (Schäfer, 2015). For this reason, it is very difficult to report on processes related to climate change. News is a phenomenon that seeks answers to the concept of 5W 1H. Five questions—what, who, where, when, how, and why—are represented by the letters of the acronym 5W1H. In a process with so many variables, reporting issues and informing the public may be exposed to many unknowns or unpredictable. This being the case, explaining climate policies to the public through mass media and the feedback it will create on the recipient side of the information is not measurable or predictable. Nevertheless, mass media can plan, try to manage and even manipulate communication processes in a strategic context, based on a number of theories. News is a very important element in this sense and has vital value in the context of society's need for information. In the mass communication dynamic, news is a phenomenon that originates from a single source, but can reach the masses, shape the perception, and even change its form as it is reproduced.

Throughout the 21st century climate crisis has been the biggest concern for the public and it is the greatest “threat” for the future of planet earth (IPCC, 2014). Nonetheless, the manner in

which the topic is portrayed in the media could affect which issues are highlighted or whether the viewer is urged to participate. In fact, media outlets like newspapers and television shows have a lot of sway, particularly when it comes to abstract topics like climate change, which most people are unfamiliar with. Media may have an impact on the parameters of political and public discussions, and as a result, on the adoption of mitigating and/or adaptive measures[2].

In recent years like newspapers, cinema films also has been paid more attention to environment and climate crisis topic. Through the Hollywood productions people's understanding of climate crisis issue received a lot of attention worldwide. The productions like; Before the Flood (2016), Warcraft (2016), An Inconvenient Sequel: Truth to Power (2017) and others receiving acclaim for appealing cinematography and narration of environmental issues that require urgent awreness and actions of earth citizens(Sharma & Chaubey, 2020).The galvanizing momentum that Hollywood gained on the subject paved the way for a new paradigm of eco-cinema studies. The term "eco-cinema," which originated with Roger C. Anderson's "Ecocinema: A Plan for Preserving Nature" (Chu, 2016), refers to films that are made with the intention of raising awareness of environmental issues and addressing the pressing concerns that arise from people's disconnection from the natural world. According to Ingram (2013), an eco-film is any picture with a conceptual plot that, more broadly, encourages ecological ideals or sensibilities. It is typically assumed that

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the purpose of this philosophical material is to increase viewers' knowledge of ideas like ecocentrism and ecological interconnectivity.

In other words, eco-cinema may be defined as a technique that aids in the public awareness of environmental concerns and resources. These films not only examine the interaction between humans and environment, but they also act as visual alerts to the devastating effects of global warming, climate change and other ecological hazards such as water contamination and air toxicity as pollution levels rise around the world. While tracing its history, it is clear that this newly established genre of Eco-cinema sprang from Ecocriticism over the last decade.

The framing concept's potential resides in its emphasis on communicative processes. Communication is a dynamic process that involves frame-building (the process by which frames develop) and frame-setting (the interaction between media frames and audience predispositions). According to Entman (1993), frames can be found in numerous places, including the communicator, the text, the receiver, and the culture. However, many frames regarding climate crisis[3] in the media are more thematic labels that serve to collect enormous volumes of information but "ignore the ideological nature and consequences of the framing process as well as the power relationships that influence that process " (Carragee & Carragee, 2004). Hence, it is quite unlikely to expect that mainstream and alternative media draw our attention to similar frames or

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understanding points. It is nearly hard to come to a consensus on the reasons, triggers, or nations that have contributed most to the expansion of the climate issue. Variations in how the issue is understood and portrayed by the media also depend on the ideology being promoted or the circumstances surrounding the issue.

However, not much has been done in the literature in the context of analyzing the nexus between news and CO2 emission leading to climate change and global warming in the USA. The literature on effects of words on newspapers and environmental quality is limited for the USA example. Therefore, to our knowledge, this study will make a significant contribution to both literature and policy makers in terms of strategies to be followed in decreasing CO2 emissions, which is the main factor of climate change if the media is used as a tool to create environmentally friendly behavior.

THEORETICAL FRAMEWORK

A major contributor to air pollution is CO2 emissions, a well-known greenhouse gas that contributes to global warming leading to climate change due to absorption of radiation. In general, although each country has been affected differently, all countries are examining its impact as part of the sustainable development agenda and trying to reduce CO2 levels. The USA is one of the largest contributors to increasing CO2 emission. In terms of the ecological footprint, the USA

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ranks second after China, with four times the population of the USA. However, The USA has made a commitment to decrease greenhouse gases under the Paris agreement for keeping the global temperature rise below two degrees Celsius compared to pre-industrial levels. Therefore, understanding the trends will help policy makers and researchers to take right actions and lead community-based solutions to improve environment quality by encouraging collective actions.

Agree on measures to shape the priorities for climate change and maintain intention to keep the temperatures lower than 1.5 Celsius degree levels, policy makers, environmental organizations, experts and consultants met in the 27th United Nations Climate Change Conference (COP) in 2022 from 6 to 20 November. The report written by the European Commission on CO2 emissions of all countries in 2022, the United States, the EU27, India, Russia and Japan were still the world's largest emitters. According to the United States Environmental Protection Agency (2023), CO2 concentrations have risen 48.1 percent since the 1750s globally due to the combustion of fossil fuels. CO2 from fossil fuel combustion, as the largest source of The USA greenhouse gas emissions with 79.4%, decreased by 1.9% between 1990 and 2021, however it increased by 6.8% from 2020 to 2021 due to changes in economic activities after Covid19 pandemic.

Information and communication devices play a very crucial role in raising awareness of both governments and public on the effects of increasing CO2 level and, consequently, climate

change. Examples of the information and communication technologies are cinema, televisions, radios, web sites, print media such as newspapers. This study will focus on the effect of news published in newspapers on CO2 emissions that trigger climate change. Newspapers are online or printed publications that are released daily with multiple pages to exchange ideas, provide news and information on a wide variety of topics and national or international events. It allows individuals and societies to monitor the activities of businesses, governments, politicians and countries by providing a platform to drive social change and highlight the opportunities, challenges, strengths and weaknesses of communities.

We investigate the role of words used in news on newspapers by using Climate Policy Uncertainty index (CPU) developed by Gavriilidis in 2021 on CO2 emission in the USA. Gavriilidis searched for articles including the terms "uncertain" or "uncertainty" *AND* "CO2" or "carbon dioxide" or "greenhouse gas emissions" or "climate" or "greenhouse" or "emissions" or "global warming" or " renewable energy" or "green energy" or "environmental" or "climate risk" or "climate change" *and* "legislation" or "White house" or "EPA" or "Congress" or "policy" or "law" or "policies" or "regulatory" in the eight leading newspaper of the USA, which are known as *The Wall Street Journal*, *USA Today*, *Tampa Bay Times, New York Times*, *Miami Herald*, *Los*

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Angeles Times, *Chicago Tribune* and Boston Globe. According to Gavriilidis (2021), the CPU captures important events related to climate policy (p.2).

To capture the effects of words related to climate policies on CO2 emission, this study considers an economic theory known as Environmental Kuznet Curves (EKC). The EKC hypothesis was developed by Grossman and Krueger in 1991 by analyzing the relationship between the income per capita as a measure of economic growth and sulfur dioxide and smoke as a measure of air pollution. They found that there is an inverted U-shaped relationship between the variables and the pollution has a cost in terms of their investment and international trade in the USA. According to the hypothesis, as a country's income or per capita GDP increases at initial growth level, air pollution rises due to the rapid expansion of polluting industries such as manufacturing. This stage is also known as scale effect, which refers to higher levels of production and consumption ignoring environmental degradation in order for countries to achieve higher levels of growth. However, with the transition of the countries from heavy industries to service oriented industries and the implementation of regulations that increase the environmental quality, after a certain point of time, as income level rises, air pollution begins to decrease. This stage is known as technological advancement or composition effect, which leads to change in the structure of an economy and a shift from resource intensive polluting industries to cleaner, environmentally friendly technologies. At this stage, the countries, communities and governments become more

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aware of environmental issues and consider protecting the environment by enforcing rules and regulations that limit consumption of natural resources and polluting energies. The USA, for example, was experiencing water pollution problems in the early stages of its development, especially during the expansion of agriculture and energy intensive industrial growth, which led to the contamination of lakes and rivers. Then, water quality improved in the country after the Clean Water Act came into effect in 1972, which mandated practices that pioneered water quality and protection. Prior to this, the US again experienced an increase in air pollutant rates due to the increase in fossil fuels from urbanization and industrial expansion, they passed the Clean Air Act in 1970 to improve air quality. In addition to these, the income threshold may differ between regions or countries due to differences in institutional quality, levels of technology, and policies or regulations implemented.

Many studies in the literature use the EKC hypothesis to check if it's valid for different countries, taking into account different control variables, time spans and model specifications. Among the recent publications, the findings of the studies conducted by, Jiang et al. (2020, 2021), Xie et al. (2019), Dogan (2019) for China, Liu and Lai (2021) for 68 countries, Mrabet et al. (2021) for 16 MENA countries, Nasir et al. (2019) for the ASEAN-5 countries, Pham et al. (2020) for 28 European countries support the validity of EKC hypothesis. Nevertheless, the outcomes of several

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other researches challenge the validity of the EKC hypothesis for certain countries. This contrast is evident in studies conducted by Mensah et al. (2018) for 28 countries, Koc and Bulus (2020) for Korea, Massagony and Budiono (2022) for Indonesia, Aslan, Ocal and Ozsolak (2022) for the USA. These diversities in investigations can be attributed to variations in the selection of different dependent and independent variables, estimation methods or time spans for analysis.

Renewable energy consumption is also another main concern of the researchers, as its role on CO2 emissions. The study conducted by Inglesi-Lotz and Dogan (2018) investigated the role of renewable and nonrenewable energy consumptions on carbon emission levels for sub-Saharan African countries and found that nonrenewable energy consumption raises the carbon emissions, while renewables controls it. Similarly, Mensah et al. (2018) indicate that consumption of renewable energy decreases the carbon emissions in countries from Organizations for Economic Cooperation and Development (OECD) by using data between the years 1990-2014.

To understand the role of foreign direct investment within the context of this study, pollution haven hypothesis can also be used, as a complementary to EKC hypothesis. According to hypothesis, developed countries with higher income levels are more aware of environmental concerns and more sensitive and progressive on protecting the environment by releasing a number of environmental regulations and sanctions. The increase in the number of regulations increase the

cost of production of dirty industries such as steel, and petrochemicals. This limits the activities of these industries in developed countries and results in shift of the polluting industry production to developing countries, where environmental awareness or sensitivities are not yet developed and therefore the legal regulations are not strict. Therefore, profit oriented companies may be attractive to invest in host countries due to weak environmental regulations that lead to saving costs for the companies. In line with the pollution haven hypothesis, according to the outcome of a studies conducted by Hitam and Borhan (2012), Chandran and Tang (2013), Lau et al. (2014), Ren et al. (2014), Tang and Tan (2015), Shahbaz et al. (2018), foreign direct investment increases the carbon emissions.

From the above-given literature, this study uses income per capita, foreign direct investment and renewable energy consumption as a determinant of the CO2 emission. However, the novelty of the present study comes from i) incorporating the Climate Policy Uncertainty index (CPU) as a measure of effects of words used in news articles on environmental matters. This recognizes the significance of words in newspapers that emphasize environmental concerns and provides insights crucial for planning and implementing environmental protection policies, and climate change policies, ii) applying co-integration test to check the availability of long run relationship among variables, iii) using multi-methodological approach with three different

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cointegration methods, namely Fully Modified Least Squares (FMOLS), Dynamic Least Squares (DOLS), and Canonical Cointegrating Regression (CCR), within the framework of Environmental Kuznet Curves (EKC) theory, and iv) investigating causal relationship between CO2 emission and its determinants by applying granger causality test.

The remainder of the papers detail the data and model specifications with the methodological strategy. And then, it discusses the empirical findings and their interpretations. Finally, the conclusion with limitations and implications are presented.

DATA AND MODEL SPECIFICATION

The study examined the annual frequency data covering 1990-2021 years for the USA. The selection of data depends on the EKC hypothesis mainly, and data on CO2 emissions (million metric tons) and energy consumptions from renewables are obtained from Monthly Energy Review released by United States Energy Information Administration (EIA) in 2023[4]. According to the EIA, CO2 emissions (in million metric tons) are generated from the burning of fossil fuels and manufacture of cement arises from gas, liquid and solid fuels. Income per capita (GDPPC) in US$ and net inflows of foreign direct investment (FDI) in US$ data are sourced from World Bank[5]. Finally, data on Climate Policy Uncertainty Index (CPU) is provided by Gavriilidis (2021), as mentioned above.

The model specification following the above theoretical framework for this study is given as below to demonstrate the long run nexus among variables:

$$CO2_t = f(GDPPC_t, GDPPC2_t, CPU_t, RENEW_t, FDI_t) \quad \text{Eq. 1}$$

CO2 is used as a measure of pollution in millions metric tons. GDPPC is income per capita in the US$, CPU is used as an indicator of word power in the media. FDI is inflows of foreign direct investment in US$, and RENEW is used as another determinant of CO2 emission as an indicator of clean energy. While the study uses CO2 emission as a dependent variable, other variables are used as independent variables. All variables are transformed into logarithmic form to avoid heterescedasticity problem and the log-log specification of CO2 emission function is constructed to capture elasticities of CO2 emission with respect to changes in independent variables as follows:

$$LCO2_t = \alpha_0 + \alpha_1 LGDPPC_t + \alpha_2 LGDPPC2_t + \alpha_3 LCPU_t + \alpha_4 LRENEW_t + \alpha_5 LFDI_t + \varepsilon_i \quad \text{Eq. 2}$$

ε_i is known as error term and assumed to be normally distributed. $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \text{ and } \alpha_5$ are the parameters and interpreted as elasticities of CO2 emission with respect to GDPPC, GDPPC2, CPU, RENEW and FDI, respectively, while α_0 is the intercept. There are some

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possibilities of the expected signs of the LGDPPC and LGDPPC2 coefficients, depending on the shape of the EKC for the USA; i) EKC is positively sloped when both $\alpha_1 = \frac{\partial LCO2}{\partial LGDPPC}$ and $\alpha_2 = \frac{\partial LCO2}{\partial LGDPPC2}$>0, ii) EKC is negatively sloped when both $\alpha_1 = \frac{\partial LCO2}{\partial LGDPPC}$ and $\alpha_2 = \frac{\partial LCO2}{\partial LGDPPC2} < 0$, iii) EKC is U-shaped when $\alpha_1 = \frac{\partial LCO2}{\partial LGDPPC} < 0$ and $\alpha_2 = \frac{\partial LCO2}{\partial LGDPPC2} > 0$, iv) EKC is inversely U-shaped when $\alpha_1 = \frac{\partial LCO2}{\partial LGDPPC} > 0$ and $\alpha_2 = \frac{\partial LCO2}{\partial LGDPPC2} < 0$. Based on the explanations regarding the theoretical background of the EKC, GDPPC is expected to have a positive sign, while GDPPC2, as an indicator of higher income, is expected to have a negative sign. Critical threshold of income per capita is calculated as $t = -0.5\alpha_1/\alpha_2$ as the monetary value.

METHODOLOGY AND RESULTS

To determine the aforementioned models, we first evaluate the variables for the order of integration. Subsequently, we assess the presence of sustained relationships among variables by conducting the Johansen co-integration test tso examine their long-term availability. Finally, we estimate the long run relationships by using FMOLS, DOLS, and CCR to check the robustness of the results.

Our methodology involves testing the stationarity of the variables. To begin, we assess the stationarity of the variables under consideration by applying two types of unit root tests, namely the Phillips-Perron (PP) test and Augmented Dickey-Fuller (ADF) test. If the variables are found

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to be integrated of order 1, namely I(1), then it can be concluded that they are stationary at their first difference, suggesting potential long-run co-integration. As indicated in Table 2, all of the series of variables exhibit a unit root in their levels, yet they become stationary in their first differences at 1% significance level. Therefore, we conclude that CO2, CPU, GDPPC, GDPPC2, RENEW and FDI are I(1) in nature. Since the variables have a unique order of integration, we can conduct co-integration tests to explore long-run relationships among the variables within each model. Following section provides a comprehensive discussion of the co-integration test.

After checking that all series are stationary using the Phillips and Perron and Augmented Dickey Fuller unit root tests, a co-integration relationship between the variables should be confirmed. The study of co-integration allows for the testing of a stable long-term relationship between two non-stationary variables. To test for co-integration among variables, we used Johansen's co-integration test, which consists of two statistical tests: the trace statistic and the maximum eigenvalue. According to the results given in Table 3, trace test indicates 3 co-integrating equations at the 5% level, while max- eigenvalue test indicates 1 co-integrating equations. After confirming the co-integration among variables, the long run elasticities of CO2 emission with respect to other variables are estimated by using FMOLS, DOLS and CCR to check the consistency of results. According to the Eq. 2. $\alpha_1 = \frac{\partial Lgdppc}{\partial Lco2}$, $\alpha_2 = \frac{\partial Lgdppc2}{\partial Lco2}$, $\alpha_3 = \frac{\partial Lcpu}{\partial Lco2}$,

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$\alpha_4 = \frac{\partial Lrenew}{\partial Lco2}$, $\alpha_5 = \frac{\partial Lfdi}{\partial Lco2}$ are the long-run elasticities of LGDPPC, LGDPPC2, LCPU, LRENEW and LFDI respectively. Table 4 reports the DOLS, FMOLS and CCR estimation results. Table provides the effects of income, word power in media, clean energy and foreign direct investment on CO2 emissions.

Our research results, obtained from all statistical methods we have conducted, demonstrate that the coefficients associated per capita GDP and its square are positive and negative, respectively. Consistent with the theoretical framework of EKC hypothesis, where $\alpha_1 > 0$ $while$ $\alpha_2 < 0$, our results reveal a quadratic relationship between CO2 emissions and per capita income. The outcomes align with the EKC hypothesis, suggesting that during the initial phases of economic development, an upswing in per capita GDP leads to higher CO2 emissions, but as per capita GDP surpasses a certain threshold, CO2 emissions start decreasing. According to the EKC, countries prioritize their economic growth in the early stages of development that leads to increased environmental degradation, including higher levels of CO2 emission. At this stage, we are expecting positive relationship $(\alpha_1 > 0)$ between per capita GDP and CO2 emissions. However, this process starts to change when they reach a turning or transition point where further increases in per capita GDP leads to decrease in CO2 emissions due to some factors such as policy frameworks and technological improvements etc. After the transition point, we expect positive relationship between income and CO2 emission $\alpha_2 < 0$. According to the estimations, income

elasticity of CO2 emission is calculated as 3.88 (p=0.06), 4.45 (p=0.03), and 3.47 (p=0.00) on average, while the coefficients of the LGDPPC2 are calculated as -0.40 (p=0.07), -0.47 (p=0.04), and -0.37 (p=0.00) in FMOLS, DOLS and CCR regressions respectively. However, since the coefficient of the LGDPPC is higher than the coefficient of LGDPPC2 in terms of the absolute values, an increase in income per capita will have less impact on air quality. Calculated income per capita turning points for USA are as given; i) $t = -\frac{0.5\alpha_1}{\alpha_2} = \frac{-0.5*3.888}{-0.407} = 4.77$ in FMOLS estimation, ii) $t = -\frac{0.5\alpha_1}{\alpha_2} = \frac{-0.5*4.449}{-0.470} = 4.73$ in DOLS, and iii) $t = -\frac{0.5\alpha_1}{\alpha_2} = \frac{-0.5*3.473}{-0.365} = 4.75$ in CCR estimation. As can be seen from the results, calculated turning points of LGDPPC remains between the minimum (4.378) and maximum (4.846) ranges shown in descriptive statistics in Table 1. After these turning points, an increase in per capita GDP starts improving air quality and it can be used as a tool to improve environmental degradation. The empirical results of the study affirm the validity of the Environmental Kuznets Curve (EKC) hypothesis for the United States. The estimation results are in line with the findings of Bulut (2019), Aslan, Ocal and Ozsolak (2022), and Dogan and Dalkılıc (2023), while contradicting with the study conducted by Baek (2015) due to the differences in years covered and methodology used.

As a main concern of the study, the coefficients of LCPU, with the values of -0.023 ($p<0.05$) for FMOLS, -0.022 ($p<0.05$) for DOLS and -0.022 (p=0.00) for CCR, has negative sign

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and highly significant in all estimations. This indicates that the Climate Policy Uncertainty index (CPU), as a measure of effects of words used in news on newspapers, decreases CO2 emission level of the USA. Given that, media can be used as an effective tool by the policy makers to improve the environmental quality, although its elasticity of CO2 is low. Because, the results indicate that 1 % increase in the value of CPU decreases the CO2 level of the USA by 0.022% on average. But, this outcome does not make any change on the argument supporting its positive impact on the people in terms of protecting the environment. Here, we can conclude that the words used in the media, especially with the availability of the technology and rise of digital media, can play a vital role in decreasing environmental degradation including CO2 emission through increasing awareness about environmental issues. Readers can be encouraged and motivated to take action by being informed about the causes and consequences of pollution and shown potential solutions. With this point of view, policy makers can actively use the media as a tool to change the behavior of consumers and producers to promote sustainable practices that improve the environmental quality. The readers can be encouraged through media as an advocate for policy changes to support clean practices reducing the CO2 emission and improving the environmental quality in general. The power of media on improving environmental quality is not only limited with individual practices supporting sustainable practices. For example, any news reporting an industry polluting the environment in a specific region can encourage collective actions taken

among the local communities and lead community engagement fostering effective community based solutions aimed at reducing environmental pollution. As a result, the media can help countries to mitigate environmental footprint and contribute to addressing pollution in the positive way around by promoting responsible consumption and production and implementing environmental friendly practices. However, this study only focuses on whether pollution-related words used in the media have an impact on CO2 emissions, and if so, it presents hypothetical approaches on how this might occur. For a deeper analysis, it is thought that conducting a study on public perception will be supportive in testing the hypotheses mentioned above. The outcome obtained here supports the idea emphasized by Ericson (1993), Gerbner & Gross (1976), Gunter (1987), Hirsh (1980), Katz (1987), Schlesinger et al. (1991), Skogan & Maxfield (1981), and Sparks (1992) that mass media can play significant role for shaping public agendas by influencing what people think.

Another explanatory variable used in the analysis is renewable energy consumption. We are expecting to have a negative relationship between renewable energy consumption and the CO2 emission level of the country. The results we obtained from the estimations are in line with the expectations. The coefficient of the LRENEW is calculated as -0.247 (p=0.00) in FMOLS, -0.221(p=0.00) in DOLS and -0.238 (p=0.00) in CCR regression methods. According to the

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FMOLS regression estimation, 1% increase in clean energy used will lead to a 0.25% decrease in CO2 emissions of the USA. The number will change as 0.22% and 0.24% in DOLS and CCR respectively. Positive impacts of renewable energy resources on CO2 emissions can be occurred through different channels. For example, renewable energy sources, such as hydropower and solar, do not emit CO2 emissions while producing electricity. A decrease in dependency on natural gas and coal reduces the fossil fuel use as well. As it is commonly known, renewable energy sources are more efficient than traditional energy consumption systems. Therefore, using these kinds of energy systems brings less energy consumption, consequently CO2 emissions. The similar conclusion has been done by Youssef (2023) for the case of the USA, which is also in line with the results of some other studies analyzing the nexus between USA's renewable energy and CO2 emissions conducted by Hossain et al. (2023), Salari et al. (2021), and Pata (2020).

Regarding the LFDI, estimation results indicate that there is a positive relationship between CO2 emission with FDI due to having a positive coefficient of FDI. The coefficients of FDI are estimated as 0.023 ($p<0.05$) in FMOLS and DOLS regressions and 0.032 ($p=0.000$) in CCR model. It means that 1% increase in FDI leads 0.023% rise in CO2 emissions of the USA. Although its impact seems inelastic, this finding indicating positive relationship between CO2 emission and FDI are also supported with the studies conducted by Hitam and Borhan (2012), Chandran and

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Tang (2013), Lau et al. (2014), Ren et al. (2014), Tang and Tan (2015), and Shahbaz et al. (2018) in the literature.

Finally, the Vector Error Correction Model Granger Causality test is employed to determine whether past values of one variable can help predict another variable within a system of multiple time series due to the presence of co-integration among the series. When the test indicates the significant causality between two variables, it implies that changes in one variable have a predictive relationship with changes in another variable in the long run.

Granger Causality test outcomes are provided in Table 5. The results reveal a unidirectional causality from LGDPPC to LCO2 and LRENEW, indicating that changes in per capita income are associated with subsequent changes in CO2 emission and renewable or clean energy. However, the reverse relationship is not observed. Moreover, there is a unidirectional causality from all variables to CO2 emission, from income to renewable energy. This underscores the significance of income, income squared, renewable energy, foreign direct investment, and the Climate Policy Uncertainty Index as pivotal factors influencing CO2 emissions. Consequently, targeted policy interventions addressing these variables can prove effective in mitigating CO2 emissions. Upon closer examination of the Climate Policy Uncertainty Index, the primary focus of this study, it becomes apparent that there is unidirectional causality from the square of income to CPU, along

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with bidirectional causality between renewable energy and CPU. Figure 1 illustrates the visual representation of the Granger causality test outcomes to interpret the causal relationship among variables.

CONCLUSION

This study analyzes the impact of the Climate Policy Uncertainty Index (CPU), which is a measure of the impact of words used in news stories in newspapers, on US CO2 emissions using three co-integration methods: FMOLS, DOLS, and CCR. In the study, annual frequency data covering the years 1990-2021 for the USA were examined, and in addition to CPU as the CO2 emission measurement of the USA, per capita income, renewable energy and foreign direct investment data were also taken into account.

Main findings of the study are given as follows:

i) There is a long run relationship among variables considered in the study,

ii) There is a positive correlation between GDP per capita, and foreign direct investment (FDI) with CO2 emission in the context of the United States. This implies that an increase in GDP per capita and/or FDI of the USA is associated with a corresponding rise in CO2 emissions,

iii) CPU and renewable energy resources positively contribute to the CO2 emission of the USA. This suggests that Climate Policy Uncertainty index (CPU), as a measure of effects of words used

in news on newspapers, and renewable energy, as a measure of clean energy, decreases CO2 emission level of the USA,

iv) The validation of the EKC hypothesis in the USA is proved due to having positive signs of LGDPPC and negative signs of LGDPPC2. This suggests that environmental quality initially worsens with economic growth but eventually improves as income reaches a certain level,

v) There is unidirectional causality from the square of income to CPU, along with bidirectional causality between renewable energy and CPU. This implies that changes in the square of income cause changes in CPU, but not vice versa, and changes in renewable energy usage can influence CPU, and changes in CPU can also influence the use of renewable energy.

As a main concern of the study, the impact of words used in news stories in newspapers have a positive impact on environmental quality improvement. Therefore, policy makers and practitioners can use the media as an efficient tool to reduce the environmental degradation, especially by considering digital media channels. Because websites and social media may reach wider audiences and encourage the people to behave environmentally friendly by promoting practices. In addition, policy makers, government bodies and media organizations can develop partnerships to emphasize the solutions and positive initiatives about environmental conservation. Some training programs for media members can be implemented to equip them

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with the knowledge to give environmental messages responsibly. Through responsible media practices and digital platforms, policy makers can use the potential of media to contribute to environmental conservation efforts.

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ENDNOTES:

[1] News around the recent Hollywood film Twitters show a similar approach in their media reports such as the science behind the most recent disaster themed film *Twisters* (2024) in Chuba (2024) [editor's note].

[2] See Kunelius, R., & Roosvall, A. (2021) [editor's note].

[3] CINEJ previously featured articles discussing the climate and media link from different perspectives like Fuchs (2020) and Thomas and Matthes (2021).

[4] Available at: https://www.eia.gov/totalenergy/data/monthly/#environment (Accessed on July 10, 2023)

[5] Available at: https://data.worldbank.org/country/united-states (Accessed on July 8, 2023)

TABLES:

Table Descriptive Statistics

	LCO2	LCPU	LGDPPC	LGDPPC2	LRENEW	LFDI
Mean	3.735472	4.530927	4.622606	21.38706	0.878176	2.247187
Median	3.733097	4.480614	4.655134	21.67039	0.833907	2.330773
Maximum	3.779275	5.387400	4.846638	23.48990	1.084826	2.708790
Minimum	3.660851	4.052913	4.378191	19.16855	0.712650	1.481586
Std. Dev.	0.029392	0.368917	0.138454	1.275328	0.110951	0.331846
Skewness	-0.284258	0.901847	-0.255419	-0.218795	0.519658	-0.745776
Kurtosis	2.573306	3.090247	1.889164	1.877102	1.830153	2.642580
Jarque-Bera	0.673705	4.348610	1.993216	1.936512	3.264960	3.136632
Probability	0.714014	0.113687	0.369129	0.379745	0.195444	0.208396

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Table Unit Root Test Results

	ADF			PP	
	Variables	with constant	with constant&trend	with constant	with constant&trend
at level	LCO2	-1.2627	-1.2142	-1.2099	-1.6129
	LCPU	-0.4415	-2.1625	-0.4415	-2.1576
	LGDPPC	-0.8723	-1.7696	-0.9736	-1.7545
	LGDPPC2	-0.6079	-1.8993	-0.6568	-1.8993
	LRENEW	0.4649	-1.4782	0.4323	-1.5647
	LFDI	-1.7738	-3.0597	-1.3291	-2.9719
at first difference	d(LCO2)	-1.9275	-6.9791***	-5.8395***	-7.6339***
	d(LCPU)	-5.4393***	-5.6458***	-5.445***	-6.655***
	d(LGDPPC)	-4.8413***	-4.9267***	-4.8464***	-4.8339***
	d(LGDPPC2)	-5.0006***	-4.9941***	-5.0021***	-4.9002***
	d(LRENEW)	-5.0343***	-5.2482***	-5.0601***	-5.2475***
	d(LFDI)	-6.4425***	-6.4232***	-7.5754***	-10.5195***

Notes: *, ** and *** denote rejection of the null hypothesis at the 10%, 5% and 1% levels, respectively. Lag lengths are given in parenthesis. (Source: Authors' results.)

Table Johansen Cointegration Test Results

Unrestricted Cointegration Rank Test (Trace)					**Unrestricted Cointegration Rank Test (Maximum Eigenvalue)**				
Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.**	Hypothesized No. of CE(s)	Eigen value	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.854	142.434	95.754	0.000	None *	0.854	57.787	40.078	0.000
At most 1 *	0.670	84.647	69.819	0.002	At most 1	0.670	33.292	33.877	0.059
At most 2 *	0.544	51.355	47.856	0.023	At most 2	0.544	23.581	27.584	0.150
At most 3	0.419	27.774	29.797	0.084	At most 3	0.419	16.292	21.132	0.208
At most 4	0.278	11.482	15.495	0.184	At most 4	0.278	9.763	14.265	0.228
At most 5	0.056	1.719	3.841	0.190	At most 5	0.056	1.719	3.841	0.190
Trace test indicates 3 cointegrating eqn(s) at the 0.05 level					Max-eigenvalue test indicates 1 cointegrating eqn(s) at				

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	the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level	
**MacKinnon-Haug-Michelis (1999) p-values	

Table Estimation results of Co-Integration Equation Models

Method: Fully Modified Least Squares (FMOLS)						
Variable	Coefficient	Std. Error	t-Statistic	Prob.		
LCPU	-0.023145	0.010093	-2.293304	0.0305	R^2=0.8754	Mean dep.var. =3.7365
LGDPPC	3.888178	1.999185	1.944881	0.0631	Adj.R^2=0.8505	S.D. dep.var.=0.0292
LGDPPC2	-0.407582	0.219534	-1.856581	0.0752	S.E.of reg.=0.0113	Sum suq. resid=0.0031
LRENEW	-0.247106	0.042447	-5.821482	0.0000	Long-run variance=0.0000	
LFDI	0.023293	0.010712	2.174432	0.0393		
C	-5.252050	4.592247	-1.143677	0.2636		
Method: Dynamic Least Squares (DOLS)						
LCPU	-0.022687	0.010799	-2.100845	0.0455	R^2=0.8823	Mean dep.var. =3.7354
LGDPPC	4.449399	2.055074	2.165080	0.0397	Adj.R^2=0.8597	S.D. dep.var.=0.0293
LGDPPC2	-0.470220	0.226277	-2.078075	0.0477	S.E.of reg.=0.0110	Sum suq. resid=0.0031
LRENEW	-0.221814	0.045200	-4.907356	0.0000	Long-run variance=0.0000	
LFDI	0.023197	0.010813	2.145238	0.0414		
C	-6.530270	4.714822	-1.385051	0.1778		
Method: Canonical Cointegrating Regression (CCR)						
LCPU	-0.022589	0.005171	-4.368736	0.0002	R^2=0.8738	Mean dep.var. =3.7365
LGDPPC	3.473808	0.932716	3.724402	0.0010	Adj.R^2=0.8486	S.D. dep.var.=0.0292
LGDPPC2	-0.365360	0.102263	-3.572753	0.0015	S.E.of reg.=0.0113	Sum suq. resid=0.0032
LRENEW	-0.238852	0.018644	-12.81127	0.0000	Long-run variance=0.0000	
LFDI	0.032842	0.006325	5.192479	0.0000		
C	-4.269561	2.144707	-1.990743	0.0575		

Table Results of Pairwise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Prob.
LCPU does not Granger Cause LCO2	30	5.36081	0.0116
LCO2 does not Granger Cause LCPU		0.03298	0.9676
LGDPPC does not Granger Cause LCO2	30	4.02784	0.0305
LCO2 does not Granger Cause LGDPPC		1.14977	0.3329
LGDPPC2 does not Granger Cause LCO2	30	4.11552	0.0285
LCO2 does not Granger Cause LGDPPC2		1.07353	0.3570
LRENEW does not Granger Cause LCO2	30	4.40721	0.0229
LCO2 does not Granger Cause LRENEW		1.02393	0.3738
LFDI does not Granger Cause LCO2	30	2.63167	0.0918
LCO2 does not Granger Cause LFDI		0.57845	0.5681
LGDPPC does not Granger Cause LCPU	30	2.49961	0.1024
LCPU does not Granger Cause LGDPPC		0.46743	0.6320
LGDPPC2 does not Granger Cause LCPU	30	2.57419	0.0963
LCPU does not Granger Cause LGDPPC2		0.45031	0.6425
LRENEW does not Granger Cause LCPU	30	2.88091	0.0748
LCPU does not Granger Cause LRENEW		3.13696	0.0609
LFDI does not Granger Cause LCPU	30	2.44763	0.1070
LCPU does not Granger Cause LFDI		0.48195	0.6232
LGDPPC2 does not Granger Cause LGDPPC	30	3.50564	0.0455
LGDPPC does not Granger Cause LGDPPC2		3.55046	0.0439
LRENEW does not Granger Cause LGDPPC	30	0.42774	0.6567
LGDPPC does not Granger Cause LRENEW		3.08262	0.0636

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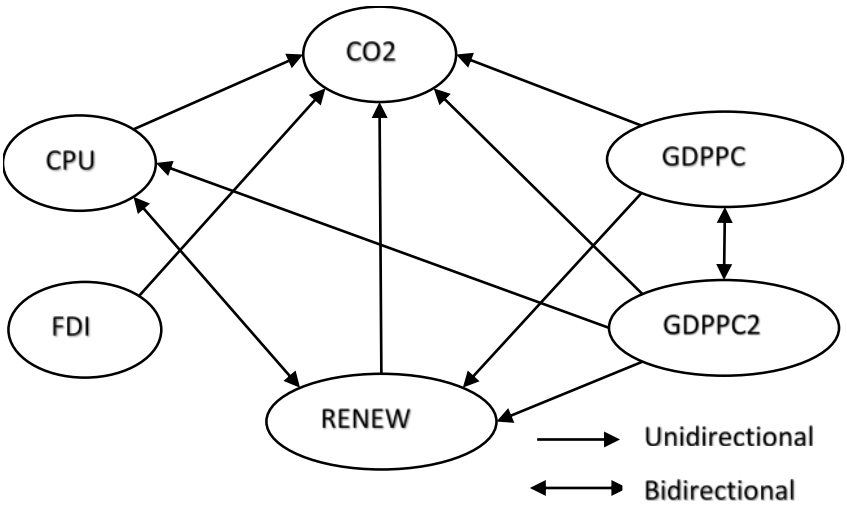
LFDI does not Granger Cause LGDPPC	30	1.02779	0.3724
LGDPPC does not Granger Cause LFDI		1.38347	0.2692
LRENEW does not Granger Cause LGDPPC2	30	0.40999	0.6680
LGDPPC2 does not Granger Cause LRENEW		3.09966	0.0627
LFDI does not Granger Cause LGDPPC2	30	0.97430	0.3913
LGDPPC2 does not Granger Cause LFDI		1.33641	0.2809
LFDI does not Granger Cause LRENEW	30	0.43581	0.6516
LRENEW does not Granger Cause LFDI		0.74318	0.4858

FIGURES:

Figure Representation of Pairwise Granger Causality Test Results



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