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ENVIRONMENTAL PERFORMANCE AND PRESS FREEDOM WITHIN AN ECONOMICAL FRAMEWORK

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ABSTRACT. The purpose of this work is to investigate novel determinant factors of environmental performance such as press freedom and voice and accountability. Having reviewed the specialized literature in this field, one can observe and analyse the differentiated magnitude of the impact press freedom imprints on the Environmental Performance Index and the greenhouse gas emissions on the other, for a generous sample of countries, according to their development levels: high income, upper middle income, lower-middle income and low-income countries. The results support the positive effect of press freedom upon lowering greenhouse gas emissions and improving the overall environmental performance of nations, particularly for the subsample of low-income countries. The current findings are robust to several proxies and control variables.

Keywords: environmental quality, press freedom, income levels, public governance, panel data analysis

JEL classifications: Q56, O44, K32

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Introduction and review of literature

Delving into the complexity of climate change, after an outburst in the normality of humanity itself, an accelerated trend of severe concerns has started to question the wellbeing of the worldwide nations. The devastating results of the meteorological disruptions highlight the importance of becoming aware of the negative effects that arise upon the health of the ecosystems and humankind, mainly caused by greenhouse gases that are constantly being released into the atmosphere after the burning of fossil fuels and other industrial activities. The science behind this phenomenon of climate change is similar to a disease of the Earth, waiting to be cured with considerable action, facing uncertainties in observing the major contributors that lead to negative environmental changes (Wei et al., 2016). Being the most pressing issue of these times, it challenges the way of living, forcing humanity to rethink its actions and embrace sustainable living as a prosperous solution that will mitigate globally the effects of climate changes. A pivotal impact in overcoming the fight against the challenges posed by climate factors, implies a sharing sense of awareness and responsibility among societies. Shaping the desired future for the following generations lies in continuous engagement and action to protect the environment. Commonly referred as the fourth estate, the press has a major position in the societies due to its power of influence regarding the policy decisions, uncovering misconduct and giving a voice to new perspectives that aim to educate the citizens (Butler et al., 2018) by promoting civic engagement and welfare. It helps cultivating information by bringing concerns to the forefront, which is essential for facing the challenges from nowadays. Climate change is a vast and serious matter, not easily understood until reported all over the media, which makes it available for people to draw information and debate the possible causes and solutions (Schäfer, 2015).

The objective of this paper is to analyse the nexus between press freedom and environmental performances, for a generous sample of worldwide countries. The authors' interest is in the effect novel determinants such as media freedom and voice and accountability have upon the environmental performances of nations, as it is known media can support a lot of climate change actions, increasing climate awareness of the people. This underscores the strong need for the press to thoroughly address the major issues produced by the climate change. The research of (Chan et al., 2021) highlights that a robust media focus on environmental topics can drive meaningful public and policy engagement.

It cannot be denied that the power and liberty of the press has a major impact upon the climate change underscored by the environmental performance, blaming the lack of interest of societies, in rapidly mitigating some serious concerns that affect the nations in terms of sustainability and economic performance, with substantial uncertainty surrounding the shifts in extreme weather events by the end of this century (Thornton et al., 2014). The unconsciousness of nations is encountered especially in the poorest nations where the income inequality exacerbates the CO2 emissions (Baloch & Danish, 2022; Danish et al., 2022), where air pollution is ranked among the top risk factors for mortality (Ritchie & Roser, 2017), whereas the media is so crucial in lightening the environmental issues (Anderson, 2011) while pushing for adopting greener and durable solutions that will improve the wellness of humankind. News about climate change rarely appears in the media and when it does, it often frames climate change as an international concern rather than focusing on its local impact (López et al., 2020). As the level of urbanization also leads to an increase in environmental pollution (Muhammad & Khan, 2021), wealthier nations must also be accountable, not only by reducing their own emissions but by investing in affordable technologies that also support sustainable development in the less developed and developing countries so that they are not forced to choose between reducing poverty or keeping a low level of emissions (Ritchie et al., 2023). An important insight from the study of Hase et al. (2021) is that the media in the Global North tends to provide more coverage of the climate change, while in the Global South, which is more likely to focus on practical implications, are more emphasized the impacts and challenges posed by the phenomenon and this suggests some regional differences in prioritizing the climate change concern. Ensuring that all voices are heard and holding accountable the highest polluting nations are key to achieving equitable and effective climate action. Media freedom becomes a significant predictor of polluting the air levels (Hswen et al., 2019), pointing out the higher importance and influence that the media has upon societies, in comparison to the environmental regulations (McCreery, 2010). The qualitative results of Wang et al. (2015) revealed that social media posts in China offer reliable firsthand accounts of the air quality across 74 cities, indicating that direct experiences with air quality significantly influence public behaviours and health concerns. Moreover, according to Harring et al. (2011), both economic conditions and content of the media independently influence public concern for environmental issues and health concerns while the tension between economic cycles and public environmental awareness appears to be diminishing. In societies where media operates without any restrictions, there is often greater political and social pressure for environmental responsibility and innovation, having as result improved environmental regulations (Agnone, 2007). Thus,

media freedom is a crucial enabler of the environmental direction, building a society that prioritizes sustainability as a lifestyle and holding individuals accountable for the protection and preservation of this living planet.

Having analysed the state of the art in this research field, it is fundament the following working hypothesis:

Increasing press freedom is related to increasing environmental performances.

The purpose of this work is to assess whether press freedom influences environmental performance in a different manner, according to the economic development levels of nations. Thus, it is stated the following research question:

How does press freedom impact environmental performances as a function of countries' income levels?

The remainder of this paper is organised as follows: section 2 describes the data and methodology that has been used, then section 3 presents the baseline results and discusses them, while section 4 concludes with policy implications and future research directions.

Materials and methods

The database used for this study covers a sample of 185 worldwide countries throughout the 2005-2022 time interval. It's an unbalanced panel data set, but it has been strived by the researchers to obtain the maximum number of observations per variable.

The main dependent variable covers several environmental performance proxies such as the Environmental Performance Index (denoted EPI), probably the most complex measure and also the greenhouse gas emissions (denoted Green) of nations. EPI reflects climate change performance, environmental health and ecosystem vitally scorecard as provided by Yale Center for Environmental Law & Policy (2024), being an aggregated indicator. In part, it includes Green, i.e. the total greenhouse gas emissions (kilotons of CO2 equivalent) as provided by World Bank (2024). Carbon dioxide emissions (denoted Emiss) as CO2 emissions (metric tons per capita), provided by World Bank (2023), are used for robustness checks.

The main independent variable covers press freedom proxies, such as the following: the Press Freedom Score (denoted PRESS_F) and the Voice and Accountability government indicator (denoted VA). PRESS_F is a global index that ranges from 0 to 100, with 100 being the best possible score as provided by Reporters without Borders (2024). VA is a World Governance dimension that reveals the extent to which citizens are able to participate in selecting their

government, as well as their freedom of expression and a free media. VA is scaled from -2.5 to 2.5 and it is provided by World Data Bank (2024), supporting its own methodology.

Control variables refer to the unemployment rate of nations (denoted Unempl, as a percentage measure of the total population of countries) and the urbanization rate (denoted Urban, as a percentage rate of the total population as well), both provided by World Data Bank (2024).

The summary statistics of the dataset, presented in Table 1., embrace a diverse landscape of social, economic and environmental conditions across different worldwide nations. Press Freedom (denoted PRESS_F) has a score that ranges from a low of 0 to a high of 100.03, with a mean of 68.29, suggesting a significant disparity in media freedom, where some regions experience total media suppression while others enjoy complete freedom. Voice and Accountability (denoted VA), an indicator of democratic governance and citizen involvement, has a mean slightly below zero at -0.11, with values spanning from -2.31 to 1.75, indicating that while some regions are highly democratic, others are facing severe limitations on political freedoms, not having the power to express freely.

The Environmental Performance Index (EPI), with an average of 52.24, has a wide range from 0 to 90.68, reflecting diverse environmental outcomes, with some nations achieving desirable results in terms of environmental performance, while others fall behind considerably. The proxy related to Carbon dioxide emissions (denoted Emiss) shows a mean of 4.35, with a minimum value of 0.02 and a maximum value of 45.41, indicating that while some regions have low emissions, others are significant contributors to global emissions. The greenhouse gas emissions variable (denoted Green), reflecting the vast contribution of polluting emissions upon climate change, has values ranging from as low as 80 to a staggering 12.7 kilotons of CO2 equivalent, pointing out differences in industrial activity and environmental impact among regions.

The Unemployment Rate (denoted Unempl) is extremely various, having a mean of 7.85 and ranging from a minimum score of 0.1 to a peak of 37.32, indicating that while some regions experience efficiency in the labor force, others face severe issues, lacking the jobs availability. Another variable, Urbanization (denoted Urban), with a mean average of 57.62 and extremes ranging from the lowest level of 9.38 to complete urbanization at the highest level of 100, spotlight the diverse stages of urban development.

Table 1. Summary statistics

Variable	Obs	Mean	Std. dev.	Min	Max
PRESS_F	2,896	68.2891	22.3036	0	100.0257
VA	3,131	-0.1118	0.9874	-2.3134	1.7517
EPI	2,986	52.2378	16.8302	0	90.6801
Emiss	2,700	4.3541	5.4298	0.0203	45.4101
Green	2,700	236558	966338	80	12700000
Unempl	3,041	7.8494	5.8048	0.1001	37.3202
Urban	3,111	57.6154	22.9415	9.375	100

Source: Author's processings in Stata 18

The correlation matrix is presented in Table 2, pointing out towards the direct or indirect relationships between the variables of interest.

Table 2. Correlation matrix

n=2439	EPI	Emiss	Green	PRESS_F	VA	Urban	Unempl
EPI	1						
Emiss	0.5106	1					
Green	0.0408	0.1331	1				
PRESS_F	0.3543	0.1144	-0.1919	1			
VA	0.6071	0.1864	-0.0469	0.8195	1		
Urban	0.6503	0.5998	0.0681	0.2303	0.3926	1	
Unempl	0.0026	-0.1053	-0.0612	0.0322	0.0208	0.0924	1

Source: Author's processings in Stata 18

The methodology of this study employs the pooled OLS models for panel data. It is used both simple and multiple regression modelling, the forward addition approach.

The baseline model is described by Equation (1). The main results use the addition of control variables to the baseline equation below.

$$\mathbf{EnvironmentalPerformance}_{it} = \beta_0 + \beta_1 \mathbf{PressFreedom}_{it} + \varepsilon_{it} \quad \text{Eq (1)}$$

Eq (1) estimates the effects of press freedom proxies upon the performance of the environment, using the notations below:

$EnvironmentalPerformance_{it}$ – various environmental performance proxies (EPI, Green, Emiss) of country *i* , year *t*;
β_0 - constant;
β_1- linear effect parameter;
$PressFreedom_{it}$ – press freedom proxies (PRESS_F, VA) of country *i*, year *t*;
ε_{it} - the residual.

Results and discussions

The outcomes of this study include the simple regression modelling of Equation (1). Table 3 estimates environmental performance proxied by EPI as a function of PRESS_F in Models (1) and VA in Models (2). Once Eq (1) is estimated, the vector of control variables (Urban and Unempl) is added to each baseline model. The main results from Table 3, for the full sample models, support a direct relationship between press freedom and environmental performance proxied by EPI: the higher the media freedom is, the more improved the performance of the environment is (positive estimated coefficients for PRESS_F and VA when explicating EPI).

Table 3. Environmental performance as a function of press freedom

OLS regression modelling of EPI, full sample				
	Model (1)	**Model (1) with added controls**	**Model (2)**	**Model (2) with added controls**
PRESS_F	0.2998***	0.1988***		
VA			9.9701***	7.2913***
Urban		0.4402***		0.3478***
Unempl		-0.2005***		-0.1829***
const	31.7232***	14.7321***	53.2751***	34.5296***
R^2	0.1473	0.4594	0.3393	0.5354
Adj R^2	0.147	0.4588	0.3391	0.5349
Obs.	2,814	2,777	2,978	2,890

Notes: *** Significant at the 0.01 level; ** Significant at the 0.05 level;
* Significant at the 0.10 level. Source: Author's processings in Stata 18

Table 4 estimates environmental performance proxied by Green as a function of PRESS_F in Models (1) and VA in Models (2) (Log-linear regressions). Once Eq (1) is estimated, the vector of control variables (Urban and Unempl) is added, to each model. All estimated coefficients of variables stay significant, keeping their signs and magnitudes. According to the results from Table 4, an indirect relationship between press freedom and greenhouse gas emissions is validated: the higher the media freedom is, the lower the greenhouse gas emissions are, thus the more improved the performance of the environment is (negative estimated coefficients for PRESS_F and VA, when explicating LogGreen).

Table 4. Greenhouse gas emissions as a function of press freedom

OLS regression modelling of LogGreen, full sample				
	Model (1)	**Model (1) with added controls**	**Model (2)**	**Model (2) with added controls**
PRESS_F	-0.0129***	-0.0196***		
VA			-0.1431***	-0.3399***
Urban		0.0342***		0.0373***
Unempl		-0.0518***		-0.0691***
const	11.5271***	10.4583***	10.3871***	8.8801***
R^2	0.0252	0.2131	0.0048	0.1964
Adj R^2	0.0248	0.2121	0.0044	0.1954
Obs.	2,503	2,488	2,688	2,628

Notes: *** Significant at the 0.01 level; ** Significant at the 0.05 level;
* Significant at the 0.10 level.
Source: Author's processings in Stata 18

To continue, and account for the heterogeneity of the sample, it has further been estimated Eq 1 with added control variables on subsamples of nations, according to World Data Bank (2024) income levels. The World Bank assigns the world's economies to four income groups: low (denoted L), lower-middle (denoted LM), upper-middle (denoted UM) and high income (denoted H) countries. Table 5 presents the estimations of EPI as a function of press freedom on subsamples of countries (H, UM, LM and L).

Table 5. Environmental performance as a function of press freedom, on subsamples

OLS regression modelling of EPI, subsamples								
	Model (1) with added controls for H	**Model (1) with added controls for UM**	**Model (1) with added controls for LM**	**Model (1) with added controls for L**	**Model (2) with added controls for H**	**Model (2) with added controls for UM**	**Model (2) with added controls for LM**	**Model (2) with added controls for L**
PRESS_F	0.0164	0.0079	0.0741***	0.3273***				
VA					1.2216***	1.1592***	2.6294***	7.3472***
Urban	-0.0684**	0.1714***	0.0504**	0.0915***	-0.0759**	0.1695***	0.0663***	0.1283***
Unempl	-0.3136***	-0.3626***	-0.2929***	0.3592***	-0.2801***	-0.3517***	-0.2696***	-0.0456
const	36.4207***	39.1866***	50.2302***	34.4356***	38.5434***	40.3283***	54.1973***	54.6627***
R^2	0.0373	0.0912	0.0498	0.3087	0.0442	0.097	0.072	0.3043
Adj R^2	0.0323	0.0876	0.0457	0.3059	0.0392	0.0935	0.0681	0.3017
Obs.	580	746	700	748	583	781	720	802

Notes: *** Significant at the 0.01 level; ** Significant at the 0.05 level;
* Significant at the 0.10 level.
Source: Author's processings in Stata 18

Table 5 contains the estimations of EPI as a function of PRESS_F (Models (1)), significant for the LM subsample of countries, with media freedom having a positive impact upon environmental performances. Then, for the L countries, the impact of press freedom on EPI is 4 times larger for L than for LM, thus the lower the development level of countries is, the more pronounced the impact of press freedom upon EPI is. Moreover, when estimating EPI as a function of VA (in Models (2)), its impact is 2 times larger for LM countries than for UM countries. Nonetheless, the impact of VA upon EPI is 3 times larger for L countries than for LM countries. It is thus validated the positive impact of media freedom upon environmental performance, with a larger magnitude for the lowest income countries, findings which are consistent with (Bathiany et al., 2018). Research on media coverage of climate change has focused on industrialized countries, leaving significant gaps in understanding how and when news media and journalists in developing countries are addressing the

concern (López et al., 2020). Already captured by the study of Boykoff (2014), a free press can amplify the voices and accountability of environmental reporters and scientists, bridging the gap between complex environmental data and public understanding.

Table 6 presents the estimations of greenhouse gas emissions as a function of press freedom (PRESS_F and VA) on subsamples of countries (H, UM, LM and L).

Table 6. Greenhouse gas emissions as a function of press freedom, on subsamples

OLS regression modelling of LogGreen, subsamples								
	Model (1) with added controls for H	**Model (1) with added controls for UM**	**Model (1) with added controls for LM**	**Model (1) with added controls for L**	**Model (2) with added controls for H**	**Model (2) with added controls for UM**	**Model (2) with added controls for LM**	**Model (2) with added controls for L**
PRESS_F	-0.0146***	-0.0395***	-0.0357***	-0.0013				
VA					-0.4889***	-1.1079***	-0.7897***	0.0174
Urban	-0.0151***	0.0248***	0.0456**	0.0166***	-0.0161***	0.0228***	-0.0526***	0.0219**
Unempl	-0.041***	-0.104***	-0.021**	0.0041	-0.0593***	-0.1183***	-0.0527***	-0.0182
const	11.4169***	12.5307***	10.5307***	10.1577***	10.1957***	9.5211***	7.7755***	9,6614**
R^2	0.0802	0.3055	0.3642	0.02	0.0942	0.2415	0.4042	0.0402
Adj R^2	0.0752	0.3023	0.3611	0.0155	0.0893	0.2383	0.4015	0.0361
Obs.	557	663	616	651	563	706	656	701

Notes: *** Significant at the 0.01 level; ** Significant at the 0.05 level;
* Significant at the 0.10 level.
Source: Author's processings in Stata 18

Consistent to the findings from Table 4, Table 6 validates the negative impact of press freedom upon greenhouse gas emissions, consistent to authors' research hypothesis as the larger the freedom of press is, the lower the greenhouse gas emissions are, thus the more performant the environment is. Although the estimated coefficients for the L subsample of countries are not significant, for the H subsample of countries one can clearly observe to have an

indirect effect of press freedom upon greenhouse gas emissions (Log-linear regressions). From models (1) there is noticed an about 3 times larger effect for UM than for H and an about 3 times larger effect for LM than for H. These estimations are supported by the ones for Models (2), which estimates LogGreen as a function of VA): when significant, there's an about 2.5 times larger effect for UM than for H while this impact is 1.5 times larger for LM than for H. Summing up, Table 6 clearly supports the negative impact of media freedom upon greenhouse gas emissions, with a larger magnitude for the upper middle-income countries, consistent with Ike et al. (2022) and Ritchie & Roser (2017) which reveal that the press freedom limits emissions in economies with smaller industry size but increases the emissions in economies with a larger industry.

These findings have important policy implications. It is underscored the firm belief that governments should act upon the freedom of press particularly in lower income countries, in order to attain improved effects on greenhouse gas emissions and environmental performance. This also answers the research question, thus urgent actions are required for raising climate awareness through the instruments the media holds, particularly in lower middle and low-income countries, for this enhanced leverage effect.

Conclusions

This paper tests press freedom as a rather new determinant of environmental performance of worldwide countries. The research hypothesis is validated, according to which increasing media freedom is related to increasing environmental performances, for most subsamples of income levelled countries, estimations which are stable to various press freedom proxies and added control variables. This suggests that when the media is free to operate without restrictions, it has a higher impact upon the public accountability leading to increased action in adopting sustainable practices, even though some nations are still in the early stages of recognizing and embracing sustainable sources (Umar & Egbu, 2019). Moreover, there is an opportunity to be more educated and well informed with a proper accessibility to the content of media, which can provide crucial skills for a democratic participation in the environmental policies (Chan et al., 2021), advocating for sustainable solutions that may lead to desirable outcomes.

The highlights of this study suggest a direct relationship between press freedom and environmental performance, as measured by the Environmental Performance Index (EPI): more media freedom is generally associated with better environmental outcomes. Additionally, there is an indirect relationship between press freedom and greenhouse gas emissions, with increased media freedom leading to a reduction in the emissions which will further enhance the environmental performance. Ensuring a supportive attitude of the governments among prioritizing the protection and freedom of the press, it can lead to beneficial action and increased public awareness regarding the gravity of the environmental issues.

During periods of economic downturn, people often prioritize other matters, especially the financial challenges over environmental concerns, while in contrast, when the economy is doing well, there is generally a greater focus on environmental degradation (McCreery, 2010; Harring et al., 2011; Patel et al., 2023). Moreover, heightened media freedom to cover environmental issues generally boosts public concern for the environment. However, it was demonstrated a clear alignment with the trend towards environmental sustainability, reflecting systematic empirical evidence in public opinion. Consistent with previous observations, the study of Harring et al. (2011) also revealed that both economic conditions and media content independently influence the public concern for environmental issues. Conversely, increased media coverage of environmental issues generally increases the public awareness. Each factor operates separately, affecting how the public perceives and prioritizes environmental issues. The influence of media on societies, when compared to the impact of environmental regulations, is significant and multifaceted (McCreery, 2010). While environmental regulations are crucial for enforcing standards and promoting sustainable practices, media coverage has the ability to shape public perceptions and priorities. Governments should also endorse programs that equip the journalists with the necessary training and help them with resources to report effectively the environmental concerns, while ensuring that the public has access to and completely understands this information. These initiatives can empower citizens to contribute significantly, leading to enhanced environmental outcomes and increased resilience to ecological threats. In this way, nations can develop an informed and engaged population that acts a vital role in global sustainability, fighting against the climate change. The industrialized countries that have produced the majority of greenhouse gas emissions are typically the least vulnerable to the effects of climate change (Alcamo & Olesen, 2012), while the less industrialized nations are more prone to becoming pollution havens (Alhassan et al., 2020). Wealthy nations must separate their consumption practices from harming the environment, leveraging their resources to support the sustainable development of poorer

nations (Block et al., 2024). The main focus of the governments should be especially on the poorest nations where the mortality risk is tremendous due to environmental pollution (Ritchie & Roser, 2017), which are highly disadvantaged in terms of having access to vital news and other materials from the media, due to the lack of internet and financial resources.

While these findings are promising, there were encountered some limitations in the study that must be acknowledged. The limits include the lack of validation for carbon dioxide emissions as another environmental quality proxy and the challenging task of missing observations. Considering the aim for future studies fostering continuous advancement, the tendency is to follow these research directions and also address some new objectives: the inclusion of more control variables; different methodologies (Fixed vs random effects modelling, Quantile regression approach); the use of dummies.

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