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Good or bad? Environmental policy and women's political empowerment in developing countries

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Abstract

The consideration of environmental conditions has affected many aspects of society. This paper assesses the effect of environmental policy on women's political empowerment (WPE). Based on a sample of 96 developing countries (DCs), we specify and estimate a static and dynamic panel data model using pooled ordinary least squares (POLS) and system generalized method of moments (sGMM) over the period 2006-2019. The results show that environmental policy significantly increases WPE. Robustness is tested through the use of disaggregated indices, political participation, civil society participation and women's civil liberties. In addition, we use alternative measures of environmental policy. The results suggest that the strategic adoption of effective and inclusive environmental policies strengthens the political empowerment of women in developing countries.

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1. Introduction

Forty years of gender research have shown that gender is an important category that needs to be considered in environmental policy and practice (Arora-Jonsson, 2014). There is a growing need to empower and facilitate women's participation. However, women's capacities remain very limited and are of global interest. According to UN Women (2023), in January 2023, out of 195 countries in the world, only 31 have a woman at the head of the executive. At the head of ministerial departments, only 22.8% are women. Only 13 countries in the world have parity between men and women in ministerial posts, i.e. 50%. In national parliaments, only 26.5% of all national parliamentarians are women, while in local authorities, women account for almost 34% of elected members of local decision-making bodies. If this trend continues, gender parity in state and legislative bodies will not be achieved before 2030. To address the challenges associated with the low political representation of women, it is necessary to follow up on SDG-5 "*ensure women's full and effective participation and equal opportunities in decision-making positions at all levels in political, economic and public life*" through indicator 5.5 1a, on women's representation in parliaments. Recent empirical literature has examined the factors that may explain this level of women's empowerment, including ICT, globalisation, education, natural resources, and the environment (Samarakoon, and Parinduri, 2015; Alves and Steiner, 2017; Dutta, 2018; Awoa et al., 2022; Ongo et al., 2023).

Environmental policy is defined as the set of initiatives that govern the relationship between man and the environment through regulatory instruments (emission standards, technical standards, product standards and authorisation procedures), economic instruments (eco-taxes, subsidies, permits, etc.) and information instruments for the benefit of both parties (Baumol et al., 1988; Oates and Baumol, 1976). The adoption of an environmental policy thus aims to remedy vulnerabilities to mitigate the consequences of and discrimination against women (Wong, 2016), and to reduce poverty (Djoudi and Brockhaus, 2011). Their impacts are felt in economies, undermining the livelihoods of households, particularly women, due to environmental deterioration, i.e. extreme changes in temperature, weather conditions and the increased frequency of climate-induced disasters, such as floods, droughts, storms, and cyclones (Habtezion, 2013). This environmental crisis has many effects on society, particularly on women. Moreover, women are more affected by the effects of climate change than men.

Policies have turned towards gender mainstreaming, attempting to include women and other marginalised social groups in environmental management and markets (Arora-Jonsson, 2014). This study is the first of its kind to our knowledge to investigate the role played by environmental policies on women's political empowerment (WPE) in a sample of developing countries (DCs). This work differs from previous studies, which analyse the opposite effect, i.e. women's participation in environmental decision-making (Atchison and Down, 2019; Nadeem et al., 2020; Kroeber, 2022), and specific aspects of women's empowerment, such as pregnancy (Niedzwiecki et al., 2020) and women's rural work (Kornom-Gbaraba et al., 2022). There are three main contributions to this study. First, this study is the first to integrate the adoption of environmental policies as a modern and relevant indicator of WPE. Indeed, to the best of our knowledge, existing literature has focused more on analysing the effects of climate change and pollution on women's empowerment (Yadav and Lal, 2018; Guivarch and Taconet, 2020). Second, we consider a large sample of 96 DCs. Indeed, according to Ibe and Amikuzuno (2019), developing countries constitute a group of countries that are highly vulnerable to climate change due to the dependence of their economies on the primary sector, for example agricultural

activities[1] , as a means of feeding themselves and generating income. Finally, it shows its polysemic nature, which is captured by considering the disaggregated WPE indices and, in addition, the socio-economic empowerment indicators for women. It also considers the specific characteristics of developing countries, such as macroeconomic stability, governance, culture, and geography. This enables relevant and targeted economic policy recommendations to be made. The aim of this article, which constitutes its originality, is therefore to examine the effect of environmental policies on WPE in developing countries.

To achieve our objective, this study covers a sample of 96 DCs over the period 2006-2019. The primary motivation for choosing this study area is the level of women's dependence on the primary sector as presented above, women's participation in political life is still low and policies for adapting to environmental change are almost non-existent and ineffective. The estimation techniques used are Ordinary Least Squares (OLS) and System Generalized Method of Moments (sGMM). OLS is used to see the overall trend and sGMM to capture the dynamics of women's empowerment. The central hypothesis supported in this work is that the adoption of effective environmental policies enhances women's political empowerment.

After this introduction, the rest of the article is organised into four further sections. The first section summarises the state of the art. The second presents the methodological strategy. The third presents the results and discussion. We conclude with suggestions for policy recommendations.

2. Brief review of the literature

According to Duflo (2012), women's empowerment is a multidimensional concept that encompasses rights, resources, voice, perception, relationships, power and achievement. Thus, Women's Political Empowerment (WPE) reflects women's increased capabilities, which translates into more choice, agency, and participation in decision-making. This is an illustration of Sen's (1985) capability theory, which stresses that development should be assessed in terms of individual capabilities, and Kenney's (1996) feminist theory, which illustrates gender empowerment. For Sundström et al (2017), WPE refers to women's ability to express themselves freely, to participate in decision-making and to the societal existence of an agency relationship.

The emerging empirical literature highlights a number of determinants of women's political empowerment. These include the determinants of financial globalisation through foreign direct investment (Alves and Steiner, 2017; Ouedraogo and Marlet, 2018; and Fernandes & Kee, 2020). Information and communication technologies (ICTs) and urbanisation are also determinants of women's political empowerment (Ongo et al., 2022; 2023; Chen and Ge, 2018); and finally, Awoa et al. (2022) also mention natural resource rents and urbanisation as determinants of women's political empowerment. If climate change has negative repercussions on the lives of men and women, and the adoption of environmental policies is the remedy, these repercussions are generally greater for poor women, due to their limited access to various resources. Women are in fact among the first victims of the negative impacts of climate change, because of their role in taking care of the family and their responsibilities, particularly in collecting water and firewood (Guivarch and Taconet, 2020). Appropriate environmental policies free up women's time and give them the opportunity to focus on decision-making.

Existing empirical studies show that rural farming households in developing countries are among the most vulnerable to environmental change (Danso-Abbeam et al., 2021; Das et al.,

[1] These agricultural activities are easily affected by atmospheric conditions such as temperature, rainfall, wind direction and speed, humidity, and atmospheric pressure.

2020). In situations of extreme poverty, destruction of livelihoods and erosion of productive assets due to environmental change, men migrate in search of jobs, abandoning their families, resulting in an increased feminisation of responsibilities (Yadav and Lal, 2018). In developing countries, changes in the environment increase workload and fatigue while lowering their self-esteem and forcing them to undertake high-risk and dangerous activities (Yadav and Lal, 2018). To improve their adaptive capacity, women need access to and control over productive assets to enable them to cope with environmental change (Leichenko and Silva, 2014).

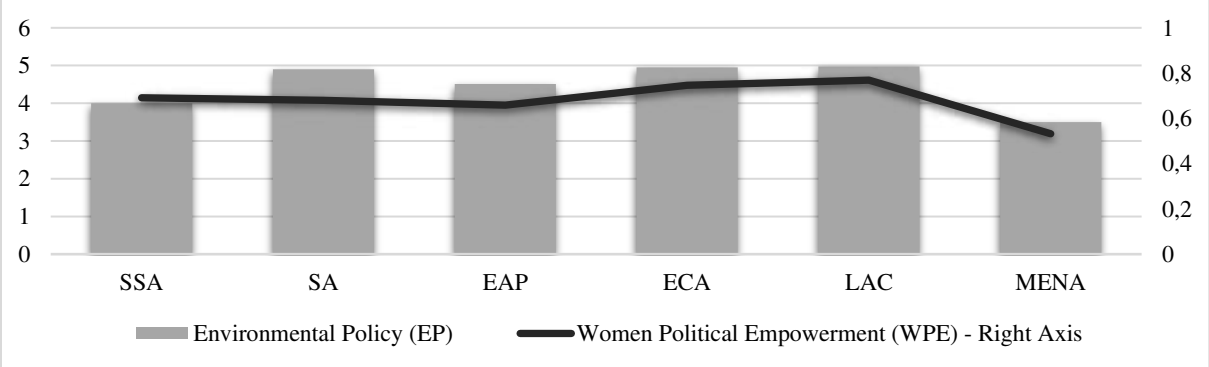
Past studies have limited themselves to describing information and communication technologies, financial globalisation, urbanisation and natural resources as determinants of women's political empowerment without, however, basing themselves on the determinants of environmental policies. This study thus demonstrates that environmental policies are a relevant determinant of women's political empowerment. The contribution of this study is threefold: first, we establish the link between environmental policy and women's political empowerment. Second, we examine the direct and indirect effects of environmental policies through relevant channels. Finally, we consider a panel of developing countries with at least the same characteristics.

3. Methodology

2.1. Data

Data on macroeconomic variables come from the *World Bank* (2021a). Data on the level of environmental policy come from the Bertelsmann Transformation Index (2021), and data on women's political empowerment come from *Varieties Democracy* (V-Dem, 2021). The sample size (96 DCs - appendix 3) and study period (2006-2019) are dictated by data availability and database pairing. Descriptive statistics (appendix 1), description of variables (appendix 2). Figure 1 shows the level of women's political empowerment and the environmental policy index in the developing countries (DCs) in our sample. We find that regions with a low level of environmental policy have low Women's Political Empowerment (WPE) scores.

Figure 1: Women's political empowerment and environmental policy in the DC regions



Source: Authors, based on data from the Bertelsmann Transformation Index (2021) and the VDEM (2021). Footnotes: South Asia (SA), Europe and Central Asia (ECA), Middle East and North Africa (MENA), East Asia and Pacific (EAP), Sub-Saharan Africa (SSA) and Latin America and the Caribbean (LAC).

Similarly, regions with a high level of environmental policy have a high level of women's political empowerment. Appendix 3 shows a positive dependency between environmental policy and women's political empowerment. This validates the results of Figure 1 and suggests that environmental policy improves women's political empowerment.

2.2.Model

The theoretical model draws on the work of Mbaye (2020), who relates the link between climate shocks and women's empowerment, and Wong (2016). The reduced model is specified by equation (1).

$$WPE_{it} = \alpha + \lambda EP_{it} + \gamma X_{itit} + v_i + \mu_t + \varepsilon_{it} \quad (1)$$

Where WPE_{it} represents women's political empowerment in country i at time t. This is a vector of the variables of interest, which incorporates the composite empowerment index and the three disaggregated indices. The overall empowerment index is calculated by Sundström et al. (2017), through *Varieties of Democracy (V-Dem)*.

The *V-Dem* WPE composite index is calculated from three dimensions of empowerment: *(i) the* Women's Civil Liberties Index (WCLI) ranging from 0 to 5*; (ii)* the Women's Civil Society Participation Index (WCSPI) ranging from 0 to 4; *(iii)* the Women's Political Participation Index (WPPI) ranging from 1 to 10. EP_{it} is the variable of interest measured by environmental regulations and incentives. It represents the extent to which environmental concerns are considered. The variable ranges from 1 (environmental concerns are not considered) to 10 (environmental concerns are effectively considered).

X is the vector of control variables composed of: *(i) FLFP*, female labour force participation is the proportion of the female population aged 15-64 that is economically active (Ross, 2008); (*ii) Urban* describes the urbanisation rate and the degree of urbanisation of cities in DCs measured by the share of the population living in cities. Unlike Ongo et al (2022), we postulate that urbanisation improves WPE; *(iii) Health* is measured by current expenditure on health as a percentage of GDP. We argue, like Asongu et al (2020), that health improves labour productivity; *(iv) FDI* is measured by foreign direct investment inflows as a percentage of GDP. We assume that FDI is a source of WPE. (*v) ICT*, the mobile phone describes the level of diffusion of information and communication technologies. Like Ongo et al (2022), we assume that ICT diffusion improves WPE; (*vi*) *Nat_ress*, natural resources reduce WPE because the rent from these resources benefits the minority (Awoa et al, 2022).

v_i captures unobserved country fixed effects; μ_t considers the time fixed effect common to all countries, and ε_{it} is the error term.

$$WPE_{it} = \alpha + \lambda_1 WPE_{it-1} + \lambda_2 EP_{it} + \beta_1 FLFP_{it} + \beta_2 Urban_{it} + \beta_3 Health_{it} + \beta_4 FDI_{it} + \beta_5 ICT_{it} + \beta_6 Nat\_ress_{it} + v_i + \mu_t + \varepsilon_{it} \quad (2)$$

2.3. Estimation technique

We use Ordinary Least Squares (OLS) and System Generalized Method of Moments (S-GMM). However, OLS is generally used as an initial analytical framework to give the general trend of the results. This technique is preferred to other techniques because of the linear nature of the variables. This reduces the problem of measuring the dependent variable. Therefore, OLS is well advised as women's political empowerment, which is our dependent variable does not change sufficiently over time. While dynamic panel is generally used (Gaddis and Klasen, 2014), due to the inherent reverse causality between environmental policy and women's political empowerment, the use of static models may lead to biased results.

To take advantage of panel data, we use the sGMM, which is more appropriate for solving endogeneity problems (Blundell and Bond, 1998). The advantage of the sGMM model is that it can correct for the endogeneity of the explanatory variables of interest and the other explanatory variables. Thus, the desirable features of the S-GMM make it possible to resolve the problems of multicollinearity, endogeneity and omitted variable bias. The use of this econometric technique allows us to obtain unbiased, convergent, and efficient estimators. In addition, we consider unobservable factors and correct for simultaneity bias between variables

of interest and control variables (Wooldridge, 2013). The sGMM method solves the problems of multicollinearity, endogeneity and omitted variable bias. The number of lags is taken from t-1 (Roodman, 2009). We use Hansen's test for overidentifying restrictions (Hansen, 1982) to assess the validity of the instruments, Arellano-Bond's (1995) AR(1) and AR(2) test to assess the presence of autocorrelation.

3. Results and discussion

3.1. Basic analysis

The estimation results indicate that environmental policy has a positive and statistically significant effect on WPE in developing countries (Table I).

Table I: Effect of environmental policy on WPE

	Dependent variable: WPE			
	Estimation method: POLS			
Variables	(1)	(2)	(3)	(4)
Environmental policy (EP)	0.0712***	0.0492***	0.0473***	0.0385***
	(0.00215)	(0.00232)	(0.00236)	(0.00239)
FLFP		0.00295***	0.00292***	0.00288***
		(0.000265)	(0.000270)	(0.000263)
Urbanisation		0.00104***	0.000876***	0.000934***
		(0.000194)	(0.000200)	(0.000207)
Health			0.0130***	0.00936***
			(0.00161)	(0.00155)
FDI			0.00122**	0.00185***
			(0.000515)	(0.000588)
ICT				0.000300***
				(0.000101)
Nat. Ress.				-0.00284***
				(0.000594)
Constant	0.379***	0.302***	0.238***	0.289***
	(0.0111)	(0.0235)	(0.0253)	(0.0238)
Observations	1,532	845	779	779
Number of countries	96	96	96	96
R squared	0.395	0.466	0.513	0.547

Source: Authors. Robust standard errors in brackets; *** p<0.01, ** p<0.05, * p<0.1

The reason given for this is that environmental policy aims to strengthen the representativeness of different social strata and achieve gender equity. Environmental policy perpetuates women's freedom, which strengthens their representativeness. This policy can help women adapt to and mitigate the effects of climate change (Atmadja et al., 2020). Without claiming to be exhaustive, three explanations stand out. Firstly, the impacts of environmental change tend to be greater on poor women, due to their limited access to various resources. Women are among the first victims of the negative effects of environmental deterioration, because of their role in taking care of the family and their responsibilities, particularly in terms of collecting water and firewood (Guivarch and Taconet, 2020; Nwoke and Ibe, 2014).

Second, in situations of extreme poverty, destruction of livelihoods and erosion of productive assets due to environmental change, men migrate in search of employment, abandoning their families, leading to increased feminisation of responsibilities (Yadav and Lal, 2018). Third, women appear less able to adapt to environmental change because of financial or resource constraints, male dominance in receiving information and extension services, and because available adaptation strategies tend to create a greater workload for women (Jost et al., 2016).

The adoption of environmental policies reduces women's workload and fatigue, while boosting their self-esteem by reducing hazardous and high-risk activities. This in turn promotes women's access to freedom of expression and decision-making.

In terms of control variables, women's health and work significantly improve women's economic performance (Ross, 2008). Urbanisation significantly improves GSP because of the infrastructural transformation that follows, and urbanisation offers opportunities that increase women's political integration. FDI flows have a positive and statistically significant effect on women's empowerment in developing countries (Ouedraogo and Marlet, 2018). The spread of the internet has a positive and statistically significant effect on women's empowerment in DCs (Tang, 2022). Because in resource-rich countries, resources are not shared equitably and benefit a minority (Awoa et al., 2022).

Table II presents the effects of environmental policy on WPE and its disaggregated indices (the civil liberties index (WCLI), the civil society participation index (WCSPI) and women's political participation (WPPI)).

Table II: Effect of environmental policy on disaggregated WPE indices

	Estimation method: sGMM			
	(1)	(2)	(3)	(4)
Variables	WPE	WCLI	WCSPI	WPPI
WPE (t-1)	0.549***			
	(0.0246)			
WCLI(t-1)		0.727***		
		(0.0267)		
WCSPI(t-1)			0.736***	
			(0.0287)	
WPPI(t-1)				0.205***
				(0.0232)
Environmental policy	0.00628***	0.00900***	0.00644***	0.00665**
	(0.00158)	(0.00129)	(0.00204)	(0.00313)
FLFP	-0.000759***	-0.000285	-0.000188	-0.00121***
	(0.000176)	(0.000196)	(0.000161)	(0.000408)
Urbanisation	0.000977**	0.000855**	-0.00119***	0.00150*
	(0.000404)	(0.000333)	(0.000381)	(0.000806)
Health	0.00278**	0.00385***	0.00144	0.00424**
	(0.00112)	(0.00102)	(0.00134)	(0.00179)
FDI	0.00217**	0.00139***	0.00316***	0.00187***
	(0.000882)	(0.000510)	(0.000632)	(0.000526)
ICT	0.000184***	-5.79e-05	0.000482***	0.000188**
	(7.06e-05)	(4.77e-05)	(8.07e-05)	(9.60e-05)
Natural resources	-0.00168***	-0.00113***	-0.00104***	-0.00262***
	(0.000254)	(0.000257)	(0.000259)	(0.000564)
Constant	0.262***	0.0971***	0.173***	0.593***
	(0.0293)	(0.0232)	(0.0344)	(0.0504)
Observations	729	729	729	729
Number of countries	96	96	96	96
Number of instruments	53	53	53	54
ar1p	0.00477	4.27e-06	0.000808	0.0386
ar2p	0.523	0.222	0.378	0.557
Hansenp	0.485	0.143	0.362	0.299

Source: Authors. Note: Standard errors in brackets; *** p<0.01, ** p<0.05, * p<0.1.

In addition, we address potential endogeneity issues that were not considered in the static panel. The results are robust from an econometric point of view, as the number of instruments is less than the number of groups. In addition, the Hansen test and the AR(2) test are not significant, while the AR(1) test is significant. These results suggest that any identification and

autocorrelation problems detected have been corrected. Furthermore, the MMG-S estimates suggest that the WPE has a memory effect (Duflo, 2012). The results remain consistent.

3.2. Robustness analysis

- **Robustness with consideration of an alternative environmental policy measure**

Improvements in environmental performance, the vitality of ecosystems and environmental health are the results of all the regulatory measures adopted by the authorities to improve environmental conditions, which are grouped together here under the term environmental policy. Environmental policy also aims to reduce CO2 emissions (table III).

Table III: Review of another environmental policy measure

	Dependent variable: WPE			
	(1)	(2)	(3)	(4)
Variables	EPI	EV	EH	CO2
Women's political empowerment (t-1)	0.518***	0.520***	0.517***	0.234***
	(0.055)	(0.055)	(0.055)	(0.031)
Environmental performance (EPI)	0.040*			
	(0.022)			
Ecosystem vitality (EV)		0.045*		
		(0.024)		
Environmental health (EH)			0.032*	
			(0.018)	
CO2 emissions (CO2)				-0.048***
				(0.019)
FLFP	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Urbanisation	0.000	0.000	0.000	0.002**
	(0.000)	(0.000)	(0.000)	(0.001)
Health	0.004*	0.005*	0.004	0.014***
	(0.003)	(0.003)	(0.003)	(0.004)
FDI	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
ICT	0.000***	0.000***	0.000***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Natural resources	-0.002***	-0.002***	-0.002***	-0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.327***	0.329***	0.325***	0.445***
	(0.043)	(0.043)	(0.043)	(0.048)
Observations	289	289	289	457
Number of instruments	43	43	43	44
Number of countries	88	88	88	91
ar1p	0.0535	0.0548	0.0521	0.00719
ar2p	0.832	0.826	0.842	0.844
hansenp	0.237	0.241	0.231	0.537

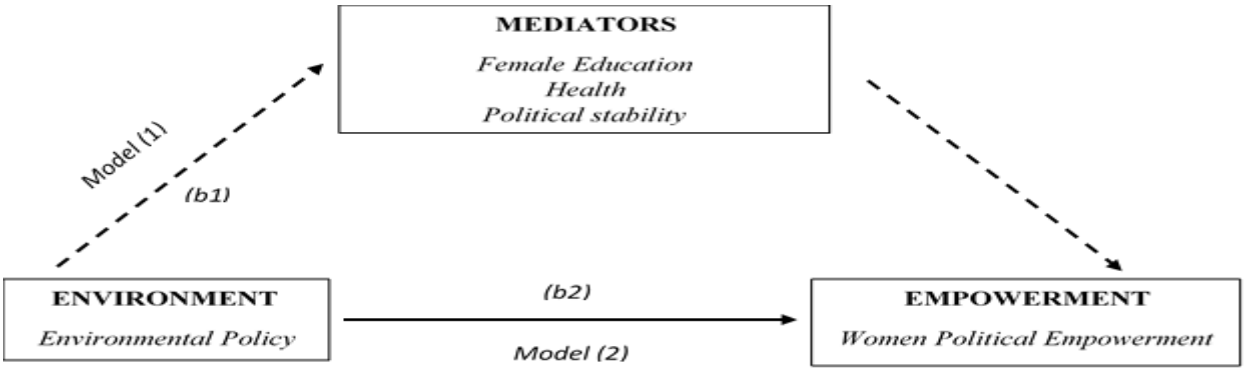
Source: Authors. Notes: *** p<0.01, ** p<0.05, * p<0.1; Standard errors in brackets

Thus, taking environmental issues into account significantly and positively improves women's political empowerment (EPF). These results corroborate the literature according to which temperature change makes women more vulnerable (Sato et al., 2020; Tumbo et al., 2020).

- **Robustness, taking account of the mediator effect**

Here we carry out a mediation analysis. Eight main mediators are used: Women's education, health, and political stability. Our approach, presented in Figure 3, is inspired by Song et al (2023).

Figure 3: Modelling the mediation effect.



Source: Authors.

The approach involves the subsequent estimation of two regression equations as described below:

$$\text{Model 1: } Med_i = \alpha_1 + b_1 EP_i + c_1^{'} X_i + \mu_i \quad (8)$$

$$\text{Model 2: } WPE_i = \alpha_2 + b_2 EP_i + b_3 Med_i + c_2^{'} X_i + \nu_i \quad (9)$$

Where Med_i represents the mediating variables (women's education, health, and political stability). The composition effect is derived from the above models as follows:

Indirect effect: $b_1 \times b_3$ **; direct effect:** b_2 and **total effect:** $(b_1 \times b_3) + b_2$.

First, we estimate model (1), which represents the effect of environmental policy on mediators (women's education, health, and political stability); b_1 is the parameter describing this effect. The second step is to estimate model (2), in which we regress environmental policy on women's political empowerment while controlling for mediators. The magnitude of this effect is given by the environmental policy coefficient (b_2). The indirect effect is obtained by the product of b_1 and b_3 , where b_3 measures the strength of the correlation between environmental policy and mediators in model (2). This term also reflects the size of the mediation, which essentially depends on the extent to which environmental policy affects mediators (b_1) and the extent to which mediators influence women's political empowerment (b_3). Table IV presents the estimates of model (1), using measures of women's education, health, and political stability as mediators respectively. Estimates of model (2) using mediators as controls are reported in columns (1b), (2b) and (3b).

Table IV: Analysis of mediation effects

	(i) Mediator: Women's education		(ii) Mediator: Health		(iii) Mediator: Political stability	
	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)
	Women's education	WPE	Health	WPE	Political stability	WPE
Environmental policy	0.0882*** (0.008)	0.0337*** (0.003)	0.2633*** (0.049)	0.0397*** (0.002)	0.2500*** (0.017)	0.0326*** (0.003)
Women's education		0.0761*** (0.013)				
Health				0.0094*** (0.002)		
Political stability						0.0354*** (0.006)
Constant	0.1007*** (0.036)	0.3166*** (0.025)	4.7540*** (0.260)	0.3007*** (0.023)	-1.6681*** (0.089)	0.3752*** (0.024)
Basic control variables	Yes	Yes	Yes	Yes	Yes	Yes
Bootstrap replications	500	500	500	500	500	500
Observations	611	611	779	779	779	779

	Mediating by women's education			Mediating by Health			Mediating by political stability		
	Coeff.	S.E.	p-value	Coeff.	S.E.	p-value	Coeff.	S.E.	p-value
(A) Mediator tests									
Delta	0.007	0.001	0.000	0.002	0.001	0.000	0.009	0.002	0.000
Sobel	0.007	0.001	0.000	0.002	0.001	0.000	0.009	0.002	0.000
Monte Carlo	0.007	0.001	0.000	0.002	0.001	0.000	0.003	0.002	0.053
(B) Composition of the effect									
Indirect effect (Sobel)	0.007			0.002			0.009		
Direct effect	0.034			0.040			0.033		
Total effect	0.040			0.042			0.041		
% of total effect mediated	17%			6%			21%		

Notes: ***, **, * indicate significance at the 1%, 5% and 10% level, respectively. Robust standard errors are shown in brackets.

Source: Authors

Overall, the results suggest that (i) environmental policy affects all three mediators (Yao et al., 2022; Dominski et al, 2021) and that the effects are statistically significant at the 1% level (columns 1a, 2a and 3a of Table 4); (ii) the three mediators have a significant separate effect on women's political empowerment (see Priyanka, 2020; Khalifa, 2017; Samarakoon and Parinduri, 2015) (columns 1b, 2b and 3b of Table IV); (iii) the coefficient estimate of environmental policy using the mediators as controls is presented in columns (1b), (2b) and (3b) accordingly ; (iv) the coefficient estimate of environmental policy on women's political empowerment increases as soon as a mediator is included in the model (columns 1b, 2b and 3b in Table IV, compared to column 1 in Table II); (iii) the coefficient estimate of environmental policy on women's political empowerment increases when a mediator is included in the model (columns 1b, 2b and 3b in Table IV, compared to column 1 in Table II). Overall, the results suggest that mediation may have occurred when some of the influences of environmental policy

on women's political empowerment are induced by women's education, health and political stability.

Conclusion

This article is the first to empirically assess the effect of environmental policy on WPE in a sample of 96 developing countries for the period 2006-2019. Several variants of the model were estimated using the pooled ordinary least squares (POLS) method and the system generalized method of moments (sGMM). The results show that the environmental policy leads to a perpetuation of women's freedom, which strengthens their representativeness. This policy can help women to adapt to and mitigate the effects of climate change (Atmadja et al., 2020). Our results are robust to a battery of robustness checks, including additional control variables, alternative measures of environmental policy and women's political empowerment. Finally, we conduct a transmission channel analysis and, without being exhaustive, find that environmental policy affects women's political empowerment. This has many implications, including influencing the development of policies that are more inclusive and responsive to women's specific needs, helping to reduce gender inequalities and increasing women's political participation. The policy recommendations are to develop gender-sensitive monitoring and evaluation mechanisms to analyse the differential impact of environmental policies on women, and to promote women's leadership and capacity-building in the sustainable management of natural resources and environmental protection. This study was limited to presenting the linear effects of environmental policies on women's political empowerment. Future work could analyse the non-linear effect of the relationship and determine thresholds and slopes. Future work could use other measures of environmental policy if they exist or construct a composite index. Despite its limitations, this study retains its authenticity in view of its major contribution to establishing the relationship.

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Appendices

Appendix 1: Descriptive statistics

Variables	Obs	Mean	Std. Dev.	Min	Max
WPE	1532	.687	.167	.158	.951
WCLI	1536	.613	.215	.024	.961
WCSPI	1536	.656	.19	.061	.948
WPPI	1532	.805	.195	.142	1
Environmental policy	1536	4.323	1.475	1	8
FLFP	854	48.583	16.436	6.04	91.31
Urbanisation	1525	49.367	19.602	9.617	92.111
Health	1378	5.725	2.304	1.752	20.413
FDI	1486	4.122	6.492	-37.173	103.337
ICT	1519	81.346	41.45	.445	205.039
Nat ress	1511	8.809	10.797	.001	68.051
CO2 emissions	1402	.572	.485	.062	3.581
Pre-primary education	1075	45.804	32.135	.716	160.292
Prim educ	1232	102.498	16.289	16.626	156.11
Second education	979	68.87	29.769	3.74	148.034
gdppercapita	1511	2.149	5.592	-47.9	96.956
inflation	1511	8.302	20.087	-30.2	604.946

Source : Authors

Appendix 2: Definition of variables

Variables	Short definition	Source
WPE	Women's political empowerment index, scaled from 0 to 1. Higher values indicate greater empowerment. WCLI: Women's Civil Liberties Index; WCSPI: Women's Civil Society Participation Index; WPPI: Women's Political Participation Index.	VDEM(2021)
Environmental policy (EP)	Environmental policy, on a scale of 1 to 10. Higher values indicate better consideration of environmental concerns. Environmental concerns are effectively addressed and carefully balanced with growth efforts. Environmental regulations and incentives are in place and applied.	IWT(2021)
EPI	The environmental performance index is measured by ecosystem vitality and environmental health.	Yale (2018)
FLFP	Female employment rate (% of female population aged 15 and over)	
Urbanisation	Urban population (% of total population)	
Health	Current expenditure on health (% of GDP)	
FDI	Foreign direct investment, net inflows (% of GDP)	
ICT	Mobile phone subscriptions (per 100 people)	
Nat ress	Total rents from natural resources (% of GDP)	World Bank(2021a)
CO2 emissions	CO2 emissions (kg per 2015 US$ GDP)	
Pre-primary or female education	Enrolment rate, pre-primary, female (% gross)	
Prim educ	Female primary school enrolment (% gross)	
Second education	Female secondary school enrolment (% gross)	
gdppercapita	GDP per capita growth (annual %)	
inflation	Inflation, GDP deflator (annual %)	
Governance	Control of corruption; effectiveness of government; political stability and absence of violence/terrorism; quality of regulation; rule of law; voice and accountability.	World Bank(2021b)

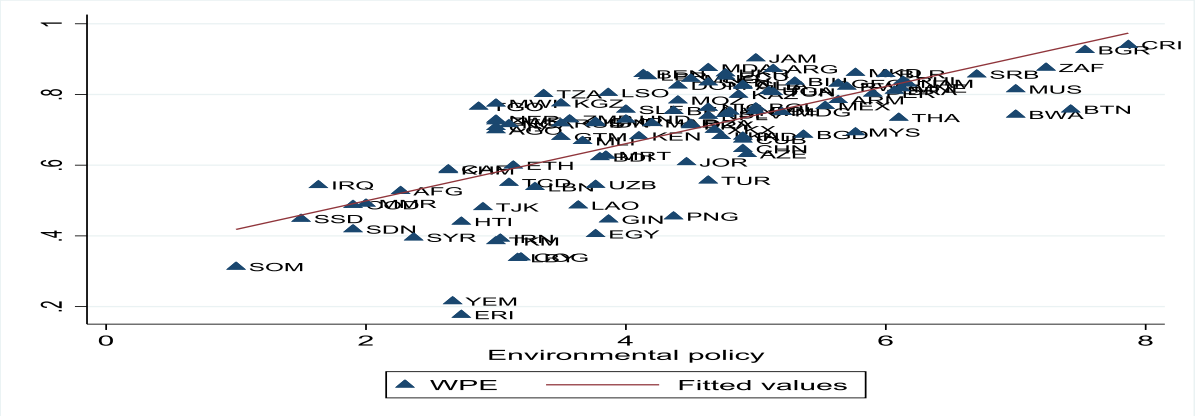
Source : Authors

Appendix 3: List of countries

Afghanistan	Botswana	Georgia	Cambodia	Maurice	Senegal	Ukraine
Angola	Central African Republic	Ghana	Lao PDR	Malawi	Sierra Leone	Uzbekistan
Albania	China	Guinea	Lebanon	Malaysia	El Salvador	Vietnam
Argentina	Ivory Coast	Guatemala	Liberia	Namibia	Somalia	Yemen. Rep.
Armenia	Cameroon	Honduras	Libya	Niger	Serbia	South Africa
Azerbaijan	Congo. Dem. Dem.	Haiti	Sri Lanka	Nigeria	Syrian Arab Republic	Zambia
Burundi	Colombia	Indonesia	Morocco	Nicaragua	Chad	Zimbabwe
Benin	Costa Rica	India	Moldova	Nepal	Togo	
Burkina Faso	Cuba	Iran. Islamic Republic.	Madagascar	Peru	Thailand	
Bangladesh	Dominican Republic	Iraq	Mexico City	Philippines	Tajikistan	
Bulgaria	Algeria	Jamaica	Northern Macedonia	Papua New Guinea	Turkmenistan	
Bosnia and Herzegovina	Ecuador	Jordan	Mali	Paraguay	Tunisia	
Belarus	Egypt. Arab Rep.	Kazakhstan	Myanmar	Russian Federation	Turkiye	
Bolivia	Eritrea	Kenya	Mongolia	Rwanda	Tanzania	
Brazil	Ethiopia	Kyrgyz Republic	Mozambique	Sudan	Uganda	

Source : Authors

Appendix 3**: Graphical correlation between environmental policy and WPE**



Source: Authors, based on VDEM (2021) and BTI (2021) data.