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Women's parliamentary representation and environmental quality in Africa: Effects and transmission channels

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Abstract

This paper contributes to the literature on the relationship between gender and the environment. There are indeed very few studies on this topic, and existing studies have not yet investigated the channels through which women's presence in parliaments affects the environment. We use a stochastic impact model extended to the population, wealth and technology regression model to estimate both the effect and transmission of women parliamentarians on the environment in 25 African countries from 2000 to 2016. The empirical results show that the presence of women in parliament contributes to the improvement of environmental quality in Africa. In addition, the mediation analysis reveals that women parliamentarians not only have a direct positive effect on the environment but also a positive indirect effect through their impact on per capita income, corruption and development assistance. To enhance the positive effects of women parliamentarians on the environment, governments should design policies to encourage women to participate in economic activities, integrate anti-corruption programmes and participate in the management of development assistance.

Keywords: Women's parliamentary, environmental quality, African countries.

JEL Classification: F63, F64, J16

1. Introduction

In contrast to the growing environment-income debate, the environment-women debate is still in its infancy and almost non-existent. Indeed, while studies exist on the comparison of women's and men's behaviour in relation to environmental issues (Blocker and Eckberg, 1989; Brody, 1984; George and Southwell, 1986; Hamilton, 1985a, 1985b; Nelkins, 1981; Passino and Lounsbury, 1976; Solomon, Tomaskovic-Devey, and Risman, 1989 which have shown that women are significantly more concerned about these issues than men ; on the other hand, Arcury and Christianson, 1990; Arcury, Scollay and Johnson, 1987; Blocker and Eckberg, 1989; Lowe and Pinhey, 1982; McStay and Dunlap, 1983; Mitchell, 1979; Van Liere and Dunlap, 1980 showed that the comparison was less obvious to make), the contribution of women to environmental quality has hardly been highlighted. However, several facts can justify why this relationship should be an ongoing and major concern for researchers. Firstly, women increasingly play an important role in the political and socio-economic life of states. Indeed, both national and international mechanisms on gender promotion have enabled the emergence and growth of the intellectual (Svaleryd, 2009; Clots-Figueras, 2012); political (Chattopadhyay and Duflo, 2004; Clots-Figueras, 2011); and socio-economic (Chattopadhyay and Duflo, 2004; de Svaleryd, 2009; Bhalotra and Clots-Figueras, 2014; Mavisakalyan, 2014; Hicks et al, 2015, 2016; Jayasuriya and Burke, 2013) women. Thus, the socio-economic and political rise of women makes it undeniable that they contribute either to the improvement or degradation of the quality of the environment. Secondly, the resurgence of environmental problems is increasingly leading governments and scientists to seek ways of reducing its scale by analysing its determinants. In this wake, women's parliamentary representation is increasingly emerging as a possible determinant of environmental quality. Third, there is clear evidence that women politicians play an important role in improving the quality of institutions and reducing inequalities (Dollar et al., 2001; Swamy et al., 2001). However, the effects of improving the quality of institutions on the environment have been highlighted by a number of authors (Weisbuch, 2000; Ostrom, 2008; Nkengfack et al., 2020). Thus, a transition effect from the relationship between women politicians and institutions to that of women politicians and the environment can be assumed. Fourth, there is no unanimity on women's contribution to environmental quality. Indeed, there are two conflicting arguments in the literature. The first argument postulates that women's relationship with the environment is "special" and that women therefore have a special interest in initiatives to improve environmental sustainability (Melissa, 2015). Thus, women

parliamentarians are more favourable to the implementation of laws to protect the environment. The second argument states that women in leadership positions in a male-dominated environment are similar to men (Adams and Funk, 2012; Sundstrom and McCright, 2014). This difference in position in the literature can be partly explained by the estimation technique used, the periodicity and the sample of countries in the study. In addition, the existing work is late in coming and has mostly focused on a comparative study of men's and women's attitudes to environmental issues. The question has been how this relationship (women-environment) is distinct from that of men, and what roles women can play in protecting or improving the environment. To fill this gap, we analyse the effects of the presence of women parliamentarians on the environmental performance of African countries. More specifically, our aim is to provide answers to the following questions: What is the impact of women's parliamentary representation on the environment? What are its implications for sustainable development?

This study is important for at least three reasons. First, although the contribution of African countries is less than 5% of global greenhouse gas emissions, these emissions are expected to increase in the coming decades in the region, in view of economic and institutional reforms aimed at increasing economic growth through industrialisation and economic diversification. Second, Africa is one of the regions least resilient to the effects of climate change. This vulnerability is exacerbated by their high level of dependence on income from the exploitation of natural resources and inequalities, foremost among which is gender inequality. In Africa, however, there is a growing interest on the part of women in issues related to the management of public assets and political life in general. Thirdly, African countries have responded to the global calls for action on climate change, with commendable policy frameworks assisted by other agreements and compacts as well as measures to mitigate climate change (Appiah and Jonhson, 2017). Thus, understanding the variables that can influence their environmental performance provides an empirical basis for effectively combating global warming.

After this introductory part, the rest of the paper is structured as follows. Section 2 presents the literature review. Section 3 describes the data and the econometric approach. Section 4 presents and discusses the main empirical results obtained. The conclusion and policy implications are given in section 5.

2. Literature review

2.1. Women's parliamentary and environment quality: evaluating the direct effect

Today, the environment is at the centre of development policies. For some economists, women have an essential role to play in this attempt to reconcile the environment and economic activities. However, there is very little work on this subject, particularly in Africa, hence the distancing of this study from existing work.

Blocker and Eckberg (1997) test the proposition that women will be more concerned about the environment than men because of their socialisation in the caring role and their relative structural position outside the labour market and in the home. They use data from the 1993 General Social Survey to further explore the issue of gender differences in environmental concerns. In particular, they examine the effects of social status, knowledge, confidence in science and religiosity. The authors find that while women tend to be somewhat more concerned about the environment than men, they are no more inclined to engage in environmental actions than men. Women (and men) of higher social status, with more knowledge and greater confidence in science are more likely to engage in environmental action, not less. In addition, they reproduce some of the findings regarding the negative effects of homemaking status and parenthood on environmental policies. For them, although there appear to be some gender differences in environmental orientations, these are neither strong nor consistent and do not extend to actions.

Using LCV score data, Fredriksson and Le Wang (2011) find that women legislators favour stricter environmental policies than their male counterparts. Moreover, the gender-corrected estimates suggest that voters do not push environmental policy to the middle, but rather choose the candidate closest to them ideologically.

For Melissa (2015) the debate on gender and the environment highlights the role of women in the use and management of natural resources, which opens up important possibilities for analysis and action in development. But there are pitfalls in conceiving of women's roles in relation to the environment in a partial, narrow or static way; in isolating them from men's roles; and in assuming that there is a close link between women and "nature". Another approach is to examine dynamic gender-differentiated activities, rights and responsibilities in natural resource management processes. A case study of the Gola Forest in Sierra Leone shows how this approach can help to ensure sustainability and equity in the design of environment-related projects.

In "citizen-candidate" models, in the absence of full political commitment, politicians implement policies according to their preferences (Osborne and Slivinski, 1996; Besley and Coate, 1997). However, it is not clear whether we should expect to observe differences in preferences between male and female politicians similar to those observed in the general public. Differences in the attitudes of men and women to climate change identified in the general public suggest that women are more aware and concerned about climate change than men (McCright, 2010; McCright and Dunlap, 2011). These gender differences in climate change may also be related to differences in social roles played in society, with the production of climate change being seen as more closely linked to activities carried out by men than by women (Spitzner, 2009).

However, it is possible that women in leadership positions in a male-dominated environment are similar to men (Adams and Funk, 2012). In a similar vein, Sundstrom and McCright (2014) do not find strong evidence of gender differences in the environmental concerns of Swedish parliamentarians. In the context of the United States, however, Fredriksson and Wang (2011) find that women parliamentarians in the House of Representatives have more proenvironmental views compared to their male counterparts.

Mohai (1992) points out that there is still relatively little information on gender differences in environmental concerns and activism. The information available so far gives a mixed picture, with some studies indicating that men are more concerned than women, others that women are more concerned, and still others finding no significant differences. Her analysis shows that women are more concerned about the environment than men before and after the application of multivariate controls for age, education, labour/head of household status and other variables. However, the magnitude of the differences is not very large. Gender differences in environmental activism provided an ironic contrast. Although women were somewhat more concerned, women's rates of environmental activism were significantly lower than men's. The gender differences in environmental activism provided an ironic contrast. Moreover, these differences are larger than differences in overall political participation rates and persist despite multivariate controls for socio-economic status, housewife status and other variables.

2.2. The role of transmission channels

Although there have been major advances in the empirical study of the effect of Women’s parliamentarian on environment, previous studies fail to empirically identify the mechanisms through which Women’s parliamentarian impedes or improves the environmental quality.

From the literature, we select GDP per capita, corruption and development aid as potential channels.

The first is the economics growth channel. In fact, there is a plethora literature on the effect of economic growth on environment, and almostall the studies conclude that the relation between the two are not linear (Yavuz, 2014; Shahbazet al., 2015; Zambrano-Monserrate et al., 2016; Noubissi et Njangang, 2017). In this context, Women's parliamentarian could ameliorate environment quality if it contributes to increase economic growth and reduce the income inequality. Conversely, women's parliamentarian can contribute to a degradation ofenvironment if their presence in parliament is accompanied by a reduction of economics activities. The empirical literature on the effects of women's parliamentarian on economic growth is unanimous. All the studies showed a benefit women's politician for the economic growth (Bhalotraet ClotsFigueras, 2014; Mavisakalyan, 2014; Jayasuriya and Burke, 2013).

The second is corruption or institution quality channel.It is recognised in the literature that improving the quality of institutions is beneficial for the environment (Nkengfack et al, 2020). In this context, women parliamentarians can contribute to improving the quality of the environment if they participate in improving the quality of institutions. The literature on the effects of women in parliament on the quality of institutions is unanimous. All these studies have indeed shown a beneficial effect of women politicians on environmental quality (Chattopadhyay and Duflo, 2004; Clots-Figueras, 2011; Dollar et al., 2001; Swamy et al., 2001).

The third channel is development aid. It is expected that environmental quality will improve as a result of well managed development aid. Indeed, development aid contributes to increasing national wealth, which is important for improving environmental quality. Thus, the action of women parliamentarians on the quality of the environment can be beneficial if they participate in the good management of development aid. Several studies have shown that women politicians are involved in improving the management of development aid (Hicks et al, 2015, 2016).

3. Empirical Specification and Data

We perform a number of regressions using different estimators.

3.1. Empirical hypothesis

To determine the impact of women parliamentarians on the environmental performance of African countries, we use the STIRPAT (Stochastic Impact by Regression on Population,

Affluence and Technology) model proposed by Dietz and Rosa (1994). Given our main objective, the focus is on the number of women parliamentarians because it is in this forum that laws are passed. In order to highlight the contribution of this work compared to previous studies, empirical results related to the usual linear specification are also presented. In simple terms, the linear model can be presented as follows.

$$\ln EPI_{it} = \alpha_0 + \alpha_1 \ln(GDP)_{it} + \alpha_2 \ln(Fem)_{it} + \alpha_3 \ln(Z)_{it} + \mu_i + \eta_t + \varepsilon_{it} \quad (1)$$

α_2 : is the effect of women parliamentarians (lnFem) on environmental performance (lnEPI); α_1 is the effect of income per capita (lnGDP) on environmental performance ; α_0 is the constant and α_3 represents the effect of control variables on the environment.

In order to verify whether some of our control variables have a mediating effect on environmental quality, we use causal mediation analysis (Baron and Kenny, 1986; Zhao et al., 2010). This approach is useful to understand whether and to what extent the effect of women's parliamentary on environment is mediated by mediators. However, it seems important to note that the analysis of mediation assumes that the presence of women's in parliament predates the transmission channels.

Relaxing this assumption may over- or under estimate the indirect effect. Thus, the results will serve as simple guidelines for policy makers. This analysis follows the method of Papyrakis and Gerlagh (2004), who study the transmission channels of the resource curse hypothesis. Yogo and Mallaye (2015) also use mediation analysis to study the transmission channels of health aid. To our knowledge, no previous attempts have focused on channels ranging from women's parliamentary to environmental quality.

The analysis of mediation is established by estimating the following models:

$$\ln Z^{j}_{it} = \beta_0 + \beta_1 \ln ICT_{it} + \psi_{it} \quad (2)$$

Where Z^j is the j^{th}channel. β_1 is the effect of women's parliamentary on the transmission channel, β_0 is the constant and Ψ_{it} is the error term. In the first step of the algorithm, equation (2) is estimated to determine the impact of women's parliamentary on each transmission channel. If β_1 is statistically significant, i.e. if women's parliamentary explains part of the variation in the transmission channel, then we calculate the indirect effects of women's parliamentary on environmental quality. By replacing equation (2) in equation (1), we obtain:

$$\ln EPI_{it} = \alpha_0 + \alpha_3\beta_0 + (\alpha_1 + \alpha_3\beta_1)\ln Fem_{it} + \alpha_2 \ln(GDP)_{it} + \alpha_3\psi_{it} \quad (3)$$
$$+ \mu_i + \eta_t + \varepsilon_{it}$$

α_1 is the direct effect of women's parliamentaryon environmental quality; $\alpha_3\beta_1$ is the indirect effect of women's parliamentary on environmental quality; and ($\alpha_1 + \alpha_3\beta_1$) is the total effect ofwomen's parliamentary on environmental quality. We estimate these effects using the structural equation modelling approach, which allows these effects to be tested in a single analysis instead of testing separate regressions. According to Zhao et al. (2010), mediation is empirically valid only if the indirect effect (i.e. $\alpha_3\beta_1$) is statistically significant.

3.2.Data

We use a large data set from 25 countries covering the period 2000-2016. We used a set of variables to formalise our model. This section presents a description of these variables.

i. Dependent variable

Our dependent variable is the quality of the environment. It is captured by the Environmental Performance Index. This index is a composite index of 24 performance indicators in ten categories covering environmental health and ecosystem vitality. These parameters provide a nationwide measure of how close countries are to meeting established environmental policy objectives. It is available at http://epi.yale.edu.

ii. Variable of interest.

Our variable of interest is legislators. It is measured by the proportion of women in the National Assembly and the Senate.

iii. Control variables

We also include six control variables from the World Development Indicator (WDI), namely:

- Income per capita (GDP). This variable is used to capture national development. Per capita income could have a significant beneficial impact on the quality of the environment according to the hypothesis underlying the Kuznets environmental curve (Sadorsky, 2013).
- Official development assistance (AID). It is measured as a percentage of GNI.
- The commercial opening (OUV). This variable makes it possible to verify the "pollution havens" hypothesis as developed by Birdsall and Wheeler (1992). Indeed,

developing countries attract environmentally damaging activities thanks to less strict environmental regulations, which reduces production costs and may therefore encourage relocation (Low and Yeats, 1992). This variable is equal to the sum of a country's exports and imports divided by its country.

- Rents (Rent): It represents the rent from the commercialisation of natural resources. It is expressed as a percentage of GDP.
- The quality of institutions: in this study we use two indicators to capture it, namely corruption, which is an indicator to capture the level of corruption in each country; we also use the level of political stability in each country.

Table 1 provides descriptive statistics of all the variables used. The existing literature inspires our choice of the different variables.

Table 1. Descriptive statistics (2000-2016)

Variables	Description	Obs	Mean	Std. Dev.	Min	Max
EPI	Environmental performance index	415	42.97372	13.63374	16.16	77.39
Fem	Women's parliamentarian's	412	18.3192	12.05237	.9	47.3
GDP	GDP per capita	425	1850.253	1892.325	256.5394	7574.282
OUV	Trade openess	423	.6748985	.2140707	.2112435	1.254776
AID	Developmentaid	425	7.453626	7.361847	.0545221	62.1866
Rent	Natural resources	425	9.975074	7.92685	.4897336	53.62712
Corrup	Corruption s	375	3.02405	.5648406	1.283263	4.048999
Polity	Political stability	425	-2.350588	20.58512	-88	9

The missing data justify the differentiation between the numbers of observations of our various variables.

The correlation analysis (Table 2 and Figure 1) suggests a positive correlation between the environmental performance of African countries and women's parliamentary representation.

Table 2: Correlation matrix of variables

	EPI	Fem	GDP	OUV	AID	Rente	Corrup	Polity
EPI	1.0000							
Fem	0.2900	1.0000						
GDP	0.5394	0.3369	1.0000					
OUV	0.1538	0.2007	0.3222	1.0000				
AID	-0.5180	-0.1388	-0.5710	-0.2296	1.0000			
Rente	-0.1661	-0.0765	-0.1738	0.0672	0.1668	1.0000		
Corrup	-0.1891	-0.1600	-0.3507	-0.0227	0.0321	0.1957	1.0000	
Polity	0.0528	0.0124	0.0874	-0.0468	-0.1347	-0.1390	-0.2315	1.0000

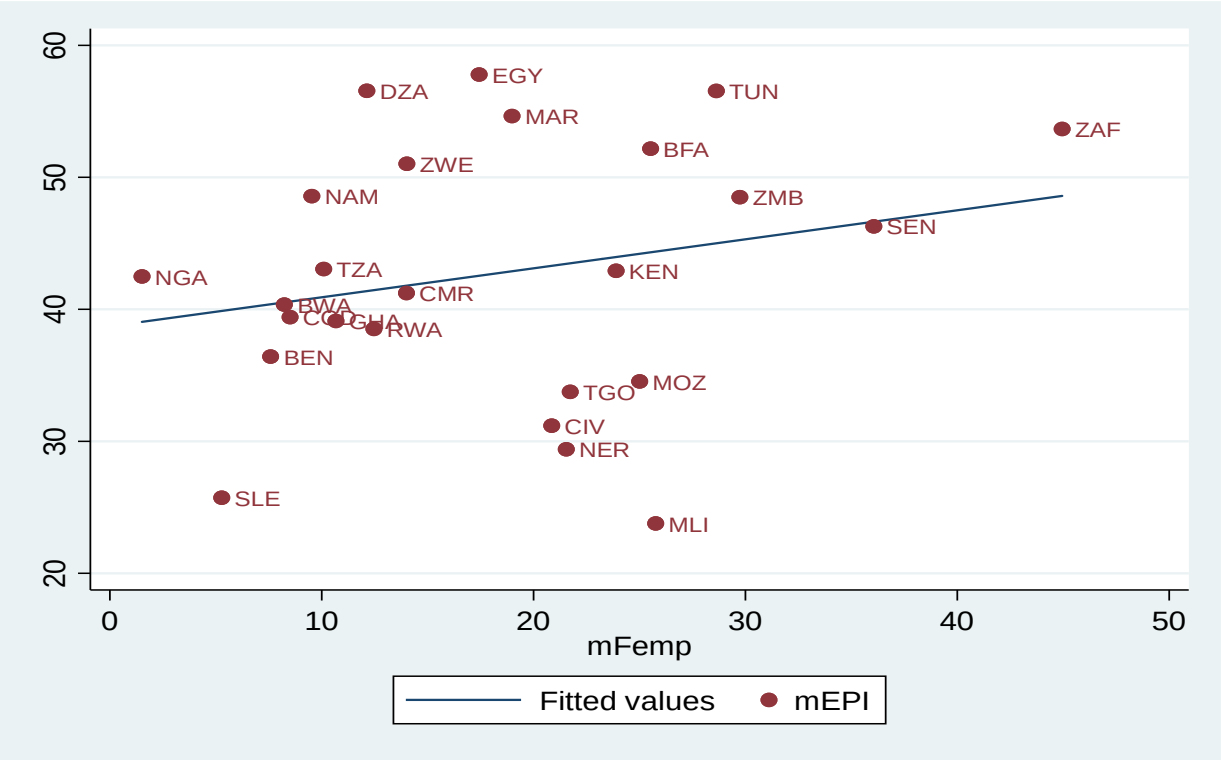

Fig1: Evolution of environmental quality with women's presence in parliament.

With regard to the other control variables our expectations are mixed with regard to the different signs. We obtained the data series on the Environmental Performance Index, parliamentary representation of women, growth, rents, development aid, political stability, corruption and trade openness from the World Development Indicator (World Bank) database, the Data-Driven Environmental Group at Yale University and the Center for International Earth Science Information Network (CIESIN) at Columbia University.

4. Results

The purpose of this analysis is to empirically estimate the effect of women's parliamentary representation on environmental quality in Africa.

4.1. Baseline estimation

Table 2 below presents the results of the impact of women parliamentarians on the environment using the ordinary least squares method. The coefficient of determination (R-squared) as well as the Fischer statistic (F) show that this model is well specified. Our findings suggest a positive and significant impact of women parliamentarians on the environmental performance of African countries. All other things being equal, an additional one point of women in parliament contributes to an improvement in environmental

performance of 6.82 percent and 8.66 percent for the bivariate models presented in columns 1 and 3. Thus, the presence of women in parliament is an asset for the improvement of environmental quality in Africa. This result is due to their caring role and their relatively structural position outside the labour market and in the home. Therefore, it is necessary to encourage the participation of women in politics in Africa for the improvement of the environmental attractiveness of African countries. This finding is similar to those found by Spitzner (2009); McCright (2010) and McCright and Dunlap (2011), who show that women are more aware and concerned about climate change compared to men. For this reason, he concludes that environmental degradation is more closely linked to activities carried out by men than by women. Similarly, Fredriksson and Le Wang (2011) and Melissa (2015) find that women legislators promote stricter environmental policies than their male counterparts. This result remains true even after removing the extreme points highlighted in Figure 1. Thus, removing these countries from the analysis does not fundamentally change the sign of our results (columns 3 and 4). However, the withdrawal of these countries has contributed to improving the environmental impact of women legislators.

Tableau 3: Women's parliamentarian'srepresentation and environmentquality (OLS)

Variables	LnEPI			
	1	2	3	4
lnFem	0.0682***	0.061101***	0.0866***	0.0721***
	(0.0167)	(0.0132624)	(0.0320)	(0.0248)
Corrup		-0.109***		-0.259***
		(0.0366)		(0.0592)
lnAID		-0.0401636**		-0.0965***
		(0.0163755)		(0.0292)
lnOUV		-0.051534		0.175**
		(0.0408226)		(0.0734)
lnRente		-0.0174		-0.0508**
		(0.0148)		(0.0219)
lnGDP		0.217***		0.177***
		(0.0172)		(0.0494)
Polity		0.088***		0.000763
		(0.0239)		(0.000944)
Constant	3.534***	2.027***	3.473***	1.706***
	(0.0440)	(0.341)	(0.0937)	(0.529)
Observations	405	365	226	205
R-squared	0.030	0.540	0.027	0.594
F test	16.64	41.09	7.345	45.54

*Notes:Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1*

In most cases (columns 2-4), the application of multivariate control variables does not help to change the meaning of women parliamentarians' relationship to the environment even if the effects diminish after the introduction of such variables. Our findings suggest that corruption is a major constraint on the environmental performance of African countries. Indeed, most national and multinational companies in Africa prefer to pay a few bribes in order to circumvent laws and regulations on environmental protection and biodiversity. Thus, the fight against corruption must be stepped up in Africa to safeguard the environment. This fight against corruption is all the more important in that it can be the cause for which the influence of development aid on the environment is negative. This is because most of the time this development aid money feeds corruption in the poorest countries (Le Monde, 2016). The majority of political instability in Africa is very often accompanied by war. This is what justifies the contribution of political stability to improving environmental quality on the continent. The quality of the institutions thus makes it possible to boost environmental performance. Thus, good institutions represent a motivation for investment in environmental protection and innovative activities. The effects of economic growth on environmental performance is consistent with the CEK assumption. Indeed, the coefficient of GDP per capita is positive and statistically significant, notwithstanding the specification. Our results thus confirm that individuals do work to improve the environment as their income increases. This is the meaning of the positive and significant sign of the variable income per capita (ln GDP). This result is consistent with that of Noubissi and Njangang (2017).

4.2. Robustness tests

To investigate the sensitivity of the results reported in Tables 2, we make robustness checks. For this purpose, we test the robustness of our results successively by using five alternative methods of estimations, namely 2SLS, 3SLS, GLS, PA, GMM and quantile. Overall, the results of the diagnostic tests show that all models are well specified. The Hansen test does not reject the validity of instruments, and the absence of second order serial correlation is also not rejected. The number of instruments is less than the number of countries, hence regression results are free from instruments proliferation. The results reported in Table 3 are qualitatively similar to those reported in Tables 2. More specifically, all the coefficients associated with women's parliamentary measures are positive and statistically significant at the conventional levels. Therefore, the empirical results are robust to the utilisation of another methods of estimation.

Tableau 4: Women's parliamentary and Environment quality: (Different estimator)

Variables	lnEPI				
	3SLS	2SLS	GLS	PA	GMM
Fem	0.00425***	0.00287**	0.00168*	0.00186**	0.0145***
	(0.00122)	(0.001)	(0.0009)	(0.0009)	(0.0009)
Corrup	-0.106***	-0.0189	-0.106***	-0.095***	-0.486***
	(0.0371)	(0.045)	(0.038)	(0.027)	(0.066)
Polity	-0.0872***	-0.0199	-0.0462**	-0.0412**	-0.352***
	(0.023)	(0.029)	(0.022)	(0.018)	(0.044)
Lnrent	-0.0206	-0.00933	-0.0177	-0.00652	-0.045***
	(0.018)	(0.017)	(0.014)	(0.014)	(0.014)
lnGDP	0.224***	0.283***	0.207***	0.222***	0.199***
		(0.027)			
	(0.019)		(0.024)	(0.014)	(0.018)
lnOUV		-0.400**			
		(0.157)			
L.lnEPI					0.523***
					(0.0940)
Constant	1.947***	0.887**	1.716***	1.601***	0.307
	(0.356)	(0.448)	(0.358)	(0.268)	(0.357)
Observations	357	363	365	365	345
R-squared	0.449	0.473			
ar1p					0.000345
ar2p					0.232
Hansenp					0.109

*Notes:Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1*

Table 4 allows us to check the robustness of the results using different estimation techniques, highlighting the important link between the regression variables and environmental quality. It can be seen that estimation by the GMM method highlights the positive and significant impact of the dependent variable lagged at the 1% threshold. This result suggests that the environmental phenomenon is an extremely slow process and therefore very dependent on past values. A policy aimed at improving the quality of the environment is therefore a long-term policy.

The majority of the previous methods focus on modelling the mean. These provide essential but limited information. It is limited in that it hides disparities, outliers and inequalities that may exist in our sample. Moreover, in order to evaluate the effect of a public policy, it is often relevant to go beyond the effect means of that policy. Quantitative regression precisely allows us to solve these various problems inherent to the average and thus appears to be more robust than other methods. Indeed, it allows a more precise description of the distribution of a

variable of interest conditional on its determinants than a simple linear regression, which focuses on the conditional mean.

Table 5: Estimation of the impact of women's parliamentary representation on the environment using the quantiles method

	lnEPI							
VARIABLES	1	2	3	4	5	6	7	8
Fem	0.00881	0.00147	0.00703***	0.00236*	0.00621***	0.00570***	0.0118***	0.00483***
	(0.00986)	(0.00177)	(0.00105)	(0.00139)	(0.000946)	(0.00124)	(0.00213)	(0.000902)
LnGDP		0.170***		0.194***		0.144***		0.158***
		(0.0251)		(0.0237)		(0.0505)		(0.0261)
LnOUV		-0.00435		-0.125**		-0.237***		-0.0376
		(0.0952)		(0.0482)		(0.0492)		(0.0354)
LnAID		-0.0585*		-0.00791		-0.0497*		-0.00552
		(0.0314)		(0.0176)		(0.0266)		(0.0171)
Lnrent		0.00767		-0.0180		-0.0146*		-0.0343**
		(0.0206)		(0.0189)		(0.00765)		(0.0155)
Constant	3.078***	2.271***	3.412***	2.106***	3.633***	2.544***	3.881***	2.904***
	(0.229)	(0.220)	(0.0225)	(0.228)	(0.0190)	(0.402)	(0.0530)	(0.239)
Obs	405	403	405	403	405	403	405	403
q1	0.100	0.100	0.250	0.250	0.500	0.500	0.900	0.900

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1 represent the signification level.

For the variable "fem", the determination coefficients are all positive, they even have low values, and tend to increase when the order of the quantiles increases. The slopes are significatively different among them. The presence of women in parliament therefore has a greater impact on the higher environmental performance indices than on the lower ones. Thus, increasing the number of women parliamentarians in Africa is good for the environment. This result confirms those found by Adams and Funk (2012) and Sundstrom and McCright (2014) who found that the fewer women in an institution, the less concerned they are about environmental issues. Table 6 also confirms this result. Indeed, we obtained the results in Table 6 by splitting our sample into two subgroups. The first group consists of countries with an average of less than 25% women in parliament over the study period and the second of those with at least 25%. The results indeed suggest that the role of women parliamentarians in improving environmental quality is much more important for the second group. Thus, the more women there are in parliament, the more environmental quality is improved in Africa.

Table 6: Impact of women's parliamentary representation on the quality of the environment according to their proportions.

	Sub-group 1 Average of less than 25% women parliamentarians		Sub-group 2 Average of at least 25% women parliamentarians	
VARIABLES	lnEPI		lnEPI	
lnFem	0.0482**	0.126***	0.319***	0.288**
	(0.0213)	(0.0148)	(0.0938)	(0.115)
lnGDP		0.239***		0.236**
		(0.0335)		(0.0954)
lnOUV		-0.136***		0.520***
		(0.0442)		(0.133)
lnAID		-0.0304*		0.0962
		(0.0180)		(0.0710)
Corrup		-0.0164		-0.257**
		(0.0250)		(0.117)
Polity		0.00185***		-0.00153**
		(0.000523)		(0.000667)
Constant	3.583***	1.767***	2.681***	1.759*
	(0.0488)	(0.299)	(0.330)	(0.930)
Observations	289	259	116	104
R-squared	0.015	0.528	0.113	0.558
F	287	252	11.58	28.39

Sub-group1 : Benin; Burkina Faso; Cameroon; Cote d'Ivoire; Ghana; Kenya; Nigeria; Rwanda; Senegal; Tanzania; Zambia

Sub-group2 : Algeria; Botswana; Congo, Dem, Rep; Egypt, Arab Rep; Mali; Morocco; Mozambique; Namibia; Niger; Sierra Leone; South Africa; Togo; Tunisia; Zimbabwe.

*Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1*

Then for the variable income per capita, the coefficients determinations are all positive and tend to fluctuate in the order of the quantiles. Its coefficient seems to reach its peak for the order of quantile equal to 25% or according to the hypothesis of the Kuznets environmental curve, one would expect an increase in its coefficient following its increase. This result can be explained by the existence of a real unequal income distribution at the level of our sample. The slopes are not homogeneous. Per capita income therefore has a positive impact on improving environmental performance regardless of gender.

The variables "InAID and InRent" have negative impacts on environmental performance with the increase in the order of quantiles. These results are in line with economic theories on environmental issues. Indeed, the negative impact of trade opening on environmental performance confirms the hypothesis that African countries can be a pollution haven for developed countries. This result also confirms that the over-exploitation of natural resources is harmful to our environment, so African countries would gain in the long term from moving

away from dependence on natural resources to improve the quality of the environment in Africa.

In summary, the robustness analysis allows us to conclude that our results are not weakened by problems of endogeneity nor by an omitted variable bias. Moreover, the results remain unchanged with respect to the alternative specification.

4.3. Mediation

The previous estimates are quite interesting as they provide useful information on how women's parliamentary representation affects malnutrition in Africa. However, the estimates do not indicate the importance and significance of channels from ICTs to malnutrition. In order to test the channels highlighted in the literature, we use a causal mediation analysis. The effect of women's parliamentary representation on each potential transmission channel is shown in Table 6.

Table 6: Results of the structural model.

Variables	LnGDP	Corrup	LnAID
Fem	0.0178***	-0.0079***	-0.01745***
	(0.0041)	(0.00209)	(0.00661)
Constant	1.6652***	3.1751***	1.6652***
	(0.1408)	(0.06763)	(0.1588)
Observations	363	363	363

Note: *Bootstrap standard errors in parentheses; *** is statistical significance at 1% level.*

The results in Table 6 show that the presence of women in parliament has a positive and significant influence on per capita income. All other things being equal, an increase in the number of women in parliament significantly stimulates economic growth. In fact, an additional woman in parliament leads to an increase in per capita income of almost 2%. This result is similar to that of Jayasuriya and Burke, 2013. In addition, women's representation in parliament negatively and significantly influences corruption and development aid. These results are similar to those of Hicks et al (2015 and 2016) and are in contrast to those of Dollar et al (2001) and Swamy et al (2001). Ultimately, the presence of women effectively contributes to better quality institutions because it reduces corruption, increases economic growth and therefore reduces dependence on development aid.

Since the presence of women in parliament partly explains the variation in transmission channels, we calculate the direct and indirect effects of women's parliamentary representation on environmental performance. The estimated coefficients of equation (3) are presented in Table 3 and the coefficient for women in parliament includes both the direct and indirect effect. In addition to its total effect, we have calculated its indirect effects using the Sobel coefficient product approach. Standard errors are corrected using the bootstrap procedure. The results are presented in Table 7.

Table 7: Indirect effects of women's parliamentary representation on environmental performance

Transmission channel	lnGDP	Corrup	lnAID
Indirect effect ($\beta_1\varphi$)	0.002776***	0.0001539*	0.0008139*
	(0.0008911)	(0.0002062)	(0.0004417)
% of the mediated effect	41 %	4 %	17 %

Note: *Bootstrap standard errors in parentheses; *, *** is statistical significance at 10% and 1% level respectively.*

The first observation we make from Table 8 is that channels have mediated the effects of women's parliamentary representation on environmental performance. Over the study period, women's parliamentary representation has indirectly contributed to improving environmental quality in Africa through per capita income, anti-corruption and development assistance. Thus, we determine the contribution of each channel to the total effect of women's presence in parliament on environmental quality using the formula $(\frac{\beta_1\gamma}{\alpha+\beta_1\gamma})$. We certify that 41%, 4% and 17% of the total positive effects of women parliamentarians on environmental quality are due to per capita income, anti-corruption and development aid respectively.

The indirect positive effects of women parliamentarians on the environment reveal that these are due to better integration into the national productive system and socio-political life. As a first approximation, analysis of the impact of women's presence in parliament suggests that countries that give women parliamentarians a greater role in overseeing economic life, administration and anti-corruption mechanisms could rapidly improve the quality of the environment. It is difficult to directly compare our results with existing research because previous studies are almost non-existent on the one hand and on the other hand, they have not highlighted the role and importance of transmission channels.

5. Conclusion

African countries have seen an increase in the emancipation of women, in terms of schooling rates and participation in the management of the city. This emancipation of women offers real assets for the development of other sectors of activity. One of the central challenges of women's participation in the management of the city is their contribution to the realisation of a true green revolution.

This study estimates the impact of women's presence in parliament on the quality of the environment in Africa. Specifically, we study the direct and indirect aspects of the effects of women's parliamentary representation on the environmental performance of 25 sub-Saharan African countries over the period 2000-2016. The results of the static panel show that increasing women's presence in parliament has a positive and significant effect on the environmental quality indicator selected for this study.

As a complement to the previous analysis, we use causal mediation analysis to highlight the role and importance of channels from women parliamentarians to the environment. Overall, the results show that per capita income, corruption and development assistance are the channels through which women parliamentarians affect the environment in Africa. Specifically, women parliamentarians have a beneficial indirect impact on the quality of the environment in Africa.

Overall, this study has shown that there are environmental benefits associated with increasing the number of women in parliament in Africa. From a policy perspective, the following measures could be adopted in order to achieve a real improvement in the quality of the environment in Africa. Firstly, governments should create conditions to facilitate and encourage women to participate in the economic and political life of their countries. These measures could increase the indirect effect of women parliamentarians on the quality of the environment.

Second, governments need to increase the presence of women in institutions as they are involved in improving the quality of institutions. Good quality institutions are useful for improving the quality of the environment.

One of the limitations of this study is that the conclusions and policy recommendations apply at the regional level and do not take into account the specificities of each country. In fact, there are some differences in the pattern of women's parliamentary representation in African countries. Therefore, it is important to extend this study to the national level to obtain additional information on the impact of these policies. Future studies could also extend this work by identifying additional transmission channels.

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