ENVIRONMENTAL PERFORMANCE AND WOMEN'S EMPOWERMENT: IS THE PARTICIPATION OF WOMEN IN DECISION-MAKING ASSOCIATED WITH STRONGER ENVIRONMENTAL POLICIES?

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ENVIRONMENTAL PERFORMANCE AND WOMEN'S EMPOWERMENT: IS THE PARTICIPATION OF WOMEN IN DECISION-MAKING ASSOCIATED WITH STRONGER ENVIRONMENTAL POLICIES?

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ABSTRACT

A small but growing research literature has found positive correlations between the participation of women in political decision-making and the comprehensiveness of the environmental policies in a country. In this thesis, I hypothesize that political empowerment of women is associated with greater environmental protection. Using a comprehensive dataset covering 194 countries in the time span between 2007 and 2015, I find substantial empirical support for my hypothesis. The results of this statistical analysis with aggregate indicators for female empowerment and environmental performance suggest that a positive and statistically significant association between both variables exists. This finding is robust to the inclusion of confounding factors such as GDP per capita, GDP growth, level of democratization, urbanization, industrialization, military expenditures, and globalization, and is consistent with the existent body of research. From a policy perspective, these results support the notion that legislators promoting comprehensive efforts towards promoting gender equality could potentially enjoy the added benefit of stronger environmental policies and protection efforts.

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INTRODUCTION

Anthropogenic climate change and environmental degradation constitute one of the most pressing issues of the 21st century,[1] yet different countries have demonstrated disparate levels of commitment to address these challenges.[2] As such, it is relevant to study all potential sources of these differences in policy response.[3] In this thesis, I attempt to identify whether the political empowerment of women in a society might potentially contribute to the implementation of stronger environmental protections across different countries.

A small but growing number of studies find positive correlations between indicators related to women's empowerment and the environmental performance of different countries and communities. Nugent and Shandra, for example, find a positive association between protected land area and an index for women's political status[4]; while Mavisakalyan and Tarverdi find a positive association between the proportion of women in national parliaments and the strength of climate change policies in a country.[5] Most of the literature does not assert a causal relationship, but any causal links that might be established in the future would point to the political empowerment of women as an important aspect of environmental policy to harness in the future. This thesis will attempt to complement this existing body of research through regression analysis using panel data from the 2018 Quality of Government dataset.

I begin by reviewing the theoretical literature on feminist perspectives addressing the role of gender in environmental policy, as well as the main findings of a selection of empirical studies.

[1] Christina Ergas and Richard York, "Women's status and carbon dioxide emissions: A quantitative cross-national analysis," *Social Science Research,* Vol. 41 (2012).
[2] Astghik Mavisakalyan and Yashar Tarverdi, "Gender and climate change: Do female parliamentarians make difference?" in *European Journal of Political Economy* (2018).
[3] *Ibid.*
[4] Colleen Nugent and John M. Shandra, "Environmental Protection Efforts, Women's Status, and World Polity: A Cross-National Analysis," *Organization & Environment,* Vol. 22, No. 2 (June 2009).
[5] Mavisakalyan and Tarverdi.

Results are generally consistent across the literature, with studies that find a positive association between different indicators for environmental performance and women's empowerment.

I then detail some of the potential causal explanations proposed in both the theoretical and empirical literature for the positive association between environmental performance and women's empowerment. Theoretical ecofeminist perspectives, as well as some articles from the psychology discipline, argue that certain characteristics intrinsic to women make them particularly inclined to protect the environment. The intersectional view, on the other hand, considers that unequal power structures related to a diverse set of factors such as "gender, socioeconomic status, ethnicity, nationality, health, sexual orientation, age and place" [6] may help explain why women may think and act differently than men with relation to the environment. Another possibility is that it may be the existence of a progressive society that leads to higher levels of both women's empowerment and environmental performance.

Finally, I conduct an empirical analysis with a standard OLS model. In this section, I analyze the relationship between aggregated indicators for female empowerment (*Women Political Empowerment Index*) and environmental performance (*Environmental Performance Index*) to see if results are consistent with previous studies. I then experiment with different dependent and control variables to test whether the same relationship holds.

My results are mostly consistent with findings in the literature. I find a positive association between the *Women Political Empowerment Index* (WPEI) and the *Environmental Performance Index* (*EPI*) in the baseline model, and baseline model results are consistent across three different dependent variables attempted. I also expand the baseline model with the *EPI* as my main

[6] Anna Kaijser and Annica Kronsell, "Climate change through the lens of intersectionality," *Environmental Politics*, Voo. 23, 2014, cited in Marcela Tovar Restrepo, "Planning for Climate Change," *Routledge Handbook of Gender and Environment,* ed. Sherilyn MacGregor (New York: Routledge, 2017), 416.

dependent variable to include an additional set of controls, after which the positive association holds, becomes increasingly significant and of a slightly larger magnitude. Some of the alternate dependent and independent variables attempted did not yield significant coefficients, although none of my results directly contradict findings in the literature.

BACKGROUND AND LITERATURE REVIEW

According to Seema Arora-Jonsson, the inclusion of gender in the analysis of environmental policy and practice began in the 1970s, and expanded during the 1980s.[7] It was French Feminist Françoise D'Eaubonne who first coined the term *ecological feminism*, or *ecofeminism*.[8] Ecofeminism associates environmental problems to androcentrism, or the patriarchal domination of men over everything, and is particularly concerned with the domination over women and nature.[9] The logical corollary of this theoretical approach is that the liberation of women will lead to the liberation of nature.[10]

Critics of ecofeminism such as Cecile Jackson have argued that the ecofeminist approach is *essentialist*,[11] and that it idealizes women and ignores the differences between them, particularly between women of the "Global North" and "Global South", where "the former tend to construct the latter as 'victims.'"[12] Vandana Shiva, an ecofeminist activist from India, does address the North-South divide in her work, and argues that "Western patriarchal development (or

[7] Seema Arora-Jonsson, "Gender and Environmental Policy," in MacGregor, 289.
[8] Susan Buckingham-Hatfield, *Gender and Environment* (New York: Routledge, 2000), 35.
[9] Jon S. Dryzek, *The Politics of the Earth*, 3rd ed. (Oxford: Oxford University Press, 2013), 189.
[10] *Ibid*.
[11] Such as Cecile Jackson; see Buckingham-Hatfield, *Gender and Environment*, 40-41.
[12] Buckingham-Hatfield, 40-41.

'maldevelopment') strategies (…) have victimized women, non-Western peoples, and nature," and that "rural indigenous women are the original givers of life and are therefore the rightful caretakers of nature."[13] Jackson, on the other hand, takes issue with the essentialism she identifies in Vandana's discourse – the assumption that female nature is unchanging, intrinsically related to nature, and uniform.[14]

Janet Biehl, another critic, objects to aspects of ecofeminism she views as "backward-looking", such as what could be construed as "goddess worship arguing" and the rejection of Western values, many of which she believes should not be discarded, such as "emancipation, democracy, civil society and public space."[15] Val Plumwood argues that focusing on women's closeness to nature risks likening women to "global super housewives" who must clean up the planet,[16] in addition to the tasks they already have, and Carolyn Merchant cautions against adopting a dualistic ecofeminist perspective that excludes all men – instead she advocates for "a partnership ethic in which men and women enjoy a non-hierarchical partnership with nature."[17]

In the 1990s, an approach termed *gender mainstreaming* gained ground, partly as a response to feminist criticism of large-scale environmental projects that did not consider gender issues, and as an effort to emphasize women's agency in environmental matters, instead of perceiving them as victims.[18] Gender mainstreaming refers to "the inclusion of a gendered analysis and concerns at all stages of the policy process," and became a priority in development programs in the 1990s.[19] Economic empowerment policies based on this theoretical approach, however, such as micro-

[13] Bernadette P. Resurrección, "Gender and Environment in the Global South," in MacGregor, 72-73.
[14] Janet Biehl, *Rethinking Eco-feminist Politics* (Boston: South End Books, 1991), cited in Buckingham-Hatfield, 41.
[15] *Ibid*.
[16] Val Plumwood, *Feminism and the Mastery of Nature* (London: Routledge, 1993), cited in Buckingham-Hatfield, 39.
[17] Carolyn Merchant, *Earthcare: Women and the Environment* (London: Routledge, 1996), cited in Buckingham-Hatfield, 39.
[18] Arora-Jonsson, 290-291.
[19] *Ibid*.

credit programs for women, have had mixed results, and critics have argued that the disregard for women's preferences and lack of understanding of their day-to-day circumstances simply brings them into an exploitative capitalist structure.[20] Critics also posit that governance approaches that incorporate women into "existing structures and organizations" are not necessarily effective either, since these structures remain dominated by men.[21] In other words, "it is not enough to 'add women and stir.'"[22] Röhr et al. argue that gender mainstreaming has had limited success because it is also necessary to understand and question the differential power that underpins gender relationships, and dismantle structural gender inequality in order to generate meaningful change.[23]

Feminist political ecology, an approach that also emerged in the 1990s, sought to distance itself from essentialist theories. It recognized unequal power relationships between women and men as the main force shaping the access of different genders to resources, yet underlined that it is not power asymmetry alone, but in interaction with other factors such as class, caste, race, culture and ethnicity, that determines processes of ecological change.[24] Much of the more recent literature addresses what is referred to as a *feminist intersectionality approach*, which focuses on power structures to illustrate how different groups relate differently to climate change, depending on specific characteristics and dynamic social contexts, such as "gender, socioeconomic status, ethnicity, nationality, health, sexual orientation, age and place."[25]

[20] Arora-Jonsson, 294-295.
[21] *Ibid*.
[22] *Ibid*.
[23] Ulrike Röhr, Meike Spitzner, Elisabeth Stiefel and Uta v.Winterfeld, *Gender justice as the basis for sustainable climate policies*. Bonn: German NGO Forum on Environment and Development / genanet. Cited in Susan Buckingham, "Gender and climate change politics," in MacGregor, 389.
[24] Dianne Rocheleau, Barbara Thomas-Slayter, and Esther Wangari, *Feminist Political Ecology: Global Issues and Local Experiences* (Psychology Press: 1996), cited in Resurrección, "Gender and Environment in the Global South," in MacGregor, 76.
[25] Anna Kaijser and Annica Kronsell, "Climate change through the lens of intersectionality," *Environmental Politics*, Voo. 23, 2014, cited in Marcela Tovar Restrepo, "Planning for Climate Change," in MacGregor, 416.

As for the existing empirical studies that examine this relationship, most available research, based on cross-country regression analysis, has found a positive association between various indicators for female empowerment and national environmental performance.

For example, Norgaard and York found that countries with a higher proportion of women in parliament are more likely to approve environmental agreements, although they concede that the ratification of treaties does not necessarily translate into genuine environmental protection, and that more research is needed on this aspect.[26] The results of a study by Colleen Nugent and John M. Shandra indicated "strong support for the idea that increasing women's political status in particular through representation in national government has a positive effect on state environmental protection efforts," although their results did not support the idea often espoused by ecofeminists that the oppression of women is associated with environmental degradation.[27] Nugent and Shandra's approach is distinct in that it rejects the idea that overall female empowerment is strongly associated with an increase in protected land area, because three of the four components considered as representative of women's empowerment (education, economic/labor status, and health) did not have a strong relationships with protected land area – only women's political status did.

Ergas and York found that in countries where women have a higher political status, per capita CO_2 emissions tend to be lower, although Rebecca Pearse is skeptical and argues that these results do not fully explain the relationship between emissions and gender, because the authors merely "'add' gender to a pre-existing 'world systems theory' of the macro-structural factors behind climate change."[28] A 2015 article by McKinney and Fulkerson finds that "nations with greater

[26] Kari Norgaard and Richard York, "Gender Equality and State Environmentalism," *Gender & Society*, Vol. 19 No. 4 (August 2005). See also Nugent and Shandra.
[27] Nugent and Shandra.
[28] Ergas and York, cited in Rebecca Pearse, "Gender and climate change," *WIREs Climate Change*, Vol. 8 (2017).

female representation in governing bodies have lower climate footprints,"[29] and research by Mavisakalyan and Tarverdi from 2018 finds that there is an association between the proportion of women in parliament and the existence of stricter climate change policies, as well as lower CO_2 emissions.[30]

While the aforementioned studies on gender power relations and state environmental performance use different variables to represent female empowerment and environmental performance across countries, they all reach compatible conclusions, in the sense that they find a positive correlation between the participation of women in decision-making and national environmental performance. As of April 2019, no statistical studies have been located with results that contradict the findings of the research mentioned above. Rebecca Pearse, however, cautions that "claims that better decision-making flows from gender equal participation may be overly hopeful," since there are many other obstacles to successful environmental policies in addition to the limited presence of women in decision-making bodies.[31]

CONCEPTUAL MODEL AND HYPOTHESIS

The main hypothesis of this thesis is that the presence of women in political decision-making is positively associated with greater levels of environmental protection in a country, and that this association is both substantively (of significant magnitude) and statistically significant. While an increasing amount of research on the issue finds that indicators related to female empowerment

[29] Laura A. McKinney and Gregory M. Fulkerson, "Gender Equality and Climate Justice: A Cross-National Analysis," *Social Justice Research* (June 2015).
[30] Mavisakalyan and Tarverdi.
[31] Pearse.

and environmental performance of a country are positively correlated, the vast majority stops short of affirming a causal relationship. Mavisakalyan and Tarverdi are among the only researchers to posit a causal link in the positive association they find between the proportion of women in parliaments and stronger climate change policies in a country.[32] I will not seek to investigate whether this link is causal, although some theories allude to possible causal explanations for a positive correlation.

Some research from the psychological perspective points to the possibility that there are intrinsic female characteristics that mediate the link between gender and environment.[33] Certain studies have found that women have higher levels of empathy, for example, defined as a tendency or ability to perceive or feel other's emotions; and men have a higher social dominance orientation, meaning that they tend to believe that "superior groups should dominate inferior groups."[34] The idea is that this makes women more likely to be concerned with the well-being of non-human life.

Ecofeminist perspectives, mentioned above in the literature review, also believe that certain characteristics intrinsic to women lead them to adopt more environmentally caring behavior. Researchers in the cultural ecofeminism tradition, for example, contend that women's proximity to nature is related to biological processes unique to female bodies, such as childbirth, and are thus are more attuned to nature's needs.[35] Social ecofeminists, on the other hand, argue that because women have long been subjugated based on their social roles, they "share with nature a feeling of being dominated," and are thus more likely to defend nature from harm.[36] The *intersectional* view

[32] Mavisakalyan and Tarverdi.
[33] João Graça, Maria Manuela Calheiros, Abílio Oliveira, and Taciano L. Milfont. "Why are women less likely to support animal exploitation than men? The mediating roles of social dominance orientation and empathy," *Personality and Individual Differences,* Vol. 129 (2018). See also Taciano L. Milfont and Chris G. Sibley, "Empathic and social dominance orientations help explain gender differences in environmentalism: A one-year Bayesian mediation analysis," *Personality and Individual Differences* Vol. 90 (2016).
[34] *Ibid*.
[35] Buckingham-Hatfield, 35-37.
[36] *Ibid*., 37.

contends that the presence of women in decision-making helps break down the structure behind gendered power relations, as feminist political ecologists would argue.

Another possible explanation for a positive correlation between female empowerment and environmental protection could be that the presence of women in political decision-making reflects a generally progressive society, which is what actually leads to more protective environmental policies. According to this perspective, the chain of causality works in a different direction: it is a progressive society that leads to policies that favor both female empowerment and the protection of nature, instead of female empowerment leading to progressive policies favoring the protection of the environment.

This leaves us with three alternative explanations: (1) it is the presence of women as such in decision-making that leads to stronger national environmental policies; (2) the presence of women in decision-making, in interaction with other factors such as social class and race, modifies the structure of gendered power relations and thus the relationship of society with the natural world; (3) it is the development of a progressive society that leads to both female empowerment and better environmental outcomes (see **Figure 1**).

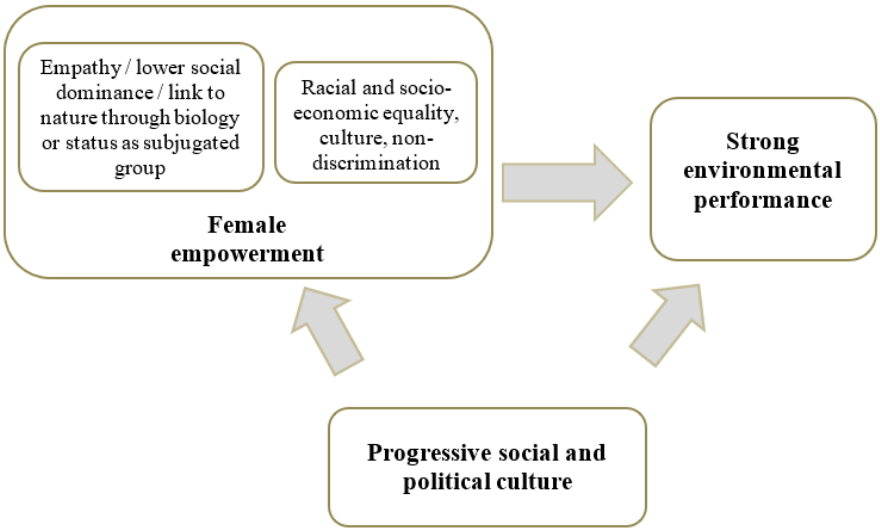

Figure 1. Alternative theoretical approaches.

EMPIRICAL ANALYSIS

There are several versions of the 2018 Quality of Government dataset, of which the most complete is the standard version.[37] It includes close to 2,100 variables and draws on more than 100 data sources. There are two variants of the standard version: the cross-sectional variant and the time-series variant; I have used the latter. The variables with which I perform the statistical analysis are described in **Annex 1** (see also **Annex 2** for descriptive statistics).

The first step in the data analysis will be to test the hypothesis that there exists a positive correlation between female empowerment and the environmental performance of a country. To mitigate concerns that my results are driven by confounding factors, I include three control variables. To test my hypothesis, I will use a standard OLS model. The model can be written such that:

$$\boldsymbol{EPI}_{t+1} = \beta_0 + \beta_1 \boldsymbol{WPEI}_{t} + \beta_2 \boldsymbol{log\ of\ GDP\ per\ capita} + \beta_3 \boldsymbol{GDP\ Growth\ Rate} + \beta_4 \boldsymbol{Polity}$$

Where *EPI* (*Environmental Performance Index*) is the dependent variable, and *WPEI* (*Women Political Empowerment Index*) is the key independent variable. The *WPEI* is an aggregate indicator for female empowerment that considers the level of agency and participation in decision-making that women in a society have.[38] The *EPI* is an aggregate indicator for the performance of a country on different environmental indicators, that gauges how close they are to established policy goals.[39] To account for the fact that any potential effect of female political empowerment is not immediate, I take the first lag of all right-hand side variables. Finally, I include time fixed effects to control for specific annual events that might have affected all countries in a given year. Given the low

[37] See https://qog.pol.gu.se/data/datadownloads/qogstandarddata.
[38] See **Annex 1** for more details. See also https://www.v-dem.net/en/news/new-measure-womens-political-empowerment/.
[39] The Environmental Performance Index (EPI) is calculated from two indices: Environmental Health and Ecosystem Vitality; see **Annex 1** for more details. See also https://epi.envirocenter.yale.edu/.

annual variation in my independent variable within the timeframe of my analysis, I chose to estimate my baseline model without including country fixed effects.[40]

The control variables included are *GDP per capita* (logged)[41], *GDP Growth Rate* and *Polity Score*. The inclusion of *GDP per capita* and *GDP Growth Rate* seeks to account for the influence that GDP may have on a country's environmental performance. It is possible, for example, that countries with environmentally protective practices have them because they can afford to implement them. Ergas and York mention research that posits the existence of an "Environmental Kuznets Curve," which follows an inverted "U" shape, where environmental degradation initially increases with economic development, but gradually decreases again after GDP per capita reaches a certain point.[42] According to this view, for high levels of development, one might expect better environmental outcomes. However, other scholars argue that economic development is a consistent driving force behind the exploitation of the environment.[43] Although there is disagreement regarding the nature of the influence of GDP on environmental performance,[44] most of the literature that regresses a dependent variable related to environmental policy on an independent variable related to female empowerment includes a control related to economic development – most frequently, GDP per capita.[45]

Figure 2 visually illustrates the relationship between the two indexes selected for this thesis and GDP per capita. There is a large group of countries that seem to exhibit high levels of all three variables (*EPI, WPEI* and *GDP per capita*), which is consistent with the Kuznets curve theoretical

[40] Using a fixed effects model and more complex econometric estimation techniques (ECM, GMM), my results are somewhat weaker, but still remain qualitatively similar (see **Table 6**, **Appendix 4**).
[41] The *GDP per capita* variable has been logged in order to normalize the distribution of the variable, which was skewed to the right.
[42] Ergas and York.
[43] *Ibid*.
[44] *Ibid*.
[45] See **Annex 3** for a table of the variables included in a representative sample of the literature.

approach. However, there are also countries that exhibit low to mid-level GDP values and high EPI values (with mid-level WPEI values), and countries exhibiting high GDP values and low to mid-level EPI values (with very low WPEI values). Most of the countries with EPI values below 50 seem to have smaller GDP levels, yet they exhibit substantial dispersion of WPEI levels.

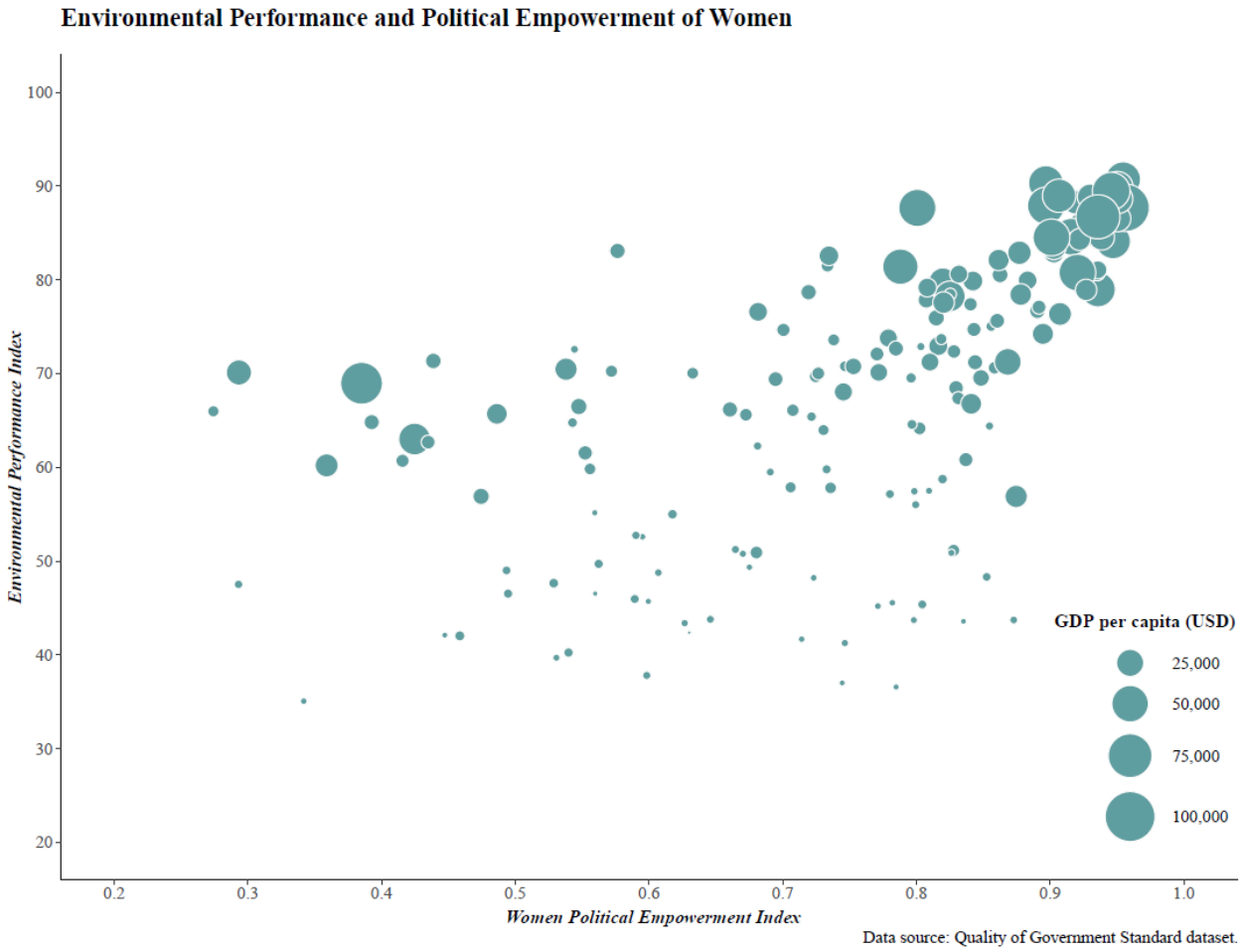

Figure 2. Scatterplot of key dependent and independent variables, with GDP.

Polity is a scale variable that ranges from -10 (for strongly autocratic countries) to +10 (for strongly democratic countries). This control seeks to account for the possibility that it is progressive values in society that could lead to both female empowerment and strong environmental policies – progressive countries do tend to have more comprehensive environmental

protections in place, so it is a variable that is likely positively correlated with both our independent and dependent variables. Mavisakalyan and Tarverdi (2018), for example, find that democracies have more stringent climate policies than other political regimes.[46] Most of the literature includes a control variable accounting for the level of democratization or political freedom of countries (see **Annex 3**).

After running this baseline regression, I examine results with two other variants of my dependent variable, *Ecoregion protection* and *Environmental policy performance.* I then add four additional controls (*Percentage of urban population, Value added of industry as percentage of GDP, Military Expenditure Index,* and *Index of Globalization*) to see if the same relationship between my key dependent and independent variables holds, and finally I experiment with additional variables, both dependent (*CO_2 emissions per capita*) and independent (*Proportion of seats held by women in national parliaments, Women's Economic Rights, Women's Social Rights, and Women's Political Rights).*

RESULTS

The baseline model yields a coefficient that is positive and statistically significant at the 95% level, although it is substantively not very large (the *EPI* is measured on a scale of 1 to 100). The results indicate that, holding control variables constant, every additional unit of women's empowerment (measured on a scale of 0 to 1) is associated with an increase in value of the *EPI* of 4.558 points (see model 1 in **Table 1**).

When I attempt a different dependent variable, *Ecoregion protection* (measured on a scale of 0 to 10), every additional unit of women's empowerment is associated with an increase in *Ecoregion*

[46] Mavisakalyan and Tarverdi.

protection of 3.781, holding the included control variables constant. This is both substantively and statistically significant, and consistent with baseline results (model 2).

I also tested the model with *Environmental policy performance*, which is measured on a scale of 1 (worst) to 10 (best). This yields a positive and significant coefficient of 3.264 (model 3), although it must be noted that this variable only has data on countries belonging to the Organization for Economic Co-operation and Development (OECD) and the European Union (EU).

Table 1. Linear regressions with control variables (models 0, 1, 2, and 3).

	Model 0 (Y = EPI)	**Model 1 (Y = EPI)**	**Model 2 (Y = Ecoregion protection)**	**Model 3 (Y = Environmental policy performance)**
Women Political Empowerment Index	3.831** (1.758)	4.558** (1.935)	3.781*** (1.329)	3.264*** (1.024)
GDP per capita *(logged)*		4.755*** (.613)	-.062 (.186)	.118 (.272)
GDP growth rate		-.029** (.012)	.008 (.008)	.007 (.008)
Polity		.003 (.049)	-.005 (.017)	.015 (.017)
Constant	61.683 (1.754)	22.444*** (5.375)	4.287*** (1.511)	1.78 (2.741)
R^2 (overall)	0.162	0.753	0.066	0.282
***Wald* X^2**	389.26	368.72	25.69	72.94
Number of countries	167	157	154	38
Number of observations	1,468	1,359	905	152

Robust standard errors in parentheses. *, **, *** indicate significance at the 90%, 95%, and 99% level, respectively.

EXPANDING THE MODEL

The inclusion of additional controls in the baseline model (with *EPI* as the dependent variable) yields the following results (see **Table 2**).

Urban population, which measures the percentage of the population that lives in urban areas, and a variable for industrialization (*Industry, value added*, as a percentage of GDP), are included

because of their potential positive association with higher levels of environmental degradation, as some of the literature has found.[47] *Urban population* yields a coefficient that remains significant at the 95% confidence level, yet smaller than the baseline model coefficient. The addition of *Industry, value added*, however, results in a coefficient nearly equal to the baseline model, with 95% significance (see expanded models 1A and 1B in **Table 2**).

The *Military Expenditure Index* variable was added because some of the literature has also found it is associated with increased environmental degradation (model 1C).[48] Finally, *Index of Globalization* (which considers economic globalization, social globalization and political globalization) is included to control for the fact that more open countries may be more willing to cooperate on environmental problems.[49] Including the *Military Expenditure Index* increases the magnitude of the coefficient by 0.676 (to 5.268), with 95% significance, and including the *Index of Globalization* increases the coefficient slightly further, to 5.425, with a 99% significance level. This means that, holding these control variables constant, every unit increase in the *WPEI* is associated with an increase in the *EPI* of 5.425 units.

While this result may be only moderately significant in magnitude, results for the baseline model were consistent with three different measures of environmental performance (*EPI, Ecoregion protection* and *Environmental policy performance*), and were also consistent with our main dependent variable (*EPI*) in the expanded model described above.

[47] Ergas and York.
[48] *Ibid*.
[49] Per G. Fredriksson and Eric Neumayer, "Democracy and climate change policies: Is history important?" in *Ecological Economics* 95 (2013).

Table 2. Linear regressions with additional control variables (models 1, 1A, 1B, 1C, and 1D).

	Model 1 (Y = EPI)	Model 1A (Y = EPI)	Model 1B (Y = EPI)	Model 1C (Y = EPI)	Model 1D (Y = EPI)
Women Political Empowerment Index	4.558** (1.935)	3.956** (2.625)	4.592** (1.976)	5.268** (2.067)	5.425*** (2.04)
GDP per capita *(logged)*	4.755*** (.613)	3.288*** (.707)	3.453*** (.682)	3.773*** (.681)	3.6*** (.693)
GDP growth rate	-.029** (.012)	-.021* (.011)	-.025** (.012)	-.032*** (.012)	-.031** (.012)
Polity	.003 (.049)	.003 (.05)	-.011 (.056)	.022 (.056)	.020 (.057)
Urban population (% of total)		.203*** (.043)	.205*** (.048)	.185*** (.05)	.169*** (.048)
Industry, value added (% of GDP)			.011 (.022)	.029 (.023)	.03 (.023)
Military Expenditure Index				-.623 (.449)	-.62 (.45)
Index of Globalization					.049** (.023)
Constant	22.444*** (5.375)	23.967*** (5.214)	22.219*** (5.04)	22.701*** (5.492)	22.014*** (5.315)
R^2 (overall)	0.753	0.692	0.709	0.728	0.7453
***Wald* X^2**	368.72	412.09	379.27	386.67	402.26
Number of countries	157	157	150	142	142
Number of observations	1,359	1,359	1,258	1,176	1,176

Robust standard errors in parentheses. *, **, *** indicate significance at the 90%, 95%, and 99% level, respectively.

ADDITIONAL VARIABLES ATTEMPTED

In addition to *EPI*, *Ecoregion protection* and *Environmental policy performance*, I also attempted the baseline and expanded models with *CO_2 emissions per capita* as the dependent variable. In this case, I obtained a positive and statistically insignificant coefficient (see **Table 3**). I would have expected a negative and significant coefficient, however, which is what Ergas and York obtain when they regress CO_2 emissions per capita on a variable representing women's

political status. Although they include similar controls, some of them are weighted, their model specification is different, and their key independent variable is different. A negative and significant coefficient would imply that an increase in women's political status is associated with a decrease in CO_2 emissions.[50] However, it is noteworthy that other empirical studies employ CO_2 emissions per capita as a control variable. Fredriksson and Neumayer include it because they consider that it "reflects the amount at stake for CO_2 emitters, and thus their lobbying incentives."[51] Mavisakalyan and Tarverdi cite Fredriksson and Neumayer's reasoning as their motivation for including it as a control.

I also attempted the expanded model with *CO_2 emissions per capita* as the dependent variable to test whether the relationship with the women empowerment index changed. The coefficient remained positive and not significant (see model 4A, **Table 3**).

[50] Ergas and York.
[51] Fredriksson and Neumayer.

Table 3. Linear regressions with CO_2 emissions as alternate dependent variable.

	Model 1 (Y = EPI)	Model 1D (Y = EPI)	Model 4 (Y = CO_2 emissions, metric tons per capita)	Model 4A (Y = CO_2 emissions, metric tons per capita)
Women political empowerment index	4.558** (1.935)	5.425*** (2.04)	1.089 (.724)	.7922 (1.025)
GDP per Capita *(logged)*	4.755*** (.613)	3.6*** (.693)	1.760*** (.221)	2.128*** (.792)
GDP Growth Rate	-.029** (.012)	-.031** (.012)	-.007** (.004)	-.004 (008)
Polity	.003 (.049)	.020 (.057)	-.005 (.015)	-.002 (.014)
Urban population (% of total)		.169*** (.048)		.026 (.039)
Industry, value added (% of GDP)		.03 (.023)		.072*** (.028)
Military Expenditure Index		-.62 (.45)		.225 (.138)
Index of Globalization		.049** (.023)		-.019 (.029)
Constant	22.444*** (5.375)	22.014*** (5.315)	-11.245*** (1.73)	-17.293*** (4.685)
R^2 (overall)	0.753	0.745	0.511	0.515
$Wald\ X^2$	368.72	402.26	313.68	173.87
Number of countries	157	142	160	146
Number of observations	1,359	1,176	5,741	2,830

Robust standard errors in parentheses. *, **, *** indicate significance at the 90%, 95%, and 99% level, respectively.

A simple scatterplot for *CO_2 emissions per capita* and the *Women Political Empowerment Index* illustrates the relationship between these two variables, and there does not seem to be a clear trend. I also attempted to take the logarithm of *CO_2 emissions per capita*, and results were similar (see **Figures 3 and 4**).

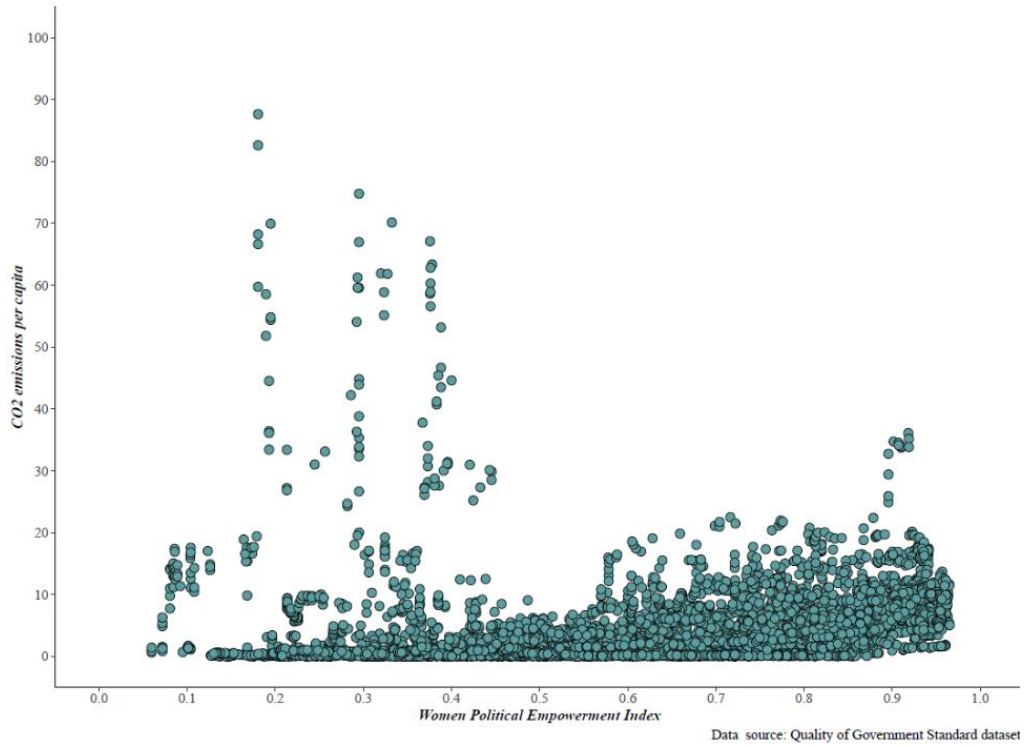

Figure 3. Scatterplot with CO_2 emissions and Women Political Empowerment Index.

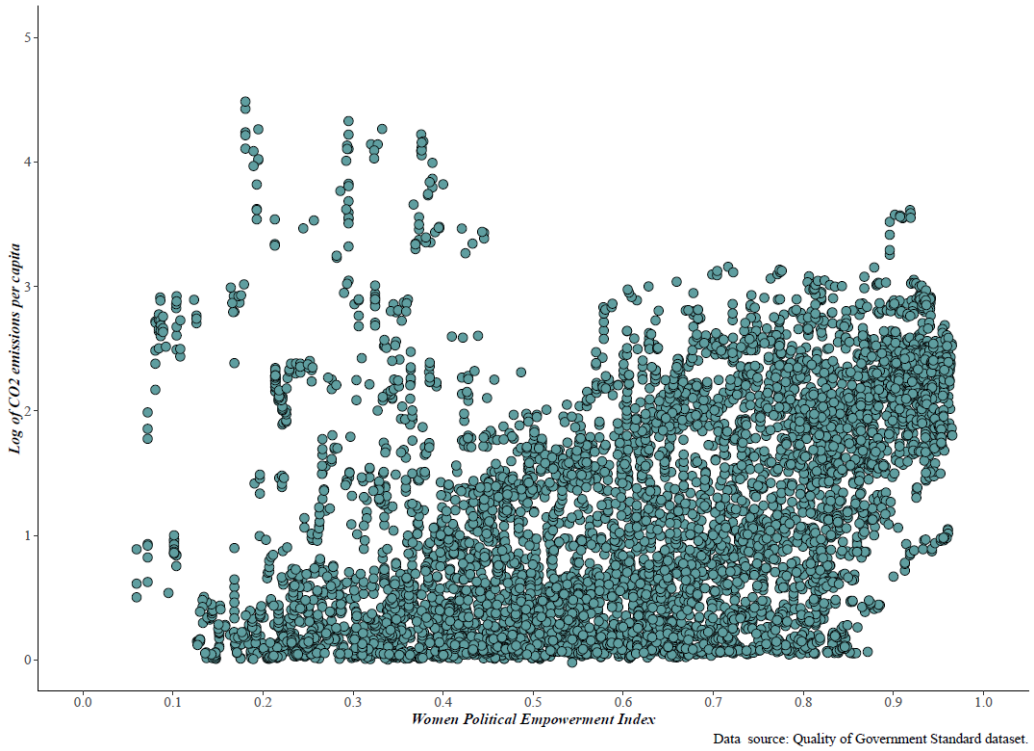

Figure 4. Scatterplot with CO_2 emissions (logged) and Women Political Empowerment Index.

A variation of the model that includes the square of the *WPEI* variable does yield a negative and significant coefficient for *CO_2 emissions per capita,* although only for very high levels of women empowerment, and only at the 90% level (see model 5, **Table 4**). It is also worth noting that this significance is lost when using the log of CO_2 emissions with the expanded model.

Table 4. Linear regressions with CO_2 emissions per capita.

	Model 4 (Y = CO_2 emissions, metric tons per capita)	**Model 4A (Y = CO_2 emissions, metric tons per capita)**	**Model 5 (Y = log of CO_2 emissions per capita)**
Women Political Empowerment Index	1.089 (.724)	.7922 (1.025)	.774** (.373)
Women Political Empowerment Index (squared)			-.565* (.340)
GDP per Capita *(logged)*	1.760*** (.221)	2.128*** (.792)	.409*** (.038)
GDP Growth Rate	-.007** (.004)	-.004 (008)	-.002*** (.001)
Polity	-.005 (.015)	-.002 (.014)	.003* (.002)
Urban population (% of total)		.026 (.039)	
Industry, value added (% of GDP)		.072*** (.028)	
Military Expenditure Index		.225 (.138)	
Index of Globalization		-.019 (.029)	
Constant	-11.245*** (1.73)	-17.293*** (4.685)	-2.527*** (.324)
R^2 (overall)	0.511	0.515	0.787
Wald X^2	313.68	173.87	11.54
Number of countries	160	146	160
Number of observations	5,741	2,830	5,741

Robust standard errors in parentheses. *, **, *** indicate significance at the 90%, 95%, and 99% level, respectively.

I also attempted to run my model with the *EPI* and independent variables that addressed more specific aspects of women's empowerment (*Proportion of seats held by women in national parliaments, Women's Economic Rights, Women's Social Rights,* and *Women's Political Rights*), to see if there is one aspect in particular that reflected a stronger correlation with my dependent variable.

With *Proportion of seats held by women in national parliaments,* the results were not significant (see **Table 5**). This is the same case for the other three variables attempted. I might have expected *Proportion of seats held by women in national parliaments* to be positive and significant, given the results obtained by Mavisakalyan and Tarverdi.

I might also have expected results for *Women's Political Rights* to be significant, given the results in Nugent and Shandra's study, which finds that women's political status (versus educational and economic) has a stronger association with the amount of protected areas.[52] For *Women's Social Rights*, there are not enough observations for both the dependent and independent variables to obtain a relevant result, because this variable ends at the year 2007, while the *EPI* begins on that year. The other two variables (*Women's Economic* and *Social Rights*) begin in 2011. Thus, a regression analysis with these two variables only holds observations for five years (2007-2011), which could partly explain why the results are not significant.

[52] Nugent and Shandra.

Table 5. Baseline regression with alternate independent variables.

Key independent variable	Model 1 (Y = EPI)	Model 1 (v2) (Y = EPI)	Model 1 (v3) (Y = EPI)	Model 1 (v4) (Y = EPI)
Constant	22.444*** (5.375)	24.329** (1.372)	17.84*** (4.536)	17.967*** (4.54)
Women political empowerment index	4.558** (1.935)			
Proportion of seats held by women in national parliaments (%)		-.002 (.013)		
Women's Economic Rights			.127 (.096)	
Women's Political Rights				-.037 (.15)
Women's Social Rights				-
GDP per Capita *(logged)*	4.755*** (.613)	4.914*** (.632)	5.718*** (.519)	5.73*** (.512)
GDP Growth Rate	-.029** (.012)	-.02 (.013)	-.039*** (.014)	-.039*** (.013)
Polity	.003 (.049)	.004 (.042)	-.001 (.055)	-.002 (.055)
R^2 (overall)	0.753	0.715	0.718	0.716
***Wald* X^2**	368.72	390.57	229.79	225.30
Number of countries	157	161	159	159
Number of observations	1,359	1,387	949	946

Robust standard in parentheses. *, **, *** indicate significance at the 90%, 95%, and 99% level, respectively.

To summarize my empirical findings, the baseline model – which controls for GDP per capita (logged), GDP growth rate, and level of democratization – with my key dependent and independent variables (*EPI* and *WPEI*, respectively) offers results that are consistent with the literature, yielding the expected positive and statistically significant association at the 95% level. When switching out the dependent variable for *Ecoregion protection* and *Environmental policy performance*, the

baseline model remains consistent, with a positive coefficient that is of slightly lower magnitude but increased significance (99% confidence level).

The expanded model with the key dependent and independent variables (*EPI* and *WPEI*) that includes additional controls (*Percentage of urban population, Value added of industry as percentage of GDP, Military Expenditure Index,* and *Index of Globalization),* also yields results consistent with expectations, resulting in a statistically significant coefficient (99% level) of slightly larger magnitude.

Some of the additional variables attempted did not yield significant results, which was not consistent with expectations. Using *CO_2 emissions per capita* as the dependent variable did not produce a significant coefficient, and it does not seem to have a consistent association with my key independent variable. In the literature, however, this variable receives treatment as both a dependent and control variable, and is included for different reasons, so this lack of significance does not contradict any of the reviewed studies.

When I attempted to switch out my key independent variable with *Proportion of seats held by women in national parliaments, Women's Economic Rights, Women's Social Rights,* and *Women's Political Rights*, there was also an unexpected lack of significance in the results, perhaps due to an omitted variable that I did not consider. For the variables distinguishing women's economic and political rights, the lack of significance is also possibly due to the low number of years that data for these variables coincides with the key dependent variable (five years), while the social rights variable only has one year in common with EPI. While experimentation with these additional variables did not yield significant results, I do not consider that it contradicts the existing research.

CONCLUSION

This thesis has analyzed women's empowerment as one of the potential sources of the disparate nature of environmental performance and policies across countries. The statistical analysis yielded a positive association between the *WPEI* and three of the dependent variables experimented with (*EPI, Ecoregion protection* and *Environmental policy performance)* for the baseline model, a result consistent with the existing research literature. The expanded baseline model with the key dependent and independent variables (the *EPI* and the *WPEI*) also yielded consistent results, controlling for GDP per capita, GDP growth rate, level of democratization, urbanization, industrialization, military expenditures, and globalization.

The immediate implication of my findings is that any policy favoring an increased social and political agency, including the presence of women in political decision-making bodies, may potentially lead to stronger environmental protection policies. It must be noted that while my results show a positive association between the *EPI* and the *WPEI*, the link is not necessarily causal. The causal relationship may also be complex, mediated by various factors. While the exact causal linkages will still be subject to debate and further research, existing studies, as well as the results of this thesis, indicate the side-effects of gender empowerment might include a strengthening of environmental protection efforts. It is also possible that international efforts to combat environmental degradation may have more success in regions where women enjoy greater political power and representation.[53] Thus, legislators promoting comprehensive efforts towards promoting gender equality could potentially enjoy the added benefit of stronger environmental policies and protection efforts.

[53] Mavisakalyan and Tarverdi.

ANNEX 1: VARIABLE DESCRIPTIONS

Variable name	Variable label	Description[54]	Source
		Dependent variables	
epi_epi	*Environmental Performance Index*	Calculated from two indices: Environmental Health (which in turn includes Health Impacts, Air Quality and Water and Sanitation) and Ecosystem Vitality (which includes Water Resources, Agriculture, Forests, Fisheries, Biodiversity and Habitat, and Climate and Energy).	Environmental Performance Data (http://epi.yale.edu/downloads).
nrmi_ecoprot	*Ecoregion protection*	Indicates whether a country "is protecting at least 10% of all of its biomes (e.g. deserts, forests, grasslands, aquatic, and tundra). It is designed to capture the comprehensiveness of a government's commitment to habitat preservation and biodiversity protection".	Natural Resource Management Index (NRMI) Data (Center for International Earth Science Information Network - CIESIN - Columbia University, 2011; http://sedac.ciesin.columbia.edu/data/collection/nrmi).
sgi_en	*Environmental policy performance*	This indicator considers the performance of different countries with regards to both national environmental policies ("Environmental Policy, Energy Productivity, Greenhouse Gas Emissions, Particulate Matter, Water Usage, Waste Generation, Material Recycling, Biodiversity, Renewable Energy"), and global environmental protection efforts ("Global Environmental Policy, Multilateral Environmental Agreements, Kyoto Participation and Achievements"). It only considers OECD countries.	Sustainable Governance Indicators (http://www.sgi-network.org/2017/).
wdi_co2	*CO_2 emissions (metric tons per capita)*	"Carbon dioxide emissions are those stemming from the burning of fossil fuels and the manufacture of cement. They include carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring."	World Development Indicators (World Bank).

[54] All citations in this column taken from the Codebook for the QoG Standard Dataset, https://www.qogdata.pol.gu.se/data/qog_std_jan18.pdf.

Variable name	Variable label	Description[54]	Source
		Key independent variables	
vdem_gender	*Women Political Empowerment Index*	Includes factors such as "fundamental civil liberties, women's open discussion of political issues and participation in civil society organizations, and the descriptive representation of women in formal political positions. The index is formed by taking the average of women's civil liberties index, women's civil society participation index, and women's political participation index."	Varieties of Democracy Dataset version 7.1 (https://v-dem.net/en/data/).
wdi_wip	*Proportion of seats held by women in national parliaments (%)*	"Women in parliaments are the percentage of parliamentary seats in a single or lower chamber held by women."	World Development Indicators (World Bank).
ciri_wecon	*Women's Economic Rights*	"These rights include: Equal pay for equal work, Free choice of profession or employment without the need to obtain a husband or male relative's consent, Equality in hiring and promotion practices, Job security (maternity leave, unemployment benefits, no arbitrary firing or layoffs, etc...), Non-discrimination by employers, The right to be free from sexual harassment in the workplace, The right to work at night, The right to work in occupations classified as dangerous, The right to work in the military and the police force."	The Cingranelli-Richards (CIRI) Human Rights Dataset (http://www.humanrightsdata.com/).
ciri_wopol	*Women's Political Rights*	"These rights include: The right to vote, The right to run for political office, The right to hold elected and appointed government positions, The right to join political parties, The right to petition government officials."	
ciri_wosoc	*Women's Social Rights*	"These rights include: The right to equal inheritance, The right to enter into marriage on a basis of equality with men, The right to travel abroad, The right to obtain a passport, The right to confer citizenship to children or a husband, The right to initiate a divorce, The right to own, acquire, manage, and retain property brought into marriage, The right to an education, The freedom to choose a residence/domicile, Freedom from female genital mutilation of children and of adults without their consent, Freedom from forced sterilization."	

Variable name	Variable label	Description[54]	Source
		Controls	
wdi_gdpcapcon2010 (logged)	*GDP per Capita* (Current Prices), logged	No additional description.	Expanded Trade and GDP Data (http://privatewww.essex.ac.uk/~ksg/exptradegdp.html).
wdi_gdpgr	*GDP Growth Rate*	"Annual percentage growth rate of GDP at market prices based on constant local currency."	World Development Indicators (World Bank).
p_polity2	*Polity*	"The polity score is computed by subtracting the p_autoc score from the p_democ score; the resulting unified polity scale ranges from +10 (strongly democratic) to -10 (strongly autocratic)."	Polity IV Annual Time-Series, 1800-2016 (http://www.systemicpeace.org/inscrdata.html).
wdi_popurb	*Urban population (% of total)*	"Refers to people living in urban areas as defined by national statistical offices."	World Development Indicators (World Bank).
wdi_gdpind	*Industry, value added (% of GDP)*	"Industry corresponds to ISIC divisions 10-45 and includes manufacturing (ISIC divisions 15-37). It comprises value added in mining, manufacturing (also reported as a separate subgroup), construction, electricity, water, and gas. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs."	World Development Indicators (World Bank).
bicc_milexp	*Military Expenditure Index*	"The Global Militarization Index is divided into three overarching categories: expenditure, personnel and heavy weapons."	Bonn International Center for Conversion (http://gmi.bicc.de/).
dr_ig	*Index of Globalization*	"The overall index of globalization is the weighted average of the following variables: economic globalization, social globalization and political globalization. Most weight has been given to economic followed by social globalization."	Axel Dreher, KOF Index of Globalization (http://globalization.kof.ethz.ch/).

ANNEX 2: DESCRIPTIVE STATISTICS

Variable	Observations	Observations for years	Mean[55]	Standard deviation	Variance	Minimum value	Maximum value	Scale
Environmental Performance Index	1,620	2007-2015	65.995	15.11	228.309	25.65	91.05	1-100
Ecoregion protection	1,157	2006-2011	6.253	3.623	13.129	0	10	0-10
Environmental policy performance	164	2013-2016	6.044	1.145	1.311	3.582	8.64	1-10
CO_2 emissions (metric tons per capita)	8,589	1960-2014	4.202	6.904	47.662	-.02	87.653	N/A
Women political empowerment index	8,620	1946-2016	.593	.224	0.05	.04	.965	0-1
Proportion of seats held by women in national parliaments (%)	3,705	1990-2016	15.751	10.92	119.247	0	63.8	0-100
Women's Economic Rights	4,864	1981-2011	1.328	.698	0.487	0	3	0-3
Women's Political Rights	4,915	1981-2011	1.786	.647	0.418	0	3	0-3
Women's Social Rights	3,643	1981-2007	1.247	.849	0.721	0	3	0-3
***GDP per Capita* (logged)**	8,003	1960-2016	8.1737	1.515	2.296	4.76	11.879	N/A
GDP Growth Rate	8,097	1961-2016	3.897	6.345	40.265	-64.047	149.973	N/A
Polity	9,408	1946-2016	.726	7.45	55.502	-10	+10	-10 to +10
Urban population (% of total)	9,310	1960-2016	49.327	25.046	627.316	2.193	100	0-100
Industry, value added (% of GDP)	6,273	1960-2016	28.908	13.059	170.544	1.882	213.690	N/A
Military Expenditure Index	3,954	1990-2016	5.231	.531	0.282	0	8	"Very low": <1.6 "Very high": >6.4
Index of Globalization	7,325	1970-2014	46.312	18.339	336.308	10.363	92.838	1-100

[55] All values rounded to the third decimal.

ANNEX 3: SUMMARY TABLE OF LITERATURE REVIEW

Article	Dependent variable	Key independent variable	Controls	Main finding
Christina Ergas and Richard York, "Women's status and carbon dioxide emissions: A quantitative cross-national analysis," *Social Science Research*, Vol. 41 (2012).	CO_2 emissions per capita	Women's political status	GDP per capita, urbanization, industrialization, militarization, world-system position, foreign direct investment, the age dependency ratio, and level of democracy	"CO_2 emissions per capita are lower in nations where women have higher political status."
Laura A. McKinney and Gregory M. Fulkerson, "Gender Equality and Climate Justice: A Cross-National Analysis," *Social Justice Research* (June 2015).	Global Footprint Network (2010) provides corresponding estimates of each nation's supply of (i.e., biocapacity) and demands on (i.e., the footprint) nature to inform inquiries into the earth's carrying capacity.	Women's Status	Biocapacity Loss, World-System Position, Development and Democracy, Forestland	"Nations with greater female representation in governing bodies have lower climate footprints, controlling for domestic (urbanization, production) and global (world-system integration) drivers. Conclusions point to the potential for gender equality and improving the status of women worldwide to curtail climate change."
Astghik Mavisakalyan and Yashar Tarverdi, "Gender and climate change: Do female parliamentarians make difference?" in *European Journal of Political Economy* (2018).	Climate Laws, Institutions and Measures Index (CLIMI)	Female political representation in national parliaments	GDP per capita (log), Openness, CO_2 emissions per capita, Democracy, Autocracy, English legal origin, French legal origin, German legal origin, Socialist legal origin	"Female representation leads countries to adopt more stringent climate change policies. We exploit a combination of full and partial identification approaches to suggest that this relationship is likely to be **causal**. In extended results, we further demonstrate that through its effects on the stringency of climate change policies, female parliamentary representation results in lower carbon dioxide emissions."
Kari Norgaard and Richard York, "Gender Equality and State Environmentalism," *Gender & Society*, Vol. 19 No. 4 (August 2005).	State participation in international environmental treaties	Percentage of legislator positions in national Parliament occupied by women in 1999	GDP per capita, Percentage GDP in service, Foreign direct investment (percentage of GDP), Official development assistance	"The findings indicate that nations with higher proportions of women in Parliament are more prone to ratify environmental treaties than are other nations."

		as reported by Prescott-Allen	(percentage of GDP), Capitalist, Percentage urban, Ln (population), Political freedom	
Colleen Nugent and John M. Shandra, "Environmental Protection Efforts, Women's Status, and World Polity: A Cross-National Analysis," *Organization & Environment,* Vol. 22, No. 2 (June 2009).	Protected land area	Index of women's educational status, Index of women's economic/labor status, Index of women's health, Index of women's political status	Freedom Index, Gross domestic product, Rural population density, Region of the world: Latin America and the Caribbean, International tourism receipts. "World policy variables": Environmental agreement participation, Environmental intergovernmental organizations, IUCN member organizations.	• "We find no support for broader ecofeminist claims that the overall oppression of women and environmental degradation are linked by a common source. However, we find strong support for the idea that increasing women's political status in particular through representation in national government has a positive effect on state environmental protection efforts." • "We confirm that women's status in terms of education, economic/labor, and health has no predictive relationship to protected land area. This result fails to support the hypothesis based on ecofeminist theory that overall empowerment of women and environmental protection are interconnected processes. However, the political component of women's status is a significant predictor of protected areas (…). This finding is further supported by the positive and significant coefficients for women in parliament (…) and women in ministerial government (…)." • "These results correspond nicely with Norgaard and York's (2005) findings that women contribute a unique voice to nation-state policy making."

ANNEX 4: ADDITIONAL MODELS

Table 6. Additional models.

	(1) Fixed effects	(2) Fixed effects with controls	(3) ECM[56]	(4) ECM with controls	(5) GMM[57]	(6) GMM with controls
WPEI *(logged)*	0.0787	0.0674**	0.0441	0.0610*	0.0441***	0.0872**
	(0.0503)	(0.0308)	(0.0276)	(0.0362)	(0.0128)	(0.0435)
EPI *(logged)*		0.669***	-0.330***	-0.340***	0.965***	0.963***
		(0.0375)	(0.0322)	(0.0383)	(0.0103)	(0.00961)
WPEI (logged), first difference			0.0539**	0.0180		
			(0.0263)	(0.0316)		
GDP per capita (logged), first difference				-0.0358		
				(0.0301)		
GDP per capita (logged)		0.0122		0.0114		0.00215***
		(0.00925)		(0.0103)		(0.000767)
GDP growth rate, first difference				-0.000201		
				(0.000137)		
GDP growth rate		-5.71e-05		0.000526		1.11e-05
		(0.000140)		(0.000355)		(0.000124)
Polity, first difference				0.000419		
				(0.000471)		
Polity		-0.000439		-0.000786**		-0.000711
		(0.000393)		(0.000335)		(0.000451)
Constant	4.112***	1.245***	1.351***	1.291***	0	0
	(0.0274)	(0.157)	(0.134)	(0.160)	(0)	(0)
R^2	0.395	0.695	0.398	0.413		
Number of countries	167	156	166	155	166	156
Number of observations	1,468	1,207	1,296	1,197	1,304	1,207

Robust standard errors in parentheses. *, **, *** indicate significance at the 90%, 95%, and 99% level, respectively. The dependent variable in all of the above models is the log of the Environmental Performance Index. The GMM model results reported in columns 5 and 6 are derived from a one-step system GMM model with two lags of the endogenous variable (WPEI, log). These models are estimated using robust standard errors.

[56] Error Correction Model.

[57] Generalized method of moments estimation.

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