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Women in Parliaments and Environmentally Friendly Fiscal Policies: A Global Analysis

Aysen Simsek Kandemir [1,*], Ramshah Rashid Lone [2] and Rasim Simsek [3]

[1] Hereke Vocational School, Kocaeli University, 41800 Kocaeli, Turkey
[2] Faculty of Business and Law, Anglia Ruskin University, Chelmsford CM1 1SQ, UK; rl70@aru.ac.uk
[3] Faculty of Economics and Administrative Sciences, Bilecik Seyh Edebali University, 11100 Bilecik, Turkey; rasim.simsek@bilecik.edu.tr
* Correspondence: aysens@kocaeli.edu.tr

Abstract: This study explores the intricate interplay between female representation in national parliaments and government fiscal policies, with a specific focus on fossil fuel subsidies, environmental taxes, and expenditure, in the context of climate change mitigation. Using a sample of 160 countries over the period from 1997 to 2022, this empirical analysis demonstrates the positive relationship between the presence of female parliamentarians and environmentally friendly fiscal measures. While women in the parliaments reduce the amount of the subsidies granted to fossil fuels, they levy environmental taxes and increase environmental spending. The findings illustrate the pivotal role of female parliamentarians in advocating for environmental legislation and transcending political ideologies and national boundaries. Addressing potential concerns of endogeneity by employing additional control variables, omitted variables, and instrumental variable analyses, this study emphasises the robustness of the results. Notably, this study finds that a critical mass of at least 30% female representation in parliaments enhances the efficacy of environmental policy outcomes. This research highlights the multifaceted impact of gender diversity on fiscal policies related to environmental protection, offering valuable insights for policymakers and organisations committed to sustainability and gender equality.

Keywords: female parliamentarians; gender diversity; environmental sustainability; critical mass theory; 2SLS

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1. Introduction

Global warming is becoming an increasingly threatening issue for all life on Earth. The call for political activism and dedication to address climate change and promote environmental protection has never been more urgent. This paper examines how the presence of women in parliamentary systems influences fiscal policymaking related to global warming and environmental protection on a global scale.

Numerous measures have been implemented to combat climate change, including international agreements such as the Kyoto Protocol (1997) and the Paris Agreement (2015), as well as actions taken at the national level. However, the effectiveness of these activities is still debatable. A recent study by Jenkins et al. [1] reveals an upward trajectory in average temperatures and anthropogenic global warming (AGW), exacerbating the global climate crisis. Projections from the European Environmental Agency underscore the challenge ahead, indicating that European Union member countries should reduce net emissions by 41% to keep the global mean temperature increase below 2 °C, or preferably 1.5 °C, by 2100. However, this figure has fallen short of the targeted 55% reduction, thereby jeopardising the pursuit of net-zero emissions by 2050 (Total Greenhouse Gas (GHG) emission trends and projections in Europe Publication, 26 October 2022, available at https://www.eea.europa.eu/ims/total-greenhouse-gas-emission-trends (accessed on

18 October 2023)). Since Europe is the only continent to have witnessed a decrease in emission levels since 1990, the aspiration of achieving net-zero emissions by 2050 appears increasingly uncertain. This raises concerns regarding the determination and effectiveness of the policies and targets set by countries and whether they would yield the desired results [2–5]. However, achieving the global target of 2050 demands a radical transformation in energy consumption patterns, a transition to cleaner and more sustainable energy sources, and substantial financial support to facilitate these transformative changes [6].

Moreover, policymakers' commitment to designing efficient policies and measures can also serve as a potent tool in mitigating and addressing the challenges of climate change. Implementing productive policies and measures, such as environmental taxes [7–10], reductions in fossil fuel subsidies [11,12], and increased government expenditures on environmental initiatives [13–15], can play a vital role in mitigating the adverse effects of climate change, advancing sustainability, and ensuring the well-being of present and future generations.

Prior literature suggests that more female representation in parliaments leads to the implementation of social policies that benefit their societies. For example, an increase in the proportion of women in parliaments resulted in higher government spending on public health [16,17], improved child health outcomes, reductions in the neonatal mortality rate [18,19], and increased educational spending [20–22]. Female parliamentarians often play a pivotal role in addressing ethical issues in society, such as reducing corruption [23–25], promoting transparency [26,27], advocating for overall good governance [28–30], and contributing to a more equitable and accountable political structure.

The presence of women in legislative bodies is also associated with an increased focus on renewable energy, conservation efforts, and environmental justice. Ergas and York [31] find that improvements in the political status of women led to a reduction in levels of CO_2 emissions per capita, while Mavisakalyan and Tarverdi [32] report that an increased female presence in parliaments has a negative impact on the level of CO_2 emissions per capita. Similarly, Benlemlih et al. [33] state that women's presence in politics is a factor that significantly reduces CO_2 emission. Salamon [34] suggests that women's parliamentary participation positively affects national renewable energy consumption. Furthermore, Fredriksson and Wang [35] find that female members of the House of Representatives tend to take a more stringent approach to environmental policy development compared to their male counterparts. More recently, Baraldi et al. [36] propose that the political inclusion of women contributes to more effective selective waste collection. These findings suggest that a higher representation of female councillors at the municipal level is associated with an increase in selective waste collection and a decrease in non-selective waste collection. However, the active role of gender in politics concerning fiscal involvement in mitigating climate change and protecting the environment remains unexplored.

In the light of gender socialisation [37,38] and feminist theory perspectives [39–41], this study argues that female parliamentarians oppose implicit, explicit, and total subsidies on fossil fuels while advocating for higher environmental taxes and environmental expenditures, which are attributed to their perceived nurturing, caregiving, and compassionate characteristics, as well as their inclination toward inclusivity and ethical decision-making. The present study utilises comprehensive data from a diverse set of over 160 countries from 1997 to 2022. The results indicate that female parliamentarians are associated with reducing the ratio of explicit, implicit, and total subsidies of countries for the fossil fuel sectors in their countries. Similarly, female parliamentarians tend to promote higher environmental taxes and spending ratios. These findings suggest a potential link between gender roles, feminist values, and policy preferences in the context of environmental fiscal policies. The findings remain robust after controlling for concerns about endogeneity through additional controls, omitted variables, and instrumental variable analysis. In addition, further analysis reveals that female parliamentarians play a significantly positive role in renewable energy generation but a negative role in the generation of non-renewable energy. The findings also suggest that a 30% critical ratio of female presence amongst parliamentarians impacts fiscal policies favouring environmental and climate problems, aligning with critical mass theory. Ultimately, the study suggests that the impact of female parliamentarians becomes evident when fossil fuel subsidies are already high and environmental taxes and expenses are already low, highlighting their effectiveness in influencing environmental fiscal policies.

Numerous studies have examined the relationship between the presence of female parliamentarians and outcomes such as reduced CO_2 emissions [31–33,42] and the promotion of renewable energy use [34,43,44]. However, these studies often fall short in exploring the mechanisms through which female parliamentarians exert influence on environmental policies. This study fills the critical gap by empirically demonstrating female parliamentarians' influence on environmental outcomes, such as CO_2 emissions and renewable energy use, through the promotion of environmentally friendly fiscal policies, including subsidies, taxes, and expenditures geared toward sustainability.

This study makes the following contributions. Firstly, it adds to the existing body of research by empirically examining the influence of female parliamentarians on government environmental fiscal policies within the context of climate change mitigation and adaptation. The results suggest that female presence in parliaments reduces explicit, implicit, and total subsidies on fossil fuels while increasing the environmental taxes and expenditures to combat environmental challenges. Furthermore, the study contributes to the existing body of research by empirically examining the pattern of how female parliamentarians influence government environmental fiscal policies. The findings demonstrate that the presence of female parliamentarians is associated with policy outcomes that vary based on the existing levels of subsidies, taxes, and expenditures. Female parliamentarians show a consistent significant effect when subsidies are already at higher levels which may reflect a push for greater fiscal responsibility, environmental consciousness, or a reallocation of resources toward more sustainable practices. On the other hand, female parliamentarians advocate for increases in environmental expenditure and tax levels when they are currently at lower levels. This insight underscores the importance of considering the initial policy environment when analysing the impact of gender diversity in parliaments.

Next, we contribute to critical mass theory by finding that females can only affect policies once their number achieves a certain threshold. The results show that female parliamentarians can only affect environmental fiscal policies when their representation crosses the threshold of 30%. In this way, the study contributes to the current debate on gender quotas in parliaments, providing valuable insights for policymakers and government organisations. We anticipate that the findings will be relevant to academic and research communities, policymakers, and governmental organisations committed to environmental preservation and gender equality at the national level.

Finally, we contribute to the literature on gender studies by providing empirical evidence of why the presence of female parliamentarians influences fiscal policies related to environmental sustainability. The rationale for women advocating environment-related fiscal policy finds its ground in Gender Socialisation and Feminism Theory projecting that women exhibit nurturing, caregiving, loving, warm, compassionate, empathetic, agreeable, conscientious, and emotionally supportive qualities. The present study validates these theoretical concepts while presenting real-world evidence of the impact of female representation in parliament on environmental policymaking. In this regard, this research broadens the scope of gender studies by examining the influence of female representation on environmental governance specifically. By focusing on the environmental policy impact of female parliamentarians, this study highlights the intersection of gender dynamics and environmental governance, offering a more holistic view of how gender representation in political systems can shape societal responses to environmental challenges.

The remaining part of the paper is organised as follows: Section 2 discusses theories, literature review, and hypothesis. Section 3 discusses the sample, data, and methods. Section 4 discusses the results. Finally, Section 5 presents concluding remarks.

2. Theory, Literature, and Hypotheses

2.1. Theoretical Overview

The extant literature discusses diverse theories to explain societal, psychological, and behavioural trait differences between women and men. Rooted in the perspectives of gender socialisation and gender social role theories, these theories propose that societal norms, expectations, and cultural practices profoundly shape gender roles and identities. The imposition of stereotypical roles and responsibilities from the early stages of psychological and behavioural development ingrains distinct values in women and men, resulting in divergent characteristics [37]. Individuals acquire gender roles and values during their formative years, contributing to observed psychological and cognitive distinctions between men and women [45,46]. Whether these specific roles and responsibilities are culturally imparted to children or acquired by children during their formative years, they can significantly influence the behaviours, decisions, and actions of both women and men within society, potentially shaping traits associated with traditional gender roles. For instance, women may exhibit nurturing, caregiving, loving, warm, compassionate, empathetic, agreeable, conscientious, and emotionally supportive qualities, while, on average, men are inclined to display disciplined; controlling; assertive; or, in some cases, aggressive traits [47–50]. Further, biological differences, encompassing neuroanatomical and neurochemical variations between women and men, represent another crucial factor contributing to behavioural distinctions [51].

Moreover, economic-based theories (economics, finance, management, and psychology) provide a "business case" for gender diversity [52–54]. According to economics-based theories, women's unique attributes reduce agency problems through improved disclosure, engagement, monitoring, and risk-taking [55–57]. Beyond the "business case", the literature also supports the "ethical/moral" case for women. Prior literature supports the theoretical prediction between women and men, with women being more ethical, caring, and stakeholder-oriented [53] with less probability of following individual goals [58].

Recently, the debate on the underrepresentation of women in politics, science, business, and decision-making roles has started gaining momentum. The shortage of women in influential positions perpetuates gendered power imbalances, hindering the development and implementation of effective policies, especially regarding environmental policies. This dynamic contributes significantly to the current crises of climate and environmental degradation [39–41,59–64]. The marginalisation of femininity in decision-making processes not only skews environmental policies but also reinforces traditional stereotypes and expectations regarding the roles and contributions of women. This imbalance becomes a self-perpetuating cycle, further entrenching the influence of masculinity in environmental governance and hindering the development of effective environmental policies. Rectifying this underrepresentation is not just an issue of gender equity; it is central to mitigating the environmental crises facing our planet.

Reports and studies demonstrate that women are more exposed to risks, harms, and threats during natural disasters due to their biological differences and lack of social and financial capital compared to men [64,65]. Women, along with boys and girls, are 14 times more likely to die during a disaster compared to men [66]. For instance, 90% of the casualties in cyclone disasters in Bangladesh in 1991 [67], 61% of the casualties in the cyclone disasters in Myanmar in 2008 [64,68], 70% of the casualties during the Indian Ocean/South Asia tsunami in Indonesia in 2004 [64,68], the majority of the casualties in industrialised countries during the heat wave that affected Europe in 2003 [69], and the majority of the victims trapped during/after Hurricane Katrina were women [70,71]. Surviving such disasters introduces new threats of domestic or sexual violence for women, deterring them from seeking or staying in shelters due to fears of physical and sexual assaults [72,73].

The identified risks and threats, intertwined with the caregiving roles shouldered by women, serve as catalysts for an elevated awareness regarding the adverse impacts of climate change and environmental degradation. Significantly, the traditionally ascribed roles of caregiving and provision by women have metamorphosed into proactive responsibilities concerning both societal and environmental issues [40,74–76]. This evolution places an augmented expectation on women to play a more substantial role in the efforts to prevent, mitigate, and adapt to the challenges posed by climate change.

2.2. Literature Review

Women consistently demonstrate a higher level of concern for environmental issues in comparison to men [77–81]. This higher environmental consciousness among women is manifested in their greater endorsement and advocacy for policies, such as plastic ban, as well as their increased preference for recyclable and reusable products [75,82–86]. Moreover, several studies indicate that women exhibit a greater inclination to adopt renewable energy practices [87–92] and consistently display more responsibility and care towards energy consumption and conservation [93–99].

Numerous studies have examined the ideologies and awareness that women show towards environmental issues. Sundström and McCright [100] emphasise that women exhibit greater environmental concern, especially in political arenas. Analysing the European Parliament, Ramstetter and Habersack [101] reveal that female parliamentarians express stronger support for environmental legislation, irrespective of their political ideologies and nationalities. Norgaard and York [102] add another layer, demonstrating that nations with a higher proportion of women in parliament display a greater inclination to ratify environmental treaties. Moving to the professional realm, where environmental concerns intersect with economics, May et al. [103] reveal that female members of the Association of Environmental and Resource Economists exhibit robust support for environmental intervention and protection, showcasing a higher level of sensitivity and responsibility.

On a broader scale, studies have shown a positive impact due to the political empowerment of women on environmental protection and outcomes [104,105]. Ergas and York [31] reveal that achieving more parliamentary seats for women in a country improves the environmental protection sensitivity in the given country and results in lower CO_2 emissions per capita. Similarly, Lv and Deng [106] posit a long-term decrease in CO_2 emissions with increased political empowerment for women. Benlemlih et al. [33] and Mavisakalyan and Tarverdi [32] show that a higher female proportion in national parliaments leads countries to emit lower levels of CO_2 by improving the adaptation of climate-change-friendly policies. In addition, McGee et al. [107] shed light on the distinctive correlation between gross domestic product (GDP) per capita and CO_2 emissions, indicating a weaker relationship in countries with greater representation of women in politics. However, while Lv et al. [42] reveal a positive association between female political presence and reduced CO_2 emissions, contingent on government quality, higher female political representation is linked to higher levels of CO_2 emissions, in the setting of poor government quality. From the perspective of women in politics and renewable energy usage, Opoku et al. [44] extend the exploration to 36 African countries, highlighting the positive effects of women's presence in national governments on energy access and efficiency, as well as a positive effect on renewable energy consumption. This finding is supported by Salamon [34], who demonstrates that a higher level of female presence in parliaments improves renewable energy consumption.

In the context of environmental governance, fiscal policies play a pivotal role in shaping the trajectory of a nation's ecological footprint. Implicit, explicit, and total subsidies; environmental taxes; and environmental expenditures are key components of fiscal strategy, directly impacting resource allocation, consumption patterns, and conservation efforts. These policies serve as powerful instruments to incentivise sustainable practices, discourage environmentally harmful activities, and channel resources toward conservation initiatives. Women, often exhibiting higher levels of environmental concern and pro-sustainability attitudes, are expected to advocate for policies that align with ecological well-being. As such, exploring the association between women in political leadership and environmental fiscal policies becomes important for the understanding of the dynamics that contribute to a commitment to the environmental sustainability of a given nation. Therefore, in light of these theories and the literature, it is expected that the greater degree of female presence in a national parliament would affect the fiscal policies related to environmental well-being positively. The hypotheses of the study are as follows:

H_1. *A higher proportion of female members in national parliaments positively affects environmental fiscal policies.*

H_{1a}. *A higher proportion of female parliamentarians in national parliaments is associated with a lower ratio of total implicit and explicit fossil fuel subsidies to GDP in a country.*

H_{1b}. *A higher proportion of female parliamentarians in national parliaments is associated with an increase in the proportion of total environmental taxes to GDP in a country.*

H_{1c}. *A higher proportion of female parliamentarians in national parliaments is associated with a higher proportion of total environmental expenditures to GDP in a country.*

3. Data and Method

3.1. Sample

This study utilised a comprehensive dataset comprising 160 countries from all continents worldwide, spanning the years 1997 to 2022. Appendix A provides a list of the countries included in the sample. The sample construction involves the inclusion of all countries with available data, without employing specific specifications or criteria.

3.2. Dependent Variables

This study focused on environmental-related fiscal policies as the dependent variable, employing three proxies: Total Explicit and Implicit Fossil Fuels Subsidies (*TEIFFS*), Total Environmental Taxes (*TET*), and Total Environmental Protection Expenditures (*TEPE*). All three variables are proportionate to the annual GDP of the countries for each year. The data for these categories have been sourced from the International Monetary Fund (IMF) website, specifically from the Mitigation section in the Climate Change Indicators Dashboard. We measured explicit subsidies as the difference between the supply cost and the price paid by the fuel user, directly related to financial aspects, while implicit subsidies account for the broader social costs, including negative externalities associated with environmental issues like air pollution and climate change. *TEIFFS* is composed of four distinct subcategories: total implicit and explicit subsidies for natural gas, coal, electricity, and petroleum. To examine these subcategories individually, the analyses include Total Implicit Fossil Fuel Subsidies (*TIFFS*), representing the sum of implicit subsidies for natural gas, coal, electricity, and petroleum, and Total Explicit Fossil Fuel Subsidies (*TEFFS*), representing the sum of explicit subsidies for natural gas, coal, electricity, and petroleum, both proportionate to the GDP of each country per year. Lower *TEIFFS*, *TIFFS*, and *TEFFS* suggest a more environmentally friendly fiscal policy adopted by the countries.

TET comprises four distinct subcategories, each strategically designed to target specific aspects of environmental impact, including activities and substances that contribute to environmental harm. The breakdown of *TET* encompasses taxes on energy (including fuel for transport), taxes on pollution, taxes on resources, and taxes on transport (excluding fuel for transport). To integrate *TET* into the models, the variable is introduced as the ratio of *TET* to the GDP of each country for each year. A higher *TET* implies a more environmentally friendly fiscal policy adopted by the countries.

The final measure for environmental fiscal policy is *TEPE*, a composite variable constructed within the framework of the Classification of Functions of Government. *TEPE* encompasses expenditures on biodiversity and landscape protection, expenditures on environmental protection not elsewhere classified, expenditures on environmental protection research and development (R&D), expenditures on pollution abatement, expenditures on waste management, and expenditures on wastewater management. To ensure comparability across countries and years, these expenditure categories are proportioned against the GDP of each country for each year. By aggregating these categories, *TEPE* serves as a comprehensive indicator of government spending dedicated to various environmental protection efforts. A higher *TEPE* implies a more pro-environmental fiscal policy adopted by the countries.

3.3. Independent Variable

The independent variable in this study, Female Parliamentarians (*FemPar*), is defined as the proportion of seats held by women in national parliaments, a measure consistent with previous research [24,32,34,108–111]. Data on female parliamentarian representation were sourced from the Inter-Parliamentary Union and World Bank DataBank World Development Indicators databases. Figure 1 illustrates the average proportion of female parliamentarians in the sample over time, indicating a steady increase from approximately 14% in 1997 to 25% in 2022.

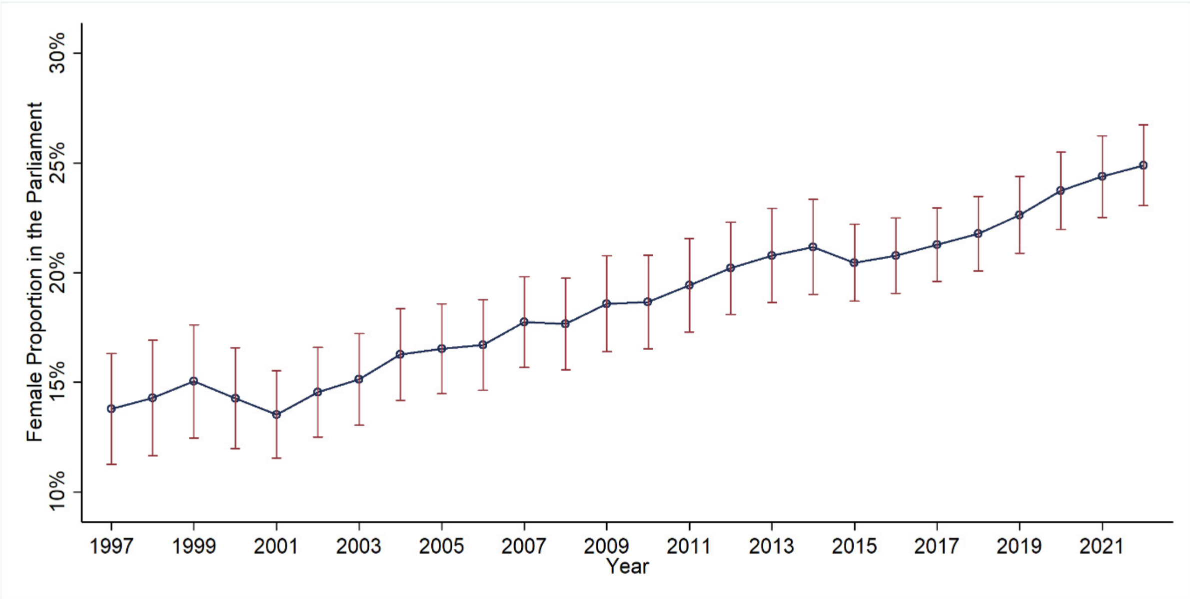

Figure 1. The sample mean of the proportion of women in parliaments.

3.4. Control Variables

The study incorporates several control variables to ensure a comprehensive analysis of the relationship between female parliamentary representation and environmental fiscal policies. GDP per capita (*GDPPC*) is included to account for economic variations among countries, reflecting the potential influence of national wealth on environmental fiscal policies [112–114]. A higher *GDPPC* might suggest greater financial capacity for investment in environmentally friendly practices, whereas lower *GDPPC* levels may indicate a focus on economic development that could potentially prioritise short-term gains over long-term sustainability. Trade openness (*Openness*), a measure of trade policies and international engagement of a country, is considered to control the impact of global economic interactions. A more open economy may face different pressures and opportunities in addressing environmental concerns compared to a less globally connected one [115–117]. As suggested by the literature [31,32], CO_2 emissions ($CO_2Emission$) of the countries are also included to control for their environmental footprints, acknowledging the potential influence of carbon emissions on their environmental policies. Nations with higher emission levels might be more likely to adopt stringent environmental fiscal policies since these countries might face greater urgency and pressure to implement policies aimed at reducing their carbon footprint. Net foreign assets (NFA) represent a country's international financial position, reflecting the difference between external assets and liabilities of the country. Including this variable as a control variable in the models helps to explore whether the financial stability and external debt levels of a country influence its commitment to environmental fiscal policies. In contrast, Foreign Direct Investment (*FDI*) serves as a control variable to assess the impact of international capital flows on environmental fiscal policies, which is important in understanding the role of external investment in shaping environmental fiscal policies [118,119]. *FDI* may indicate the influence of international stakeholders on the policy decisions of a country, potentially impacting the prioritisation of environmental concerns. Finally, the urban population to total population ratio (*UrbanPop*) is included to control for demographic factors, suggesting that a higher level of urban population leads to more intense economic activity [120,121] and, in turn, a higher level of CO_2 emissions [122,123]. This implies a greater need for stringent environmental fiscal policies to counterbalance the elevated emissions in countries with higher levels of urbanisation. The descriptions of the variables are provided in Appendix B.

3.5. Model

To capture the effects of the proportion of women parliamentarians on environmentally friendly fiscal policies, the following models are formed for the current study:

$$Y_{i,t} = \alpha_0 + \beta_1 FemPar_{i,t} + \gamma X_{i,t} + \varepsilon_{i,t} \quad (1)$$

where $Y_{i,t}$ is a matrix of environmental fiscal policies proxied by *TIFFS*, *TEFFS*, *TEIFFS*, *TET*, and *TEPE* of country i at time t; $FemPar_{i,t}$ is the proportion of women parliamentarians in country i at time t; and $X_{i,t}$ is a matrix of *GDPPC*, *Openness*, $CO_2Emission$, *NFA*, *FDI*, and *UrbanPop* of country i at time t. Finally, $\varepsilon_{i,t}$ is the error term; α_0 is the constant; β_1 is the coefficient representing the estimation between female parliamentarians and environmental fiscal policies; and γ represents the vectors of coefficient estimates.

3.6. Descriptive Statistics

Table 1 presents the descriptive statistics of the variables. The table presents the mean, standard deviation, minimum, maximum, and median as well as 25% and 75% quartiles for the variables in the model. The mean value of *TEIFFS* is 0.063 with a standard deviation of 0.088, while the mean value occurs for *TEFFS* at 0.013 and for *TIFFS* at 0.051 with standard deviations of 0.13 and 0.68, respectively. Additionally, the mean value of *TET* is 0.034 with a standard deviation of 0.021, while the mean value of *TEPE* is 0.009 with a standard deviation of 0.009. The mean value of *FemPar* in this study is 0.197 with a 0.119 standard deviation, which is consistent with previous studies (e.g., [32,34,42]). Finally, the mean (standard deviation) values for the country control variables are 8.677 (1.461), 0.850 (0.350), 9.730 (2.328), 25.093 (3.008), 3.948 (3.394), and 0.597 (0.226) for *GDPPC*, *Openness*, $CO_2Emission$, *NFA*, *FDI*, and *UrbanPop*, respectively.

Table 1. Summary statistics.

Variables	Mean	SD	Min	Max	25%	50%	75%
TEFFS	0.013	0.030	0.000	0.455	0.000	0.002	0.010
TIFFS	0.051	0.068	0.000	0.606	0.009	0.027	0.062
TEIFFS	0.063	0.088	0.000	0.836	0.012	0.029	0.082
TET	0.034	0.021	0.004	0.067	0.014	0.034	0.052
TEPE	0.009	0.009	0.000	0.081	0.002	0.007	0.014
FemPar	0.197	0.119	0.000	0.638	0.107	0.181	0.274
GDPPC	8.677	1.461	4.705	11.803	7.600	8.657	9.891
Openness	0.850	0.350	0.383	1.459	0.555	0.791	1.102
CO_2Emission	9.730	2.328	2.303	16.186	8.202	9.836	11.350
NFA	25.093	3.008	13.228	29.135	22.857	25.511	27.469
FDI	3.948	3.394	0.155	10.888	1.208	2.946	5.818
UrbanPop	0.597	0.226	0.106	1.000	0.429	0.612	0.775

Table 2 demonstrates a Spearman correlation analysis. The signs of the variables between dependent variables and independent variables show no surprise. The correlation analysis result highlights that there are no closely correlated coefficients between regressors; therefore, multicollinearity is not a concern of this study.

Table 2. Spearman correlation matrix.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) TEFFS	1.0000											
(2) TIFFS	0.4298 ***	1.0000										
(3) TEIFFS	0.5915 ***	0.9472 ***	1.0000									
(4) TET	−0.1158 *	−0.3072 ***	−0.2724 ***	1.0000								
(5) TEPE	0.1024 *	−0.1638 ***	−0.1188 **	0.4024 ***	1.0000							
(6) FemPar	−0.0305 ***	−0.1554 ***	−0.1563 ***	0.1039 ***	0.0476 *	1.0000						
(7) GDPPC	−0.0491	−0.3557 ***	−0.3340 ***	0.3866 ***	0.5063 ***	0.2298 ***	1.0000					
(8) Openness	0.0947	0.0146	0.0643	0.3236 ***	0.4459 ***	−0.0172	0.3800 ***	1.0000				
(9) CO_2Emission	0.3648 ***	0.3300 ***	0.3201 ***	−0.0115	0.0763	0.0690	0.2108 ***	−0.1312 **	1.0000			
(10) NFA	−0.0788	0.1775 ***	0.0946	−0.1665 ***	−0.2917 ***	0.0673	−0.0689	−0.3860 ***	0.4535 ***	1.0000		
(11) FDI	0.0042	0.0445	0.0381	−0.0035	0.0703	0.0057	0.0429	0.2466 ***	−0.1329 **	−0.1018 *	1.0000	
(12) UrbanPop	0.0793	−0.0881	−0.0786	0.0714	0.2938 ***	0.1993 ***	0.5010 ***	0.0261	0.2611 ***	0.0957 *	0.0829 ***	1.0000

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4. Empirical Results

4.1. Female Parliamentarians and Environmental Fiscal Policies

The ordinary least squares (OLS) estimates of Equation (1) in Table 3 reveal the impact of the proportion of female presence in national parliaments on various environmental-related fiscal policies. Confirming the expectations of this study, the results indicate that female parliamentarians positively influence environmentally friendly fiscal policies. Examining fossil fuel subsidies separately, *FemPar* has a negative and significant effect on *TEFFS* (Model 1) and *TIFFS* (Model 2). In Model 3, combining explicit and implicit fossil fuel subsidies as *TEIFFS* yields results consistent with Models 1 and 2, indicating that female parliamentarians decrease the share of subsidies in GDP allocated to fossil fuels explicitly (*TEFFS*), implicitly (*TIFFS*), and combined (*TEIFFS*). Thus, H_{1a} is supported.

Table 3. Baseline results.

	(1)	(2)	(3)	(4)	(5)
Variables	***TEFFS***	***TIFFS***	***TEIFFS***	***TET***	***TEPE***
FemPar	−0.031 ***	−0.064 ***	−0.096 ***	0.018 ***	0.007 ***
	(0.009)	(0.021)	(0.027)	(0.004)	(0.002)
GDPPC	−0.006 ***	−0.015 ***	−0.021 ***	0.006 ***	0.003 ***
	(0.001)	(0.003)	(0.004)	(0.001)	(0.000)
Openness	0.004	0.024 ***	0.028 **	−0.005 ***	0.004 ***
	(0.004)	(0.009)	(0.012)	(0.002)	(0.001)
CO_2Emission	0.004 ***	0.020 ***	0.025 ***	0.001 *	0.000 ***
	(0.001)	(0.002)	(0.002)	(0.000)	(0.000)
NFA	−0.002 ***	−0.006 ***	−0.008 ***	−0.001 ***	−0.000 ***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
FDI	−0.001 ***	0.000	−0.001	0.000 **	0.000
	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
UrbanPop	0.030 ***	0.017	0.047 **	0.000	−0.007 ***
	(0.007)	(0.017)	(0.023)	(0.004)	(0.001)
Constant	0.066 ***	0.110 ***	0.176 ***	0.001	−0.016 ***
	(0.014)	(0.033)	(0.042)	(0.006)	(0.002)

Table 3. *Cont.*

	(1)	(2)	(3)	(4)	(5)
Variables	***TEFFS***	***TIFFS***	***TEIFFS***	***TET***	***TEPE***
Observations	686	686	686	1401	1236
R-squared	0.132	0.219	0.210	0.271	0.331
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Model 4 explores the relationship between *FemPar* and environmental taxes (*TET*). Female politicians show a strong positive association with environmental taxes, reflected in a significantly higher share of environmental taxes in GDP. Therefore, the findings support H_{1b}. Finally, Model 5 investigates the connection between *FemPar* and the ratio of environmental spending to GDP (*TEPE*). As anticipated, a greater degree of female participation in national parliaments is positively and significantly associated with increased environmental protection expenditure. This suggests that countries allocate a larger share of GDP for environmental protection expenditure when there are more women in parliament, supporting H_{1c}.

Furthermore, to confirm that the collinearity is not problematic for this study, a Variance Inflation Factors (VIF) analysis was conducted. The findings in Table 4 show that the highest VIF value in the models is 2.92, and the average VIF value is 1.75, indicating that the variables remain within a safe threshold [124–126].

Table 4. VIF analysis.

	VIF	**1/VIF**
FemPar	1.17	0.855
GDPPC	2.92	0.342
Openness	1.74	0.574
CO_2Emission	1.70	0.587
NFA	1.37	0.729
FDI	1.32	0.756
UrbanPop	2.73	0.366
Mean VIF	1.75	

4.2. Female Parliamentarians and Renewable and Non-Renewable Energy Generation

Energy production emerges as a critical arena where policies and practices converge, shaping a country's sustainability profile. By broadening the scope to encompass women's influence on environmental favouritism from fiscal policies to actions that directly affect emission levels, this investigation of female parliamentarians and energy generation provides a comprehensive understanding of women's multifaceted roles in shaping environmental policies beyond fiscal perspectives. The data for renewable and non-renewable energy generation were collected from the International Renewable Energy Agency (IRENA).

Table 5 presents the results of the relationship between the proportion of female representation in national parliaments (*FemPar*) and various aspects of energy generation. Across different sub-areas of renewable energy generation, the influence of female politicians is overwhelmingly positive, with significant associations observed in total renewable energy generation as well as in bioenergy, geothermal, hydropower, solar, and wind. This alignment underscores the potential role of women in driving sustainable energy practices and fostering the importance of renewable energy for the environment. However, an intriguing exception emerges in the case of marine energy (tidal and wave power), where the coefficient for *FemPar* exhibits an unexpected negative sign. This result may be attributed to various factors, such as the negative effects of marine renewable energy plants on the marine environment and ecology [127,128], technological and technical maturity [129,130], and the cost of implementing marine energy plants [131,132].

Table 5. The effects of female parliamentarians on the generation of renewable and non-renewable energy.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Variables	**Bioenergy**	**Geothermal**	**Hydropower**	**Marine**	**Solar**	**Wind**	**Total Renewable**	**Fossil Fuels**	**Nuclear**	**Other Non-Renewable**	**Pumped Storage**	**Total Non-Renewable**
FemPar	2.650 ***	3.553 **	1.390 ***	−19.238 ***	5.472 ***	8.394 ***	4.261 ***	−2.290 ***	−3.496 ***	1.143	0.868	−1.996 ***
	(0.431)	(1.466)	(0.463)	(3.320)	(0.772)	(0.752)	(0.459)	(0.319)	(0.458)	(0.709)	(0.549)	(0.377)
GDPPC	0.742 ***	−0.537 ***	0.136 **	3.770 ***	0.948 ***	0.962 ***	0.196 ***	−0.057	0.544 ***	0.952 ***	0.470 ***	0.143 ***
	(0.060)	(0.168)	(0.062)	(0.457)	(0.100)	(0.096)	(0.060)	(0.037)	(0.065)	(0.095)	(0.061)	(0.046)
Openness	0.508 ***	−7.619 ***	−2.186 ***	2.701 *	0.214	0.104	−1.035 ***	−0.087	0.053	0.294	0.119	−0.142
	(0.179)	(0.672)	(0.192)	(1.416)	(0.312)	(0.307)	(0.188)	(0.123)	(0.186)	(0.265)	(0.213)	(0.148)
CO_2Emission	0.649 ***	−0.588 ***	0.588 ***	−0.290	0.469 ***	0.900 ***	0.781 ***	1.309 ***	0.491 ***	1.068 ***	0.664 ***	1.136 ***
	(0.033)	(0.076)	(0.034)	(0.335)	(0.054)	(0.054)	(0.032)	(0.021)	(0.052)	(0.072)	(0.054)	(0.026)
NFA	0.014	0.310 ***	0.038 *	−0.095	0.264 ***	−0.014	0.098 ***	−0.131 ***	−0.031	−0.013	0.058 *	−0.082 ***
	(0.022)	(0.064)	(0.020)	(0.244)	(0.040)	(0.037)	(0.021)	(0.014)	(0.031)	(0.036)	(0.031)	(0.018)
FDI	−0.058 ***	0.033	0.006	−0.517 ***	−0.108 ***	−0.048 *	0.005	0.034 ***	−0.056 ***	−0.031	−0.019	0.011
	(0.017)	(0.065)	(0.017)	(0.119)	(0.027)	(0.027)	(0.017)	(0.011)	(0.017)	(0.022)	(0.018)	(0.013)
UrbanPop	−1.496 ***	3.689 ***	−1.545 ***	−27.333 ***	−3.599 ***	−1.162 *	−1.503 ***	0.468 **	0.447	4.822 ***	−0.605	0.802 ***
	(0.383)	(1.147)	(0.412)	(4.429)	(0.607)	(0.600)	(0.380)	(0.238)	(0.498)	(0.632)	(0.453)	(0.293)
Constant	−7.783 ***	9.407 ***	1.980 ***	−2.453	−16.545 ***	−14.505 ***	−3.031 ***	−0.370	0.620	−20.036 ***	−6.804 ***	−1.258 **
	(0.617)	(1.682)	(0.587)	(9.406)	(1.155)	(1.029)	(0.602)	(0.418)	(0.863)	(1.341)	(0.904)	(0.514)
Observations	1342	274	1480	105	1073	1097	1818	1328	405	532	467	1550
R-squared	0.546	0.524	0.390	0.685	0.402	0.510	0.478	0.827	0.492	0.616	0.519	0.708
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

In non-renewable energy sectors, *FemPar* continues to exert an influence. Female politicians consistently play a negative role in energy generation from fossil fuels, nuclear power plants, and overall total non-renewable areas. This intriguing pattern suggests that higher female representation in national parliaments aligns with a shift towards environmentally conscious policies and a reduced reliance on traditional, non-renewable energy sources.

4.3. Critical Mass of Female Representation in Parliaments on Fiscal Policies

While the findings suggest that female presence in the national parliaments is a strong source of motivation for environmentally friendly fiscal policies and renewable energy generation, it is important to understand that having only a few women in parliament may not inherently translate to meaningful change. Merely token representation, where the number of female parliamentarians is insufficient to constitute a critical mass, may lack the transformative influence needed to amplify women's voices in the legislative process. Achieving a certain ratio of female representation appears crucial to realising the full potential of women's impact on policy decisions and shaping a more sustainable and inclusive political area.

Token theory posits that when women constitute less than 15% of an organisation's population, their presence becomes more symbolic, rather than exerting substantial influence in decision making [133] because, as a minority, they might be subject to—whether intentionally or unintentionally—limited visibility, gender bias, limited networking opportunities, boundary heightening, performance or peer pressures, barriers to advancements, and role entrapment. This notion of tokenism, reinforced by the absence of a critical mass, underscores the importance of a minimum threshold of female representation for impactful contributions. Token theory has been widely discussed in political research, indicating that a critical mass, typically defined as around 30% of a legislative organisation, is crucial to unlocking the true potential of women to democratically influence decisions and legislative outcomes [134–141].

Table 6 reports the relationship between female parliamentarians and environmentally friendly fiscal policies across varying levels of female representation in national parliaments. The analysis categorises parliaments based on female representation: those with less than 10%, between 10% and 20%, between 20% and 30%, and surpassing the proposed 30% threshold and assesses the consistency of results with the baseline findings presented in Table 3 of this study. Notably, when the female proportion is below 10%, between 10% and 20%, or between 20% and 30% of the national parliament, the impacts on *TEFFS*, *TIFFS*, *TEIFFS*, *TET*, and *TEPE* exhibit inconsistencies, with some scenarios showing an opposing relationship or inconclusive and insignificant results. However, a compelling pattern emerges as the proportion increases, especially when surpassing the 30% threshold. Beyond this mark, a consistent negative association is observed with fossil fuel subsidies—*TEFFS*, *TIFFS*, and *TEFFS*—highlighting the influential role of female parliamentarians in reducing fiscal support for non-renewable energy sources. This trend extends to *TET*, where a positive and significant relationship emerges once the female ratio exceeds 30%, indicating a supportive stance toward environmental taxes. The impact of women in parliaments on *TEPE* also aligns with expectations, revealing a positive and significant relationship beyond the 30% threshold. These findings underscore the importance of achieving a substantial representation of women in parliaments to effectively shape environmentally conscious fiscal policies and foster sustainable energy practices.

Table 6. Critical mass theory.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Variables	***TEFFS***	***TIFFS***	***TEIFFS***	***TET***	***TEPE***	***TEFFS***	***TIFFS***	***TEIFFS***	***TET***	***TEPE***
FemPar < 10%	0.005 *	0.002	0.008	−0.004 ***	−0.002 ***					
	(0.003)	(0.007)	(0.009)	(0.001)	(0.000)					

Table 6. *Cont.*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Variables	***TEFFS***	***TIFFS***	***TEIFFS***	***TET***	***TEPE***	***TEFFS***	***TIFFS***	***TEIFFS***	***TET***	***TEPE***
10% ≤ *FemPar* < 20%						0.006 ***	0.021 ***	0.027 ***	−0.001	0.000
						(0.002)	(0.005)	(0.007)	(0.001)	(0.000)
GDPPC	−0.006 ***	−0.015 ***	−0.021 ***	0.006 ***	0.003 ***	−0.006 ***	−0.014 ***	−0.020 ***	0.007 ***	0.003 ***
	(0.001)	(0.003)	(0.004)	(0.001)	(0.000)	(0.001)	(0.003)	(0.004)	(0.001)	(0.000)
Openness	0.004	0.025 ***	0.029 **	−0.005 ***	0.004 ***	0.005	0.029 ***	0.034 ***	−0.006 ***	0.004 ***
	(0.004)	(0.009)	(0.012)	(0.002)	(0.001)	(0.004)	(0.009)	(0.012)	(0.002)	(0.001)
CO_2 Emission	0.005 ***	0.020 ***	0.025 ***	0.000	0.000 ***	0.004 ***	0.020 ***	0.024 ***	0.000	0.000 ***
	(0.001)	(0.002)	(0.002)	(0.000)	(0.000)	(0.001)	(0.002)	(0.002)	(0.000)	(0.000)
NFA	−0.002 ***	−0.006 ***	−0.008 ***	−0.001 ***	−0.000 ***	−0.002 ***	−0.005 ***	−0.008 ***	−0.001 ***	−0.000 ***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
FDI	−0.001 **	0.000	−0.001	0.000 **	0.000	−0.001 ***	−0.000	−0.001	0.000 ***	0.000
	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
UrbanPop	0.030 ***	0.014	0.044*	0.001	−0.006 ***	0.028 ***	0.009	0.037	0.002	−0.007 ***
	(0.007)	(0.017)	(0.023)	(0.004)	(0.001)	(0.007)	(0.017)	(0.023)	(0.004)	(0.001)
Constant	0.065 ***	0.113 ***	0.178 ***	0.002	−0.015 ***	0.060 ***	0.086 ***	0.146 ***	−0.001	−0.018 ***
	(0.014)	(0.033)	(0.043)	(0.006)	(0.002)	(0.014)	(0.033)	(0.043)	(0.006)	(0.002)
Observations	686	686	686	1401	1236	686	686	686	1401	1236
R-squared	0.120	0.208	0.197	0.267	0.330	0.126	0.226	0.214	0.262	0.322
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	(11)	**(12)**	**(13)**	**(14)**	**(15)**	**(16)**	**(17)**	**(18)**	**(19)**	**(20)**
Variables	***TEFFS***	***TIFFS***	***TEIFFS***	***TET***	***TEPE***	***TEFFS***	***TIFFS***	***TEIFFS***	***TET***	***TEPE***
20% ≤ *FemPar* < 30%	−0.002	−0.011 *	−0.013 *	−0.001	0.000					
	(0.002)	(0.006)	(0.007)	(0.001)	(0.000)					
FemPar ≥ 30%						−0.009 ***	−0.016 ***	−0.025 ***	0.006 ***	0.001 **
						(0.002)	(0.006)	(0.008)	(0.001)	(0.000)
GDPPC	−0.006 ***	−0.015 ***	−0.021 ***	0.007 ***	0.003 ***	−0.006 ***	−0.015 ***	−0.021 ***	0.006 ***	0.003 ***
	(0.001)	(0.003)	(0.004)	(0.001)	(0.000)	(0.001)	(0.003)	(0.004)	(0.001)	(0.000)
Openness	0.005	0.028 ***	0.033 ***	−0.005 ***	0.004 ***	0.004	0.023 **	0.027 **	−0.004 **	0.004 ***
	(0.004)	(0.009)	(0.012)	(0.002)	(0.001)	(0.004)	(0.009)	(0.012)	(0.002)	(0.001)
CO_2 Emission	0.004 ***	0.020 ***	0.025 ***	0.000	0.000 ***	0.004 ***	0.020 ***	0.024 ***	0.001 **	0.000 ***
	(0.001)	(0.002)	(0.002)	(0.000)	(0.000)	(0.001)	(0.002)	(0.002)	(0.000)	(0.000)
NFA	−0.002 ***	−0.006 ***	−0.008 ***	−0.001 ***	−0.000 ***	−0.002 ***	−0.006 ***	−0.008 ***	−0.001 ***	−0.000 ***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
FDI	−0.001 ***	0.000	−0.001	0.000 ***	0.000	−0.001 ***	0.000	−0.001	0.000 ***	0.000
	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
UrbanPop	0.028 ***	0.011	0.039 *	0.001	−0.007 ***	0.031 ***	0.017	0.049**	−0.000	−0.007 ***
	(0.007)	(0.017)	(0.023)	(0.004)	(0.001)	(0.007)	(0.017)	(0.023)	(0.004)	(0.001)
Constant	0.067 ***	0.107 ***	0.175 ***	−0.002	−0.017 ***	0.065 ***	0.109 ***	0.174 ***	0.002	−0.016 ***
	(0.014)	(0.033)	(0.043)	(0.006)	(0.002)	(0.014)	(0.033)	(0.042)	(0.006)	(0.002)
Observations	686	686	686	1401	1236	686	686	686	1401	1236
R-squared	0.116	0.212	0.199	0.262	0.322	0.134	0.216	0.208	0.273	0.325
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.4. Dynamic Influence of Female Representation in Parliaments on Fiscal Policies

Table 7 reports the reactions of female parliamentarians to varying levels of environmentally friendly fiscal policies. In this analysis, environmental fiscal policies are divided into three categories based on quartiles: 25th (Q25), 50th (Q50), and 75th (Q75). The baseline analysis is then reconducted using these three quartile-based samples.

Table 7. Effect of female parliamentarians on environmental favouritism using quantile regression estimates.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Variables	***TEFFS* *Q25***	***TEFFS* Q50**	***TEFFS* Q75**	***TIFFS* *Q25***	***TIFFS* Q50**	***TIFFS* Q75**	***TEIFFS* Q25**	***TEIFFS* Q50**	***TEIFFS* Q75**	***TET* Q25**	***TET* Q50**	***TET* Q75**	***TEPE* Q25**	***TEPE* Q50**	***TEPE* Q75**
FemPar	0.000 **	−0.003 ***	−0.079 ***	0.001 *	−0.003 **	−0.088 **	−0.005 *	−0.007 *	−0.227 ***	0.012 ***	0.005 *	0.002	0.002 ***	−0.001 **	0.008 *
	(0.000)	(0.001)	(0.020)	(0.002)	(0.005)	(0.051)	(0.003)	(0.006)	(0.062)	(0.003)	(0.003)	(0.003)	(0.000)	(0.001)	(0.003)
GDPPC	0.000	−0.000	−0.005	−0.000	−0.001	−0.019 **	−0.000	−0.001	−0.029 **	−0.000	0.002 ***	0.001 *	0.000	0.001 ***	−0.001 ***
	(0.000)	(0.000)	(0.003)	(0.000)	(0.001)	(0.009)	(0.000)	(0.001)	(0.011)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Openness	−0.000	−0.000	−0.012	0.002 *	−0.003	−0.026	0.003 **	−0.001	−0.063 **	0.000	0.001	−0.002 **	0.000 **	−0.000	0.003 ***
	(0.000)	(0.000)	(0.010)	(0.001)	(0.002)	(0.022)	(0.001)	(0.003)	(0.028)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
CO_2 Emission	0.000 **	−0.000	0.003 *	0.001 ***	−0.000	0.019 ***	0.002 ***	0.001	0.015 **	−0.001 ***	0.000	0.000	0.000 ***	−0.000	0.000
	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.004)	(0.000)	(0.001)	(0.006)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
NFA	0.000	−0.000	−0.002 *	−0.000	−0.000	−0.005 *	−0.000	−0.000	−0.005	−0.001 ***	0.000	−0.000 *	−0.000	0.000	−0.000 **
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.003)	(0.000)	(0.000)	(0.004)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
FDI	−0.000	0.000	−0.001	0.000	−0.000	0.005 **	0.000	−0.000	0.003	−0.000	0.000 *	−0.000	−0.000	−0.000	0.000
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
UrbanPop	−0.000	0.001	0.056 ***	0.002	0.010 **	0.031	0.002	0.009 *	0.138 ***	0.004	−0.010 ***	−0.001	−0.001 **	−0.002 **	0.021 ***
	(0.000)	(0.001)	(0.018)	(0.002)	(0.004)	(0.039)	(0.002)	(0.005)	(0.051)	(0.003)	(0.003)	(0.002)	(0.000)	(0.001)	(0.003)
Constant	−0.000	0.003 *	0.096 ***	−0.005 *	0.037 ***	0.239 ***	−0.007 *	0.046 ***	0.412 ***	0.089 ***	0.018 ***	0.007 **	0.000	−0.003	0.017 ***
	(0.000)	(0.001)	(0.035)	(0.003)	(0.008)	(0.086)	(0.004)	(0.009)	(0.114)	(0.003)	(0.004)	(0.004)	(0.001)	(0.002)	(0.004)
Observations	204	240	242	210	247	229	213	249	224	431	481	489	486	398	352
R-squared	0.138	0.086	0.165	0.367	0.042	0.131	0.332	0.044	0.169	0.286	0.119	0.074	0.110	0.230	0.196
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The consistent negative influence of female parliamentarians (*FemPar*) on explicit, implicit, and combined fossil fuel subsidies only appears when the subsidies for fossil fuels are in the highest quartiles of *TEFFS*, *TIFFS*, or *TEIFFS*. In contrast, when subsidies are in the lowest quartile, *FemPar*'s influence is either positive for *TEFFS* and *TIFFS* or remains negative for *TEIFFS* but with a weaker association. Therefore, the results suggest that women in parliaments have more influence on environmentally friendly fiscal policies when the explicit, implicit, and combined subsidies are at higher levels. When subsidies for fossil fuels are already high, the negative impact of *FemPar* may reflect a push for greater fiscal responsibility, environmental consciousness, or a reallocation of resources toward more sustainable practices. Conversely, when subsidies are low, *FemPar* shows less resistance to maintaining or slightly increasing these levels, recognising that further decreases could lead to unintended consequences, such as potential disruption of sectors, increased unemployment, economic destabilisation, or even social unrest.

A similar pattern for *FemPar* extends to *TET* and *TEPE*. *FemPar* shows a positive and significant effect when taxes are initially lower, indicating a tendency to increase them. However, when taxes are already higher, *FemPar* does not exert a significant impact in further elevating them. Here, *FemPar* may advocate for higher taxes to discourage environmentally harmful practices and promote sustainable alternatives. On the other hand, when taxes are already high, the potential for further increases might be limited due to political considerations or the need to balance economic priorities. Furthermore, *FemPar* is associated with significant decreases in expenditure if they are higher but an increase when the expenditures are lower. The role of female members of the parliaments in decreasing expenditures when they are higher could be driven by efforts to optimise spending, eliminate inefficiencies, or redirect funds to areas with more pressing needs. When expenditures are low, *FemPar* may seek to increase funding to bolster environmental protection initiatives. In navigating these complexities, the findings suggest that female politicians may strategically advocate for incremental changes that align with environmental goals while considering the broader economic implications, fostering a pragmatic approach to policy adjustments.

4.5. Robustness Checks

4.5.1. Additional Control Variables

One of the potential challenges faced by this study is the influence of unobserved determinants on environmentally friendly fiscal policies, which might bias the baseline estimates presented in Table 3. To address issues such as confounding factors, unobserved heterogeneity, or endogeneity, a set of additional variables is introduced into the baseline models. The objective of this exercise is to scrutinise factors contributing to variation in environmentally friendly fiscal policies by testing the sensitivity and robustness of the baseline models. The findings with additional control variables are presented in Table 8.

Table 8. OLS regression with additional variables.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Variables	***TEFFS***	***TIFFS***	***TEIFFS***	***TET***	***TEPE***
FemPar	−0.030 ***	−0.044 **	−0.074 ***	0.010 **	0.005 **
	(0.008)	(0.020)	(0.024)	(0.005)	(0.002)
GDPPC	−0.010 ***	−0.023 ***	−0.034 ***	−0.005 ***	0.000
	(0.003)	(0.008)	(0.009)	(0.001)	(0.001)
Openness	0.007 **	0.022 ***	0.029 ***	−0.009 ***	0.005 ***
	(0.003)	(0.008)	(0.010)	(0.002)	(0.001)
CO_2Emission	−0.001	0.011 ***	0.009 ***	−0.002 ***	0.001 ***
	(0.001)	(0.002)	(0.002)	(0.000)	(0.000)
NFA	−0.001 ***	−0.000	−0.002	−0.001 ***	−0.000 ***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)

Table 8. *Cont.*

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Variables	***TEFFS***	***TIFFS***	***TEIFFS***	***TET***	***TEPE***
FDI	−0.000	0.002 ***	0.002 *	0.000 *	0.000
	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
UrbanPop	0.008	0.005	0.013	−0.022 ***	−0.001
	(0.007)	(0.018)	(0.021)	(0.004)	(0.002)
IncomeGroup	−0.001	−0.014 **	−0.015 **	0.005 ***	0.000
	(0.003)	(0.006)	(0.008)	(0.002)	(0.001)
Democracy	−0.006 **	−0.008	−0.014 *	0.007 ***	0.005 ***
	(0.003)	(0.006)	(0.008)	(0.001)	(0.001)
Autocracy	0.010 **	0.040 ***	0.050 ***	−0.001	−0.002 **
	(0.004)	(0.010)	(0.012)	(0.003)	(0.001)
HDI	0.186 ***	0.439 ***	0.624 ***	0.062 ***	0.002
	(0.027)	(0.064)	(0.077)	(0.013)	(0.005)
PoliticalStabilty	−0.087 ***	−0.063 **	−0.149 ***	0.002	0.006 ***
	(0.012)	(0.029)	(0.034)	(0.006)	(0.002)
RuleofLaw	−0.054 **	−0.150 ***	−0.204 ***	0.049 ***	0.035 ***
	(0.023)	(0.055)	(0.066)	(0.012)	(0.005)
RegulatoryQuality	−0.011	−0.058	−0.069	0.041 ***	−0.006 *
	(0.018)	(0.043)	(0.052)	(0.010)	(0.004)
Corruption	0.038 **	0.036	0.074 *	−0.029 ***	−0.019 ***
	(0.015)	(0.036)	(0.043)	(0.009)	(0.003)
VulnerabilityScore	−0.001	−0.096	−0.097	−0.010	0.003
	(0.028)	(0.067)	(0.081)	(0.014)	(0.006)
DependencyonImportedEnergy	−0.011 ***	−0.019 **	−0.030 ***	−0.004 *	−0.000
	(0.003)	(0.008)	(0.010)	(0.002)	(0.001)
EducationExpenditure	0.001 *	0.003 **	0.005 **	0.001 **	−0.000 *
	(0.001)	(0.002)	(0.002)	(0.000)	(0.000)
Constant	0.082 ***	0.010	0.092	0.029 **	−0.021 ***
	(0.027)	(0.066)	(0.079)	(0.014)	(0.006)
Observations	499	499	499	991	1018
R-squared	0.419	0.527	0.560	0.518	0.498
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

In addition to the variables employed in the baseline models, the models in Table 8 showcase a wide range of country-specific factors: income (*IncomeGroup*), democracy (*Democracy*), autocracy (*Autocracy*), Human Development Index (*HDI*), political stability (*PoliticalStability*), rule of law (*RuleofLaw*), corruption (*Corruption*), regulatory quality (*RegulatoryQuality*), Climate Change Vulnerability Index (*VulnerabilityScore*), dependency on imported energy (*DependencyonImportedEnergy*), and education expenditures (*EducationExpenditure*).

The variable *IncomeGroup* represents different income categories in our analysis, ranging from 1 for low to 4 for high-income countries. The inclusion of income groups in our models allows us to explore how a country's economic status may influence its approach to environmentally friendly fiscal policies. Generally, higher-income countries have more financial resources to invest in sustainable initiatives, protect natural capital, promote sustainable development goals, and adopt environmentally conscious policies, while lower-income countries may face different economic challenges and prioritise other aspects of development [142–145]. Examining these relationships serves to provide insights into how economic factors shape a country's environmental policy strategy. Following Mavisakalyan and Tarverdi [32] and Marshall et al. [146], *Democracy* and *Autocracy* represent the degree of democratic governance and autocratic rule based on classification on a 21-point scale, allowing a country to be designated as autocratic if its value falls between −6 and −10 and as democratic if it falls between 6 and 10. Democracies are often characterised by greater transparency, citizen participation, and accountability, which may contribute to more environmentally conscious policy making [147–149]. Conversely, autocratic regimes may prioritise economic development and political stability over environmental concerns. Autocracies may face fewer checks and balances, potentially leading to decisions that prioritise short-term economic gains at the expense of long-term environmental sustainability [150–152].

The variable *HDI* is derived from the United Nations Development Programme (UNDP) and serves as a comprehensive measure of a country's average achievements in critical dimensions of human development. Comprising indicators of a long and healthy life, educational attainment, and a decent standard of living, the *HDI* represents the geometric mean of normalised indices for each of these three dimensions. The inclusion of *HDI* allows for the assessment of how countries with higher human development scores may exhibit different approaches to environmentally friendly fiscal policies, reflecting the interconnectedness of socio-economic well-being and environmental consciousness [153,154]. Furthermore, the analysis included indicators from The Worldwide Governance Indicators (WGI) provided by the World Bank, which are *PoliticalStability*, *RegulatoryQuality*, and *RuleofLaw*. *PoliticalStability* assesses the likelihood of political unrest or violence, *RegulatoryQuality* evaluates the strength of regulatory frameworks, and *RuleofLaw* measures the extent to which laws are applied and enforced. In addition to these indicators, *Corruption* is also added to the model to gauge the level of corruption within the government.

The analysis also incorporates the *VulnerabilityScore*, *DependencyonImportedEnergy*, and *EducationExpenditure*. The *VulnerabilityScore* is a tool that evaluates social, economic, and environmental factors to assess national vulnerabilities across three core areas: exposure to climate-related natural disasters and sea-level rise; human sensitivity in terms of population patterns, development, natural resources, agricultural dependency, and conflicts; and future vulnerability by considering the adaptive capacity of a country. Countries facing vulnerability to climate change at higher levels might proactively adopt measures to mitigate its impact, aligning with their interests to address environmental challenges before they escalate [34,155]. Nawaz and Alwi [156] argue that a higher level of dependence on imported energy leads to higher CO_2 emissions, while Pan et al. [157] suggest that relying heavily on imported energy resources could result in negative economic and environmental implications. Therefore, higher dependency on imported energy sources worsens energy security and disrupts socio-economic and environmental sustainability. Finally, education plays a crucial role in promoting environmental sustainability by raising awareness, encouraging sustainable practices, and driving innovation in clean technologies, and education spending allows most of the population to better understand their environment, which can contribute to environmental protection [158–160].

The relationship between female parliamentarians and environmentally friendly fiscal policies remained consistent with the baseline model, even after incorporating these additional controls. This resilience in the observed association underscores the robustness of the link between female parliamentary representation and proactive environmental fiscal measures, highlighting its significance amid the intricate inter-relationship between diverse country-specific factors.

4.5.2. Omitted Variable Bias

Inspired by the methodology of Oster [161], this study investigates the sensitivity of its findings to potential omitted variable bias. The assessment of omitted variables hinges on the stability of coefficients, using R-squares derived from regressions with and without controls to establish an identifiable set. If the identifiable set excludes zero, then the null hypothesis that an omitted variable might be driving the results can be rejected.

To determine the identified set, $\tilde{\beta}$ and β^* are employed, where β^* is determined using the formula from Oster [161]:

$$\beta^* \approx \tilde{\beta} - \delta\left[\dot{\beta} - \tilde{\beta}\right]\frac{R_{max} - \tilde{R}}{\tilde{R} - \dot{R}} \tag{2}$$

where $\dot{\beta}$ and $\dot{R}$ are the coefficient and R-squared from the regression model, respectively, with only environmentally friendly fiscal policies and female presence in the national parliaments and no control variables, where $\alpha = 0$ and $\widetilde{\beta}$ and $\widetilde{R}$ are the coefficient and R-squared from the regression model with control variables in addition to environmentally friendly fiscal policies and female presence in the national parliaments where $\alpha \neq 0$. δ is the relative degree of observable variables compared to unobservable variables, and finally, R_{max} denotes the R-squared from a hypothetical regression of the dependent variables on both observed and unobserved variables. Oster [161] proposed that the coefficient of the independent variable should swing between $\widetilde{\beta}$ and β^* calculated under the assumption of $\delta = 1$ implying the unobservable factor has the same magnitude of influence as the observed factors in the model, suggesting a substantial potential for bias due to the omitted variables.

Table 9 presents the results of the omitted variables analysis. In this analysis, to set the upper bound in the identified sets, R_{max} ranges from $R_{max} = 0.9$ which is defined as an extreme value [161] to $R_{max} = \min\left\{2.2\widetilde{R}, 1\right\}$ which is defined as a more conservative value [162]. While Oster [161] suggests that most of the bounds would not endure when subjected to the conditions of $R_{max} = 1$, this study applied the assumption of $R_{max} = 0.9$ considering measurement errors that could occur in environmentally friendly fiscal policies accounting for 10% of the variation therein. Using different combinations of upper bounds with lower bounds, none of the given conditions include zero in the identified sets. The results presented in Table 9 suggest that the findings of the study are unlikely to suffer from omitted variable bias.

Table 9. Test of omitted variable bias—Oster (2019).

	TEFFS	*TIFFS*	*TEIFFS*	*TET*	*TEPE*
Oster Conditions	**Identified Set**	**Identified Set**	**Identified Set**	**Identified Set**	**Identified Set**
(1) $[\widetilde{\beta},\ \beta^*_{(R_{max}=\min\{1.25\widetilde{R},1\},\ \delta=1)}]$	[−0.114, −0.031]	[−0.197, −0.064]	[−0.283, −0.096]	[0.018, 0.097]	[0.007, 0.028]
(2) $[\widetilde{\beta},\ \beta^*_{(R_{max}=\min\{1.5\widetilde{R},1\},\ \delta=1)}]$	[−0.132, −0.031]	[−0.229, −0.064]	[−0.329, −0.096]	[0.018, 0.117]	[0.007, 0.034]
(3) $[\widetilde{\beta},\ \beta^*_{(R_{max}=\min\{2\widetilde{R},1\},\ \delta=1)}]$	[−0.169, −0.031]	[−0.294, −0.064]	[−0.419, −0.096]	[0.018, 0.157]	[0.007, 0.046]
(4) $[\widetilde{\beta},\ \beta^*_{(R_{max}=\min\{2.2\widetilde{R},1\},\ \delta=1)}]$	[−0.184, −0.031]	[−0.319, −0.064]	[−0.455, −0.096]	[0.018, 0.173]	[0.007, 0.051]
(5) $[\widetilde{\beta},\ \beta^*_{(R_{max}=0.9,\ \delta=1)}]$	[−0.089, −0.031]	[−0.152, −0.064]	[−0.220, −0.096]	[0.018, 0.069]	[0.007, 0.020]

4.5.3. Instrumental Variable Analysis

Addressing unobserved heterogeneity is imperative in statistical analyses to uphold the validity and reliability of research findings. While this study incorporated additional control variables (Section 4.5.1) and employed Oster's [161] indicative test for omitted variable bias (Section 4.5.2) to assess the robustness of the baseline results by gauging the effects of unobserved factors on female presence in parliaments and environmentally friendly fiscal policies, it is challenging to completely purify any relationship from the bias introduced by unobserved heterogeneity. Another widely adopted approach in the literature to mitigate this challenge is the use of instrumental variable analysis, which allows for the estimation of a 2SLS model.

Following Mavisakalyan and Tarverdi [32], this study used the number of years since females were granted the right to vote as an instrumental variable. Female suffrage is considered a relevant and appropriate instrument for several reasons: (i) female suffrage should be correlated with the female presence in national parliaments, making it a relevant instrument for the endogenous variable of interest; (ii) the historical process of granting voting rights to females is likely to be exogenous to contemporary environmental policies, which means that changes in environmental policies are not directly influenced by past decisions related to female suffrage; and (iii) a country's history of suffrage should greatly influence the female presence in parliaments but is not directly expected to affect current environmentally friendly fiscal policies, which ensures that the instrument primarily influences the endogenous variable through its impact on female parliamentary representation.

Table 10 presents the results of the 2SLS instrumental variable analysis. To test the validity of the instrumental variable, four different tests were conducted. *Kleibergen–PaapWald rk F-statistics* for *TEFFS*, *TIFFS*, *TEIFFS*, *TET*, and *TEPE* are higher than the acceptable threshold of the 10% critical value (16.38), which suggests rejecting the fact that the instrument employed is weak. Statistically significant *Kleibergen–Paap rk LM* shows that the models are not under-identified. Furthermore, a statistically significant *Sanderson–Windmeijer F test* implies that the Female Suffrage instrument variable is an explanatory variable for the female presence in national parliaments. Statistically significant *Anderson–Rubin Wald test*s suggest that the instrument employed in the models is valid, i.e., the instruments collectively have explanatory power for the endogenous variable in the second stage. Finally, the statistically significant p-values from the *Wu–Hausman* test across all models reveal endogeneity bias in the *ffempar* regressors, indicating that 2SLS estimation is appropriate to address this issue. Along with these tests, the first stage of the 2SLS regressions (Model 1, 5, and 7) analyses the relationship between female suffrage and female representation in national parliaments by controlling all other factors from the baseline model. The findings suggest that there is a strong association between the years since women have been given the right to vote and the ratio of female parliamentarians to the total number of members in the parliaments.

Table 10. 2sls IV regression.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	FirstStage *FemPar*	**SecondStage *TEFFS***	**SecondStage *TIFFS***	**SecondStage *TEIFFS***	**FirstStage *FemPar***	**SecondStage *TET***	**FirstStage *FemPar***	**SecondStage *TEPE***
FemPar		−0.292 ***	−0.924 ***	−1.216 ***		0.252 ***		0.031 ***
		(0.081)	(0.243)	(0.305)		(0.060)		(0.008)
Suffrage	0.001 ***				0.001 ***		0.001 ***	
	(0.000)				(0.000)		(0.000)	
GDPPC	0.001	−0.004 **	−0.009 *	−0.013 *	0.019 ***	0.001	0.029 ***	0.002 ***
	(0.005)	(0.002)	(0.005)	(0.007)	(0.003)	(0.002)	(0.003)	(0.000)
Openness	0.003	0.003	0.021	0.024	−0.038 ***	0.005	−0.002	0.004 ***
	(0.015)	(0.006)	(0.016)	(0.020)	(0.011)	(0.004)	(0.011)	(0.001)
CO_2Emission	0.005 *	0.006 ***	0.024 ***	0.029 ***	−0.007 ***	0.002 ***	−0.005 ***	0.001 ***
	(0.003)	(0.001)	(0.003)	(0.004)	(0.002)	(0.001)	(0.002)	(0.000)
NFA	0.004 *	−0.001	−0.001	−0.002	0.008 ***	−0.003 ***	0.005 ***	−0.001 ***
	(0.002)	(0.001)	(0.002)	(0.003)	(0.001)	(0.001)	(0.001)	(0.000)
FDI	0.001	−0.001	0.002	0.002	0.000	0.000	−0.002 *	0.000
	(0.001)	(0.000)	(0.002)	(0.002)	(0.001)	(0.000)	(0.001)	(0.000)
UrbanPop	0.050 *	0.043 ***	0.057 *	0.100 **	0.068 ***	−0.017 **	−0.061 ***	−0.005 ***
	(0.028)	(0.011)	(0.031)	(0.040)	(0.022)	(0.008)	(0.022)	(0.002)
Constant	−0.041	0.049 **	0.053	0.103	−0.151 ***	0.039 ***	−0.148 ***	−0.010 ***
	(0.054)	(0.021)	(0.062)	(0.081)	(0.028)	(0.014)	(0.037)	(0.003)
Observation	686	686	686	686	1401	1401	1236	1236
R-Squared		0.7096	0.7601	0.8451		0.344		0.623
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
				F Test of Excluded Instruments				
Sanderson–Windmeijer *F* test				19.22 ***		24.16 ***		66.51 ***
				Under Identification Test				
Kleibergen–Paap rk LM statistic				17.07 ***		24.64 ***		55.42 ***
				Weak Identification Test				
Kleibergen–Paap rk Wald *F* statistic				19.22		24.12		66.51
				Weak Instrument Test				
Anderson–Rubin Wald test				22.68 ***		39.98 ***		16.11 ***
				Endogeneity Test				
Wu–Hausman Chi^2 (1)		18.63	35.14	39.76		37.99		11.417
(*p*-val.)		(0.0000)	(0.0000)	(0.0000)		(0.0000)		(0.0007)

Note: Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

In the second stage (Model 2, 3, 4, 6, 8), the relationships between *FemPar* and *TEFFS*, *TIFFS*, *TEIFFS*, *TET*, and *TEPE* were assessed using the predicted value of *FemPar* after excluding the instrumental variable. The second stage findings are consistent with the baseline regression estimates, suggesting that female representation in national parliaments is a driving factor for more environmentally friendly fiscal policies. The ensuing analysis and results shed light on the robustness of the main findings, considering the potential influence of unobserved heterogeneity on the relationship between female parliamentary representation and environmentally friendly fiscal policies.

5. Conclusions

This comprehensive examination of the relationship between female parliamentary representation and environmentally friendly fiscal policies has revealed significant insights. The findings of the study highlight the positive influence of female parliamentarians on environmentally friendly fiscal policies. However, this positive influence for environmental favouritism extends beyond the overall environmental policy agenda to other environment-specific domains, such as being a driving force for the assumption of renewable energy generation while concurrently mitigating energy generation from non-renewable sources. Furthermore, the findings reveal a rational approach adopted by female politicians in supporting environmentally friendly fiscal policies. Their careful navigation is evident in actions aimed at avoiding potential pitfalls, such as under-subsidising critical sectors or imposing excessive taxes and expenditures on environmental initiatives. This strategic approach is necessary to prevent unintended economic consequences, emphasising the thoughtful and considered role of female leaders in shaping environmentally sustainable fiscal policies.

Furthermore, an insightful aspect revealed by the study is the consistency of results when the proportion of female parliamentarians exceeds 30% in national parliaments. This suggests that beyond gender quotas, creating sufficient space for women within political bodies is crucial for realising the positive impact of female representation on environmentally friendly fiscal policies. The study advocates for a dual approach—the implementation of gender quotas to ensure inclusivity and the creation of an environment that facilitates substantial female participation, emphasising the importance of both strategies in achieving optimal outcomes.

This policy implication suggests that governments and political parties may benefit from actively promoting and supporting gender diversity within their legislative bodies. By encouraging the inclusion of women in parliamentary roles and leadership positions, countries can potentially enhance their environmental policy agendas. To put this implication into practice, governments might consider implementing measures, such as gender quotas, targeted recruitment efforts, and leadership development programs, to ensure a more balanced representation of women in parliaments. In addition, political parties may actively seek out and support female candidates, fostering a political environment that values gender diversity.

The goal of these policies and measures is not only to promote gender equality but also to harness the potential benefits of diverse perspectives and experiences in shaping policies related to environmental protection and climate change mitigation. By actively pursuing gender diversity in parliaments, countries can work towards more comprehensive and effective strategies to address pressing environmental challenges. This policy implication underscores the broader significance of the findings, advocating for proactive steps to enhance gender representation in politics for the benefit of environmental sustainability and inclusive governance. Furthermore, countries with established and effective environmental policies can also benefit financially by attracting environmentally conscious investors [163].

Despite the insights provided by this study, several limitations should be acknowledged. First, the geographical scope of the analysis, encompassing a broad sample of countries, may obscure region-specific variations in the impact of female parliamentary representation on environmental fiscal policies. Although the study establishes a general relationship between female parliamentary representation and environmentally friendly fiscal measures, it does not empirically explore why a higher number of female parliamentarians might lead to improved environmental policies. Factors such as the age, education, or cultural background of female parliamentarians could influence this relationship and warrant further investigation. To address these limitations and build on the current research, several avenues for future study are suggested. Future research could focus on region-specific analyses to uncover localised effects and variations in policy outcomes. Investigating the impact of female parliamentary representation on specific environmental policies, such as renewable energy or waste management, could provide more detailed insights. Additionally, incorporating intersectional factors and examining the influence of global dynamics on national policies could enhance our understanding of the complex interplay between gender representation and environmental fiscal measures. Exploring the economic rationale behind these relationships in greater detail, potentially with new data and methodologies, would further validate and expand upon the findings of this study.

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Appendix A

The list of sample countries is as follows:

Albania	Czechia	Kuwait	Romania
Algeria	Denmark	Kyrgyzstan	Russian Federation
Angola	Djibouti	Latvia	Rwanda
Antigua and Barbuda	Dominica	Lebanon	Samoa
Argentina	Dominican Rep.	Lesotho	Saudi Arabia
Armenia	Ecuador	Libya	Senegal
Austria	Egypt	Lithuania	Serbia
Azerbaijan	El Salvador	Luxembourg	Seychelles
Bahamas	Equatorial Guinea	Madagascar	Sierra Leone
Bahrain	Estonia	Malaysia	Singapore
Bangladesh	Eswatini	Maldives	Slovakia
Barbados	Fiji	Mali	Slovenia
Belarus	Finland	Malta	Solomon Islands
Belgium	France	Mauritania	South Africa
Belize	Gabon	Mauritius	Rep. of Korea
Benin	Gambia	Mexico	Spain
Bhutan	Georgia	Micronesia	Sri Lanka
Bolivia	Germany	Moldova	Sweden
Bosnia and Herzegovina	Ghana	Mongolia	Switzerland
Botswana	Greece	Montenegro	Tajikistan
Brazil	Guatemala	Morocco	Tanzania
Brunei Darussalam	Guinea	Mozambique	Thailand
Bulgaria	Guinea-Bissau	Myanmar	DR Congo
Burkina Faso	Guyana	Namibia	Timor-Leste
Burundi	Haiti	Nepal	Togo
Cabo Verde	Honduras	Netherlands	Tonga
Cambodia	Hungary	Nicaragua	Tunisia
Cameroon	Iceland	Niger	Turkey
Canada	India	Nigeria	Uganda
Central African Rep.	Indonesia	Norway	Ukraine
Chad	Iran	Oman	United Arab Emirates
Chile	Iraq	Pakistan	United Kingdom
China	Ireland	Panama	United States of America
Colombia	Israel	Papua New Guinea	Uruguay
Comoros	Italy	Paraguay	Uzbekistan
Rep. of the Congo	Jamaica	Peru	Vanuatu
Costa Rica	Japan	Philippines	Venezuela
Côte d'Ivoire	Jordan	Poland	Vietnam
Croatia	Kazakhstan	Qatar	Yemen
Cyprus	Kenya	North Macedonia	Zambia

Appendix B

Variable	Definition
Dependent Variables	
The ratio of Total Explicit Fossil Fuel Subsidies to GDP (*TEFFS*)	The proportion of the total explicit subsidies, expressed in the local currency, for natural gas, coal, electricity, and petroleum to the GDP in the local currency of each country per year. Source: IMF, World Bank.
The ratio of Total Implicit Fossil Fuel Subsidies to GDP (*TIFFS*)	The proportion of the total implicit subsidies, expressed in the local currency, for natural gas, coal, electricity, and petroleum to the GDP in the local currency of each country per year. Source: IMF, World Bank.
The ratio of Total Explicit and Implicit Fossil Fuel Subsidies to GDP (*TEIFFS*)	The proportion of the total implicit and total explicit subsidies, expressed in the local currency, for natural gas, coal, electricity, and petroleum to the GDP in the local currency of each country per year. Source: IMF, World Bank.
The ratio of Total Environmental Taxes to GDP (*TET*)	The proportion of the total sum of environmental taxes in the local currency including taxes on energy (including fuel for transport), taxes on pollution, taxes on resources, and taxes on transport (excluding fuel for transport) to the GDP in the local currency of each country per year. Source: IMF, World Bank.
The ratio of Total Environmental Protection Expenditures to GDP (*TEPE*)	The proportion of the total sum of environmental taxes in the local currency including expenditure on biodiversity and landscape protection, expenditure on environmental protection not elsewhere classified, expenditure on environmental protection R&D, expenditure on pollution abatement, expenditure on waste management, and expenditure on wastewater management to the GDP in the local currency of each country per year. Source: IMF, World Bank.
Independent Variable	
The ratio of Female Parliamentarians (*FemPar*)	The proportion of seats held by women in national parliaments of each country per year. Source: World Bank, Inter-Parliamentary Union.
Control Variables	
Gross Domestic Products per Capita (*GDPPC*)	The natural logarithm of the GDP per capita of each country per year. Source: World Bank.
Trade Openness (*Openness*)	The ratio of total trade encompassing total exports and total imports to the GDP of each country per year. Source: World Bank.
CO_2 Emission ($CO_2Emission$)	The natural logarithm of the emissions of CO_2 from burning oil, coal, and gas for energy use; burning wood and waste materials; and from industrial processes such as cement production in kilotons of each country per year. Source: World Bank.
Net Foreign Assets (*NFA*)	The proportion of the difference between the sum of foreign liabilities and foreign to the GDP in the local currency of each country per year. Source: IMF.
Foreign Direct Investment (*FDI*)	The ratio of the net inflows of investment to acquire a lasting management interest (10 per cent or more of voting stock) in an enterprise operating in an economy other than that of the investor to the GDP in the local currency of each country per year. Source: World Bank.
Urban Population to Total Population (*UrbanPop*)	The ratio of the population living in urban areas to the total population of a country each year. Source: World Bank.

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