



The Role of Gender in Environmental Policy

Female Political Representation and Government Environmental Protection Expenditure in the EU

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Abstract

Environmental protection is an important policy area for many countries, but countries vary considerably in the amount allocated towards this. The study aims to explain this variation and does so by looking at how female representation in national parliaments influences government environmental protection expenditure in EU member states. It draws on two alternate theories, the median voter theorem and the citizen candidate model, to construct a hypothesis of how differences in preferences of men and women could translate into spending. The hypothesis is that increased female representation translates into increased spending since women, on average, are more environmentally concerned. The study utilises panel data for EU countries for 2004- 2023, and uses a two-way fixed effects model with stepwise introduction of controls. With this setup and controls for ideology, national wealth, higher education, and fossil dependency, no statistically significant results are found. While the study finds no empirical support for the hypothesis, it contributes to the literature by focusing on environmental spending – an underexplored dimension in female representation studies. The results may help refine how the policy impact of gender representation is understood in future research.

Keywords: political economy, environmental politics, female representation, two-way fixed effects

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Abbreviations

Abbreviation	Description
CCM	Citizen Candidate Model
EPE	Environmental Protection Expenditure
EU	European Union
MVT	Median Voter Theorem
pp	Percentage point
WiP	Share of Women in Parliament

1. Introduction

Environmental protection has become increasingly relevant over the past few decades. Pollution, waste, and loss of biodiversity and nature were first recognised as serious issues during the 1972 United Nations Conference on the Human Environment in Stockholm (European Parliament 2018; United Nations n.d.). Today, environmental protection is an important policy area in most democracies – particularly within the EU, with its history of coordinated policies, and reputation as a key player in environmental and climate policy. Still, governments of EU member states differ substantially in the level of resources allocated to environmental protection – ranging from 0.1 to 1.2 percent of GDP in 2024 (Eurostat 2026a), representing more than a tenfold difference in relative spending levels. Even though there is scientific consensus on climate change, environmental concerns among the public can vary systematically between societal groups. Numerous previous studies have found that women express greater environmental concern and are more likely to act pro-environmentally than men (Mohai 1992; McCright 2010; Clements 2012; Sundström & McCright 2014). This, in combination with the under-representation of women in political power (Campa 2021; UN Women 2026), raises a democratic question about whose preferences are reflected in public policy, and whether the preferences of female politicians influence policy outcomes such as environmental spending. Most studies on the effects of female representation on policy focus on non-spending environmental outcomes, general spending, or spending allocated to broader social sectors. Therefore, this study aims to analyse the effect of female political representation on environmental protection expenditure, using a two-way fixed-effects panel model. The aim is to answer the following research question:

How does female representation in national parliaments influence government environmental protection expenditure in EU member states?

2. Literature review

This chapter addresses previous research in this field. It is structured by first identifying how preferences vary between men and women, before moving on to studies on female representation and policy. The literature review concludes by identifying where previous research seems to be insufficient and how this study can contribute to this field. It should be noted that this study conceptualises gender in binary terms – male and female. This is because most studies and available data in this field do not account for other gender identities.

2.1 Gender differences in political preferences

Political preferences are commonly studied either through ideological positioning, typically left-right orientation, or by examining attitudes towards specific policy areas. While ideological positioning can provide a general indication of policy preferences, especially regarding the allocation of resources, differences may emerge in specific policy areas. This section will therefore address studies focusing on gender differences both in terms of ideological orientation and in attitudes towards particular policy areas.

2.1.1 Ideological orientation

Numerous studies have found that there are general differences in ideological orientation between men and women (Inglehart & Norris 2000; Edlund & Pande 2002; Giger 2009; Langsæther & Knutsen 2025; Nennstiel & Hudde 2025). Previous research mentions a traditional gender gap and a modern gender gap (Nennstiel and Hudde 2025). Up until the 1980s, women voted more conservatively, or placed themselves further to the right on a left-right scale, than men. Since the 1980s, there has been a shift towards a modern gender gap where women both vote and place themselves further left than men on the political spectrum. This is in line with the findings of Edlund and Pande (2002), who found that women were becoming increasingly left-wing in both the United States and Europe. This evidence is not fully supported by Nennstiel and Hudde (2025), who could not find strong general evidence of an emerging gender divide in Europe, but they did find a stable trend of an emerging gender divide in 18 of the 29 countries. Persson et al. (2024) states that we know little about why men and women develop different political preferences. They argue that these differences may stem from differences in experiences and social positions. This may include unfair treatment or discrimination in areas such as the labour market, welfare system, or within the household.

These papers provide insight into how men and women generally differ in political positions; the question of whether these broad ideological differences can translate into differences in policy area preferences remains. While environmental issues are often connected to the political left, these studies are not enough to determine if gender differences still remain when zooming in on specific areas.

2.1.2 Policy areas

By shifting focus from ideological orientation to attitudes towards policy areas, it becomes evident that gender differences still remain, but vary slightly across Europe. Women generally have more progressive political views, place a higher value on gender equality, prioritise the environment over economic concerns, and are more pro-immigration (Langsæther & Knutsen 2025). However, the study by Langsæther and Knutsen (2025) found this to be generally stronger for younger people. These results were also stronger for Western European countries than in Southern European ones, which they discussed in terms of religious, historical, and cultural factors. Since attitudes towards the environment are central to this thesis, this slight ambiguity requires further investigation. When focusing specifically on the general public's attitudes towards the environment, the differences appear well-documented but modest. Multiple studies have found that women generally express greater concern for the environment and are more likely to act pro-environmentally than men (Mohai 1992; McCright 2010; Clements 2012; Sundström & McCright 2014).

If these observed differences in political preferences are also present among political representatives, they may be reflected in the parliament composition and, in turn, influence policy. This would require that the observed gender differences in environmental preferences are not only expressed in attitudes, but also in political behaviour such as voting decisions and candidate support. If such differences persist among politicians, this may suggest that the gender balance in parliament is associated with differences in policy preferences between male and female politicians. However, research on gender differences in preferences among politicians is scarce (Ramstetter & Habersack 2020). Fraune (2016) found that female delegates differ from male delegates in their energy policy preferences and take environmental concerns more seriously. This pattern has also been observed in Sweden, where Sundström and McCright (2014) found significant gender differences in environmental concern, with women reporting greater concern than men in municipal and county councils, and in the Swedish Parliament – these differences are largely explained by political orientation. This is similar to the findings of McAllister and Studlar (1992), who found that party affiliation is the strongest predictor of preferences in Australia; gender matters little except for

questions of gender equality. These findings suggest that gender might matter for national environmental protection expenditure, but only in certain contexts.

2.2 Effects of female representation on policy

This section analyses the literature on the impact that female representation has on policy. Here, two distinct categories of studies emerge: the first being those focused on the policy-making process. These studies tend to analyse how female political representation influences legislative behaviour and policy formulation. The second category discusses policy in terms of financial allocation and focuses on how female representation affects government spending. Therefore, this section has been divided into two subsections based on these two categories.

2.2.1 Policy-making process

Similar to gender differences in preferences at the national political level, research on the role of gender in policymaking is relatively underexplored (Fredriksson & Wang 2011). Studies looking at how female political representation influences legislative behaviour suggest that gender does matter for pro-environmental behaviour. Fredriksson and Wang (2011) find that female US politicians favour stricter environmental policies than their male colleagues. Additionally, Ramstetter and Habersack (2020) find that although male and female legislators in EU member states express similar environmental concerns, female legislators are significantly more likely to support environmental legislation than men – even after controlling for ideology. Since women are currently underrepresented in political power, these results indicate that men’s preferences generally shape current environmental policies. However, differences in legislative behaviour do not automatically translate into policy outcomes. Institutional constraints such as party discipline and limited agenda-setting power may restrict the ability of individual politicians to influence final policy decisions – an idea supported by Salamon (2025), who argues that corruption limits the agency of female politicians. As a result, even if female politicians are more supportive of environmental policies, their impact may be diluted in collective decision-making processes. This raises the question of whether these differences in preferences are observable in more concrete outcomes, such as government spending and budget allocation, beyond legislative behaviour.

2.2.2 Government spending

In the literature review by Hessami and da Fonseca (2020), they state that an increase in the fraction of female representation in developed countries has not affected the size and composition of public spending. However, the studies cited

in this argument all focus on sub-national levels and tend to focus on aggregate spending or broadly defined spending categories. For example, the study by Ferreira and Gyourko (2014) focuses on mayors in the US and finds that having a female chief executive has no impact on total spending per capita and spending composition – but only analyses the sectors 1) salaries and wages, 2) police department, 3) fire department, and 4) parks and recreation. Such studies might therefore miss the effects of national spending allocated towards policy areas at the national level. The impact of female representation on spending is more evident for policy areas within social spending; Park (2017) finds that OECD countries with higher female legislative representation tend to spend more on childcare and education. By contrast, Koch and Fulton (2011) find that increased female legislative representation decreases conflict behaviour and defence spending.

Studies focused on environmental spending are less common, and the papers that study the effect of female representation on environmental outcomes tend to focus on broader climate change policy outcomes, (Mavisakalyan & Tarverdi 2019; Salamon 2025) or energy (Koengkan et al. 2026), rather than sector-specific spending. However, they all focus on female representation in national parliaments and provide insight as to how that affects environmental variables. Mavisakalyan and Tarverdi (2019) find that higher female representation in national parliaments results in more stringent climate policies, which leads to lower CO₂ emissions. Similarly, Koengkan et al. (2026) finds that increased representation significantly increases access to clean energy, particularly in high-income EU countries. Additionally, Salamon (2025) finds that there would be significant environmental improvements across a variety of factors in low corruption countries if there were gender parity in parliaments. While her estimates for how great these improvements are may be overstated, the relationship is supported by Mavisakalyan and Tarverdi (2019), as well as Koengkan et al. (2026). So, while none of these studies analyse spending specifically, they all provide evidence of a relationship between female political representation and positive environmental outcomes, which might be mediated by spending.

2.3 Contribution of this study

To summarise this research area, political science studies on female representation and environmental policy tend to examine behavioural effects and policy-making processes, rather than fiscal outcomes such as budget allocations. In contrast, economic studies analysing the impact of female political representation on government spending tend to find limited or context-dependent effects. However,

this literature is commonly focused on aggregate public spending or broadly defined spending categories, with specific sections being less explored. This might conceal variation across more specific policy sections, such as environmental protection. This suggests a research gap between these two strands of literature, where the effects of female representation on spending allocated towards environmental protection are underexplored. By integrating insights from political science studies on preferences and legislative behaviour with an economic framework focused on measurable monetary outcomes, this study aims to provide additional insight into whether female representation affects budget allocation in environmental protection. This allows for an assessment of whether the gender of political representatives translates into differences in actual budget allocations, beyond what can be explained by party ideology alone.

3. Theory

To analyze how female representation in national parliaments influences environmental government spending in the EU, this study draws on two theoretical frameworks – the median voter theorem and the citizen candidate model. Both theories address how policies are shaped, but differ in their assumptions about whose preferences shape these policies. This chapter introduces these theories and discusses their implications for the expected relationship between female political representation and environmental government spending.

3.1 The Median Voter Theorem

The Median Voter Theorem (MVT) was introduced by Downs in 1957 (Rowley 1984). By taking the intuition of Hotelling's beach where firms move towards the center to attract customers, and Black's theoretical model for group decision-making (Black 1948), Downs introduces the strategic politician. He created the notion that politicians were motivated by self-interest, acting only to attain the income, prestige, and power that come from being in office. To attain this, political candidates act as vote-maximising agents who formulate policies to win elections, rather than win elections to formulate policies. By applying the economic foundations to politics, Downs created the idea of a political market where voters are consumers, political candidates are firms, and politics is the product. In this competition, both candidates are located on a linear political right-left spectrum and move towards the median voter to attain more votes – a concept similar to Hotelling's beach. Based on this, the gender and political preferences of the candidate should not matter. However, just as with general equilibrium theory, the MVT relies on several restrictive assumptions that often do not hold in the real world (Rowley 1984). When the assumptions are relaxed or adjusted, the MVT turns out to be less robust (Rowley 1984). In real-world politics, voters and candidates do not have perfect information, politicians can deviate from their promised positions, parties cannot always be placed solely on a linear scale, and voting can be strategic or personal rather than purely preference-based. Therefore, the MVT may lack predictive power in a modern EU setting. Still, the theory provides a way to understand the impact of gender differences in the political preferences of politicians by arguing that they are responsive to the public's preferences, rather than implementers of their personal preferences. Through this theory, a positive relationship between female representation and environmental protection expenditure could be seen as a reflection of the environmental preferences of the public.

3.2 The Citizen Candidate Model

Besley and Coate (1997) introduced the Citizen Candidate Model (CCM) as an alternative theory of policy formation in representative democracies. Using game theory, they model politics as a three-stage game. In the first stage, all citizens can choose to become candidates. Citizens can run for public office, but it comes with a utility cost. This means that the ones who choose to run for office care enough about politics to face these costs. Stage 2 is voting; all citizens have the right to vote and can choose between the candidates who have decided to run. Citizens vote based on expected policy outcomes, since elected candidates are assumed to implement their own preferences. Therefore, voters choose candidates based on their perceived preferences, competence, and identity, because this is what the candidate will inevitably stick to. Here, the preferences of politicians are a key factor in voting behaviour and policy formation. Any gender differences in political preferences would persist for politicians, and increasing the share of women in parliament would mean a larger share of politicians who, on average, place greater importance on environmental issues. This would mean a larger share of generally more pro-environmental politicians present in the political system, which may be reflected in environmental spending through negotiations, priorities, and policy suggestions. Combined, these theories provide two perspectives on how we could understand female representation: 1) as a manifestation of the preferences of passionate citizens who choose to become candidates, or 2) as an aggregation of public preferences (see Figure 1). Each theory provides a different way to understand the link between how female representation could influence environmental spending (see Figure 2).

Median Voter Theorem	Citizen Candidate Model
Politicians adapt to voters	Politicians keep their preferences
Policy caters to the median voter	Policy is based on the winner's preferences
Preferences of candidates do not matter much	Preferences of candidates matter
Fixed candidates (parties)	Citizens decide to candidate
Politics is one-dimensional	Politics can be multidimensional

Figure 1. Summarised comparison of the foundational setup of the Median Voter Theorem and the Citizen Candidate Model. Source: own illustration using Freeform, based on Rowley (1984), and Besley & Coate (1997).

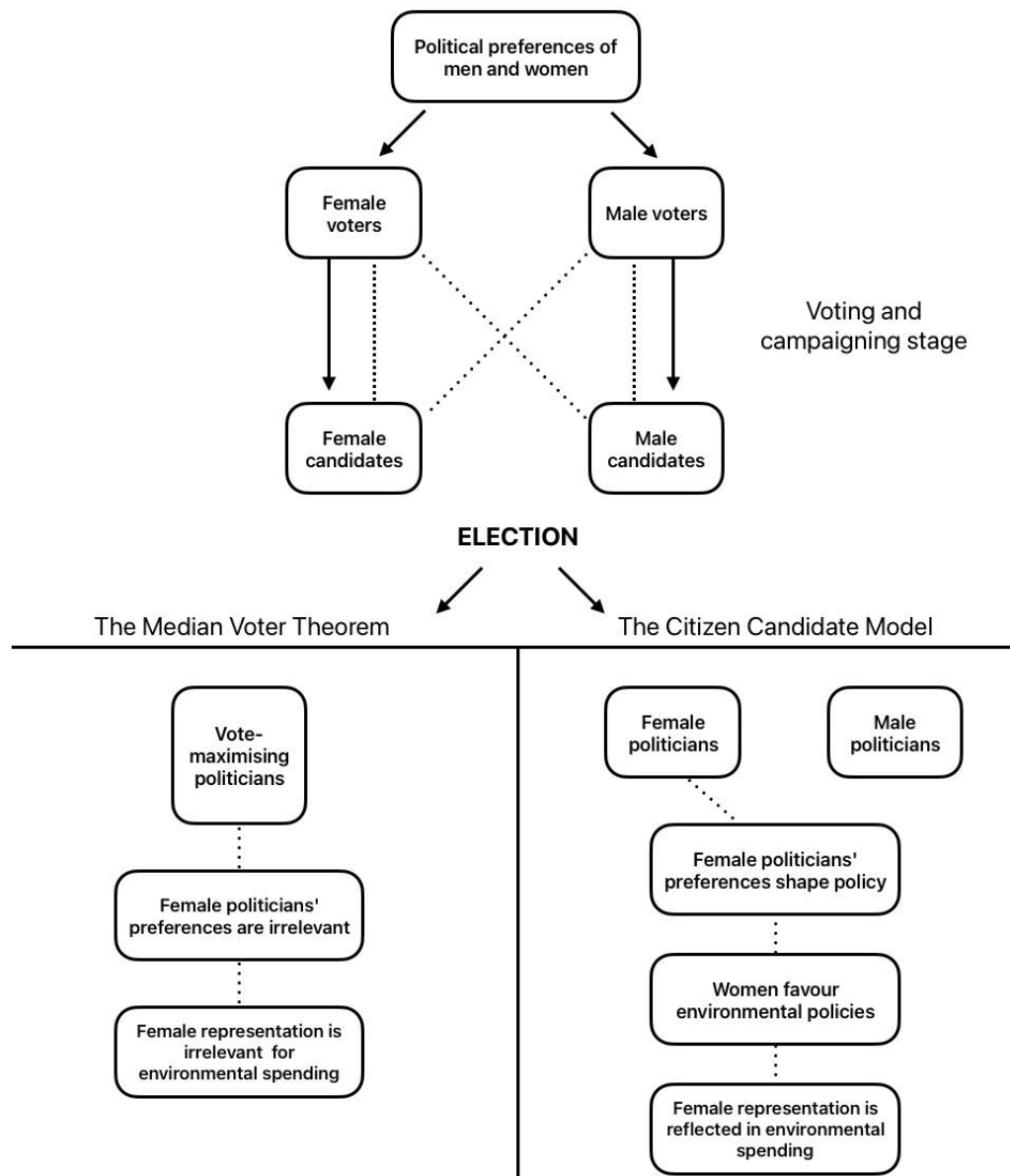


Figure 2. Overview of the theories. Source: own illustration using Freeform.

4. Conceptual Framework

Before stating the expected results of this study, it is important to clearly outline the proposed mechanism explaining why female parliamentary representation may affect government environmental spending. This framework begins with the assumption, supported by previous research, that men and women differ in their political preferences. These men and women are voters who can choose to become political candidates. Under the MVT, where candidates cater to the preferences of the voters to gain votes, the choice between a male and female candidate would be less relevant since the candidates' policy positions are catered to the median voter. From the CCM perspective, voters decide based on the preferences of the candidate, since this is the path the candidate will pursue once elected.

Using CCM, an increase in female representation could mean that voters either use the fact that women are generally more pro-environmental to infer that their preferred policies are also more pro-environmental. Using MVT, this increase might mean that the political platform closest to the median voter happens to have more women, which could suggest increased public environmental concerns. If the share of elected women increases, a larger share of the legislative body would have preferences associated with women, such as greater environmental concerns. Whether these differences will translate into policy outcomes depends on the theoretical framework applied (see Figure 2). Under the MVT, increased environmental spending would reflect public preferences rather than gender-based preferences. In contrast, the CCM suggests that the preferences of individuals persist when they become elected and can therefore influence policy outcomes, such as environmental spending.

This influence could manifest on two levels: the government level where budget is negotiated, and the parliamentary level, where representatives vote on the proposed budget. Specifically, the study focuses on the legislative body since it is directly elected by the public. Seeing as ministers in the central government are usually drawn from the parliament, a higher share of women would mean a higher probability of women being appointed to the central government, where the national budget is formulated. While these negotiations could primarily be decided based on party preferences, individual preferences may influence the budget as parties have to compromise, which means straying from the party objectives and deciding which areas they can afford to be less strict on. If environmental protection is viewed as competing with other spending priorities within a limited budget, policymakers who place greater importance on environmental protection may allocate relatively more resources to environmental

projects during budget negotiations. When this budget is presented to parliament, representatives vote for the budget. While they do tend to vote on budgets in line with their party, it is a theoretically possible channel for preferences to manifest.

Given that previous studies (Mavisakalyan & Tarverdi 2019; Salamon 2025; Koengkan et al. 2026), all find positive associations between female representation and environmental policy outcomes, the CCM provides a plausible theoretical framework for how such an effect may arise. Just as the CCM, I hypothesise that the preferences of men and women persist as they become politicians and that these influence their priorities. Since there are examples where female representation has affected sector-specific spending (Koch & Fulton 2011; Park 2017), and female politicians are generally in favour of stricter environmental policies than men, and associated with better environmental outcomes, I expect that increased female representation will translate into policy priorities and be reflected in government spending allocated towards environmental protection measures that fall into these categories.

5. Data

This chapter will introduce the data used in this study and begin with a description of the sample. In the sections following 5.1, the variables are introduced and divided into main variables and control variables. All data used is annual.

5.1 Sample

The sample includes the current 27 EU member states. Since the number of member states has changed over the years, I chose 2004 as the start year, as a large number of states joined the EU this year (see Appendix 1). It was also around this time that the modern EU climate cooperation began with the introduction of the EU Emissions Trading System in 2005 – a major pillar of EU climate policy (European Parliament 2018). Due to data limitations, the last year covered by the study is 2023. Most countries included have data for all 540 observations, but there is missing data – resulting in an unbalanced panel. Missing data occur in environmental expenditure, tertiary education, and fossil electricity production. The missing data is quite random for education, but for environmental expenditure, the early years of Slovakia are missing, and in fossil electricity production, all data for Bulgaria are missing.

The choice of the EU as a sample is motivated by the insights of previous studies (McAllister & Studlar 1992; Sundström & McCright 2014; Fraune 2016), and the need for high-quality, comparable data. These mixed findings of gender differences in environmental attitudes of politicians suggest a need for comparable institutional settings with a similar context. Studying countries within the EU provides similarities in levels of development compared to a global sample, democratic systems, and governance structures and norms due to the shared baseline of entry requirements and prolonged cooperation (European Union n.d.). Since environmental government spending is the dependent variable of this study, it is important that the countries within the sample are similar in these senses. Countries that differ substantially in these aspects likely have different policy priorities. Economically less advanced countries might place higher importance on economic development than environmental protection, whereas more economically advanced countries might prioritise environmental protection higher since they have already established a high economic baseline (Langsæther & Knutsen 2025). Even with these mentioned similarities within the sample, we can still expect differences worth observing since there are still differences in environmental spending and female parliament representation within the EU (see Table 2). While choosing the EU limits the generalisability of

the study, it is deemed necessary. This decision reduces the risk that observed differences are driven by variation in institutional settings rather than gender. By focusing on the EU and including fixed effects, this study aims to reduce the influence of such differences. Focusing on the EU also enables access to the Eurostat database, which provides high-quality data provided by the European Union.

5.2 Main variables

Data for the main variable of interest – female representation in national parliaments – are provided by Inter-Parliamentary Union (IPU) monthly ranking of women in national parliaments, via World Bank and obtained through Our World in Data as annual data (Our World in Data et al. 2026b). This data is presented as a share of women in parliament and captures the percentage of seats in the lower or single chamber of the legislature held by women, and was compiled using information provided by National Parliaments. This measurement does cover representation in the politically dominant chamber, but not necessarily the full legislative system, since upper chambers in bicameral systems are not included. However, this is not deemed an issue in this study – rather a necessary boundary for comparability. Since the primary interest is to capture the part of the legislative system that is directly elected by citizens, it helps that upper chambers are excluded since these seats can be elected indirectly compared to lower or unicameral chambers, which are usually elected directly. Studying female political representation as representation in national parliaments is consistent with the literature, as it can be seen in previous studies (Mavisakalyan & Tarverdi 2019; Salamon 2025; Koengkan et al. 2026), and with the conceptual framework, as the channel through which gender preferences enter the political system through elected politicians.

The dependent variable is government spending allocated towards environmental protection. To capture this, data on general government expenditure (COFOG) from Eurostat is used – specifically the share of GDP allocated towards environmental protection by the central government (Eurostat 2026a). To break down what environmental protection entails, COFOG uses a classification system based on the Classification of Environmental Protection Activities (CEPA) (European Commission 2019) and include: waste management, waste water management, pollution abatement, protection of biodiversity and landscape, research and development related to environmental protection, and a rest category of environmental affairs and services that cannot be assigned to previous categories. The dependent variable will therefore capture the percentage of GDP that central governments allocate towards these activities.

5.3 Control Variables

To reduce the risk of omitted variable bias and make causality claims more plausible, I will include four control variables in the model. These variables should affect the dependent variable, environmental spending, and be related to the variable of interest, female representation.

5.3.1 Structural Controls

The first category is structural controls, which includes government ideology and the share of fossil fuels in electricity production. These are deemed as structural since they shape the playing field by setting institutional rules for how much the political climate allows female representation to affect environmental spending. Both variables relate to how environmental policy is politically and structurally constrained by public and industrial interests.

The control for ideology control is from the Comparative Political Dataset (CPDS) (Armingeon et al. 2025b). From this dataset, the study gathers annual data on government composition given as cabinet posts held by right, left, and center parties respectively, in percentage of total cabinet posts – weighted by the number of days in office in a given year (Armingeon et al. 2025a). As these three variables often add up to 100 percent, only left-wing parties will be included to avoid perfect multicollinearity. This variable is also theoretically motivated as left-wing political orientation tends to be more pro-environmental (Neumayer 2004). Ideally, the ideology control would be measured at the parliamentary level, as this corresponds more to the main explanatory variable. However, government composition is considered a suitable proxy since it is ultimately determined by the parliamentary party compositions. Including an ideology control variable is important to reduce omitted variable bias when estimating the effect of female representation on environmental spending. Since both gender and ideology may influence environmental policy preferences, controlling for government ideology helps isolate the association of interest.

The share of electricity generated by fossil fuels is included as a control for structural fossil fuel dependency. This data is sourced by Ember and Energy Institute - Statistical Review of World Energy, presented and processed by Our World in Data. It captures electricity generation from coal, oil, and gas, as a percentage of total electricity produced in the country (Ember et al. 2026). While electricity production does not fully capture fossil fuel dependency, it is a central component of energy systems and an indicator of the system structure. Since the goal is to control for differences in political and economic incentives to protect the environment, focusing on production rather than consumption is deemed more

relevant. Production better captures the domestic economic interests in fossil fuels, and the environmental harm from burning fossils affects the given country. Countries that largely depend on fossils for their electricity production may therefore face more intense pressure to reduce pollution or be reluctant to reduce emissions if exported electricity is a prominent GDP source.

5.3.2 Socioeconomic Controls

The socioeconomic controls relate to social characteristics and include GDP per capita and higher education. While the structural controls shape policy more directly, these controls shape societal development and public preferences that can also shape policy, but less directly. GDP per capita is used to control for differences in national wealth and economic development, as this is likely related to both environmental spending and female representation. This data is obtained through Our World in Data, where the original data from Eurostat, OECD, IMF, and World Bank has been processed (Our World in Data et al. 2026a). The data is expressed in constant international dollars. This is a hypothetical currency that adjusts local currencies for differences in the cost of living across countries and inflation (Rohenkohl et al. 2025). This measurement captures how rich a country is relative to its population and can be used to understand trends in economic growth and living standards. By not including GDP per capita, the model might conclude that a larger share of women in parliament increased environmental spending, when the reality is that richer countries spend more on environmental protection and elect more women.

The second socioeconomic control is the percentage of citizens aged 25-64 of a given reporting country that has completed an EQF level 5-8 tertiary education (Eurostat 2026b). Applying this to a Swedish context, tertiary education level 5–8 corresponds to post-gymnasial education at a university or college; level 5 being a shorter academic education, 6 being a bachelor's degree, 7 being a master's degree, and level 8 being a doctoral degree. By setting the age span to 25-64, the data covers a large portion of people of working age, which is normally considered age 15–64, and have also had time to complete a tertiary education. Choosing tertiary education within the EU is relevant since all countries have compulsory education for children (European Education and Culture Executive Agency 2023), and many member states offer free tertiary education for citizens and EU citizens (World Population Review 2026). This control is included to control for the effect of a more educated population since educational institutions provide the tools to think critically, assess scientific papers, and reflect on societal issues – creating trust for scientific expertise.

6. Method

Since the study aims to examine the relationship between female parliamentary representation and government environmental protection expenditure across EU member states over time, panel regression with two-way fixed effects using N-1 country and T-1 year dummies is utilised. This makes it possible to estimate this relationship while holding other variables constant, and capture both cross-country and over-time variation. Including country fixed effects allows control for stable country differences such as the political culture, long-run institutions, and baseline environmental attitudes and gender equality norms, which might affect female representation and environmental spending. Additionally, including time fixed effects allows control for time-specific shocks that affect all countries within the sample. This is especially important in the context of the EU since these countries share climate and financial policies to a high degree, and these affect the sample at the same time. Controlling for time-specific shocks reduces the risk of attributing the effect of such common trends on environmental protection to female parliamentary representation.

The model assumes linearity between the main and dependent variables which allows for an easier interpretation than non-linear models. Preliminary visual inspection did not suggest a strong non-linear relationship between the variables. The model also uses robust standard errors clustered at the country level to account for autocorrelation within countries over time, as annual observations within countries are related. Using this methodological setup, the estimates will capture within-country change over time after removing common time shocks. This allows me to analyse how government environmental protection expenditure changes as a given country changes its share of women in parliament, which directly addresses the research question of this study. Controls will be added stepwise to enable discussion about the contribution of each control and its effect on the relationship. First, structural controls are added as they shape incentives and political agenda-setting. Second, socioeconomic controls are added as they capture broader aspects such as national wealth and human capital that can shape public support for climate policies and economic abilities. The model used is estimated as follows, with abbreviations explained in Table 1:

$$EPE_{it} = \beta_1 WiP_{it} + \beta_2 GovL_{it} + \beta_3 FosSEP_{it} + \beta_4 GDP_{it} + \beta_5 Edu_{it} + \alpha_i + \gamma_t + \varepsilon_{it}$$

Table 1. Econometric model abbreviations.

EPE	Government environmental protection expenditure as share of GDP
WiP	Share of women in parliament
GDP	GDP per capita: PPP adjusted, constant international dollars
GovL	Share of cabinet posts held by left-wing parties
FossEP	Share of electricity production from fossil fuels
Edu	Share of population aged 25-64 with completed tertiary education
α	Country fixed effects
γ	Time fixed effects
ε	Error term
i	Suffix for country
t	Suffix for year

7. Results

This chapter presents the results and does so by providing a short overview of general trends in the main variables, before introducing the descriptive statistics and the main results.

7.1 Overview

While female representation has increased steadily over the past decades (see Figure 3), environmental protection expenditure has varied more (see Figure 4). Looking solely at these graphs, there is no clear indication that female representation has increased spending since they do not follow the same stable upwards trend. The irregular pattern in EPE over time suggests that there is quite a large variation worth investigating to provide knowledge of the factors determining EPE levels. However, this study only analyses the effect of female representation.

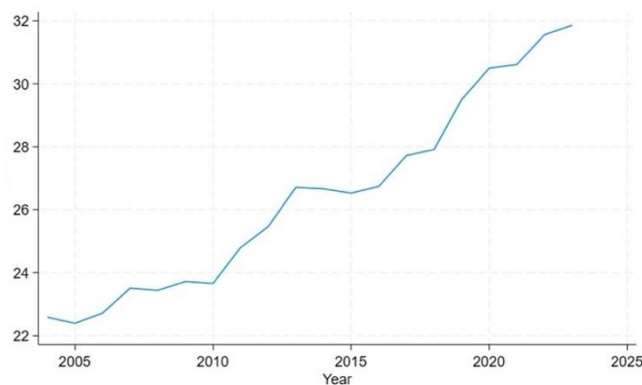


Figure 3. Mean of Share of Women in Parliament (%) over time.

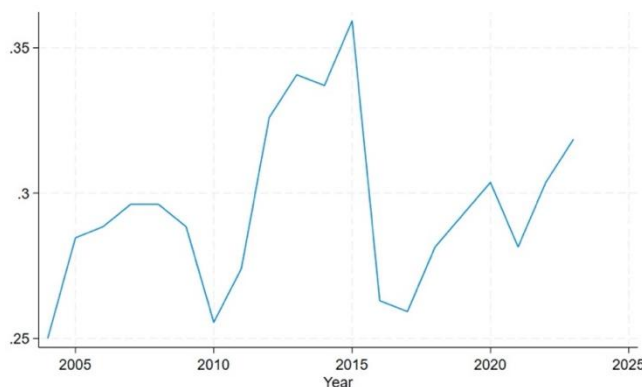


Figure 4. Mean of Environmental Protection Expenditure (% of GDP) over time.

7.2 Descriptive Statistics

Visual interpretation of the plotting of WiP and EPE suggests a mostly linear negative relationship between WiP and EPE. Looking solely at these trends, this would indicate that countries spend less on environmental protection as female representation increases, where each percentage point increase in female representation is associated with the same change in EPE – regardless of the level of WiP. There is a slight curvature at low levels of WiP, which could indicate mild non-linearity (see Figure 3). At this stage, no controls are active, and the relationship observed is not representative of the model, but rather an indication of a weak relationship.

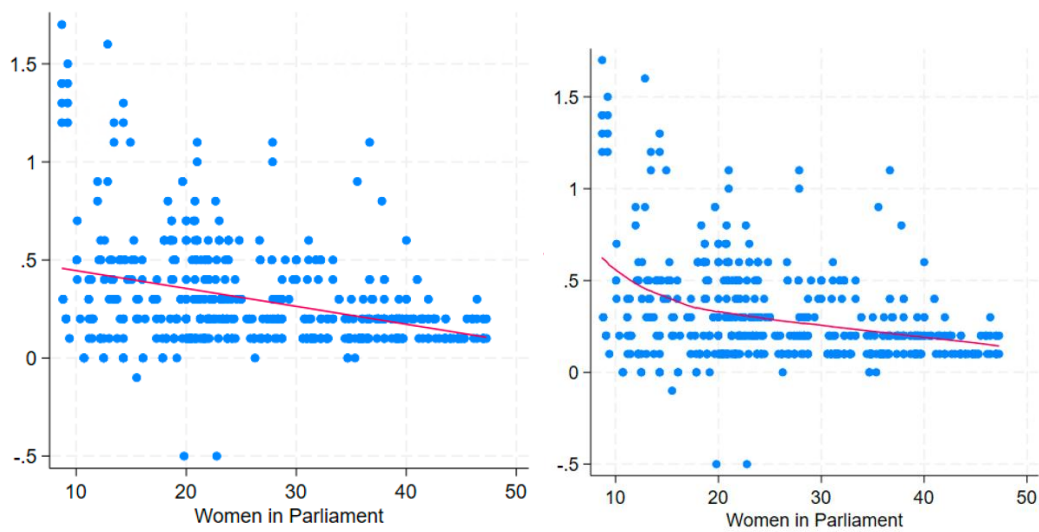


Figure 5. Plotted values of Share of Women in Parliament (x-axis) and Environmental Protection Expenditure (y-axis). From left: first graph; fitted line in red, second graph; lowess smoothed line in red.

The summary statistics in Table 2 show that variation is very uneven across variables. Both WiP and Edu have low to moderate variation across the sample, with less variation compared to other variables. This tells us that both the share of female representation in parliaments and the percentage of the population with a completed tertiary education have remained quite stable across countries and over time, with both being below 30% on average. This suggests quite stable levels of female representation and higher education. On the contrary, EPE and GovL have high variation, with GovL ranging from 0% to 100%, and EPE ranging from -0.5% to 1.7%. This tells us that the sample varies a lot across countries and over time in terms of the amount spent on environmental protection and the cabinet posts held by left parties. It is expected that the party composition of the government changes frequently as it is responsive to the public's preferences. Environmental expenditure also varies a lot, even though it remains low as a share

of GDP. This variation mainly comes from between-country differences, as most countries remain quite stable over time. Surprisingly, EPE also takes negative values for three observations: Estonia 2010-2011 and Czechia 2009. This may appear counterintuitive given that the variable is measured as environmental protection expenditure as a share of GDP. This may be due to accounting or reporting adjustments within the COFOG framework.

When looking at the control categories, it becomes apparent that the structural controls, FossEP and GovL, exhibit greater variation than the socioeconomic controls, GDP and Edu. This suggests that the sample is more consistent across countries and over time socioeconomically than structurally. Still, there are big differences between the structural controls, with GovL having much higher variation. This is expected since it changes regularly with elections, whereas electricity production systems may be more stable over time.

Table 2. Summary statistics. To allow comparability in variation, the coefficient of variation (CV) is included. It is calculated by dividing the standard deviation by the mean, with a low CV indicating less variation.

VARIABLES	N	mean	sd	min	max	CV
WiP	540	26.43	10.36	8.696	47.28	0.39
EPE	534	0.295	0.269	-0.500	1.700	0.91
GDP	540	47,903	21,906	16,389	138,678	0.46
Edu	530	29.53	9.502	10.40	53.40	0.32
FossEP	520	52.02	27.45	1.403	100	0.53
GovL	540	32.03	33.61	0	100	1.05

Since panel data is used, the correlation matrix in Table 3 reflects correlations across all observations, both across countries and over time. Therefore, no inference claims can be made as the correlation cannot separate relationships between variables across countries or over time. For example, there is a moderate negative correlation between WiP and EPE, but this does not necessarily mean that countries with more women in parliament tend to spend a smaller share of GDP on environmental protection. This correlation could be driven by country differences or common time trends affecting both variables. However, the table is useful to assess the control variables used. Table 3 shows no high correlations between any control variables. This suggests that there are no conceptual overlaps and that the control variables capture different factors.

Table 3. Correlation matrix. Variable abbreviations from Table 1.

	<i>WiP</i>	<i>EPE</i>	<i>GovL</i>	<i>FossEP</i>	<i>GDP</i>	<i>Edu</i>
<i>WiP</i>	1					
<i>EPE</i>	-0.3609	1				
<i>GovL</i>	0.1305	0.0086	1			
<i>FossEP</i>	-0.4381	0.1466	-0.1695	1		
<i>GDP</i>	0.3093	-0.1566	0.0797	-0.0227	1	
<i>Edu</i>	0.4748	-0.2272	-0.0350	-0.1949	0.3424	1

7.3 Main Results

The results of Table 4 show very few statistically significant results. Model 6, the main model with all controls added, shows that a one percentage point (pp) increase in the share of women in parliament is associated with a 0.00145 pp increase in environmental protection expenditure as a share of GDP, within-country and over time, holding all else constant. Interpreting this in relation to the mean of EPE, we divide 0.00145 by the EPE mean of 0.295. This shows that a one pp increase in female representation is associated with a 0.49% increase relative to the mean level of environmental spending of each country. Even relatively large changes in female representation are associated with very small changes in environmental spending. For example, a 10 pp increase in WiP would be associated with an increase in EPE of 0.0145 pp. However, just as for specifications 1 through 5, this finding is not significant and cannot be deemed statistically different from zero. This means that, given this method and model, there is insufficient evidence to conclude that the effect of female representation on environmental expenditure differs from zero, suggesting that environmental protection expenditure is not responsive to parliamentary gender composition at the national level. This does not mean that the effect is proven to be zero and that women have no influence, only that the effect is so small and uncertain that the model cannot deem it different from zero.

Although statistically insignificant, the WiP coefficient remains weak and positive across the specifications – suggesting that added controls do not fundamentally alter, or drive, the relationship. By looking at each model separately, we can interpret the explanatory power of each control for environmental expenditure. In Model 2, time fixed effects were added, which did not change the WiP coefficient much – indicating that external shocks do not affect the relationship much. In Models 3, 4, and 6, the controls GovL, FossEP, and Edu were added, respectively. None of them were statistically significant – meaning that the presence of left-parties in government, share of fossils used in electricity production, and population with completed tertiary education, have no association with

environmental expenditure in these models. The insignificance of GovL means that left-wing parties in government are associated with higher environmental spending in this model. The only variable with a significant coefficient is GDP per capita. In Model 6, the coefficient indicates that a 10,000 international dollar increase in PPP-adjusted GDP per capita is associated with a 0.0428 pp decrease in the share of GDP spent on environmental protection, given the model and holding all else constant. The negative coefficient suggests that, conditional on the controls in the model, higher GDP per capita is associated with a lower share of GDP allocated towards EPE. While the observed GDP coefficient is statistically proven to explain variation in EPE, it should be interpreted carefully. Firstly, because the model is not designed to identify a causal effect of GDP per capita on EPE. Secondly, because GDP is the denominator when calculating environmental protection expenditure as a share of GDP, this scaling likely affects the relationship. We can therefore not conclude that GDP determines how much countries spend on environmental protection.

In terms of model fit and R^2 , this is quite stable across the stepwise control specifications, ranging from around 0.76 to 0.78. This means around 75-78 percent of the total variation in environmental protection expenditure is explained by the model specifications. The remaining 22-25 percent represents all the variation in EPE that the model does not explain. While this could be real omitted variables, it can also be due to random noise, unaccounted non-linearities, possible interaction effects, and other variations not accounted for. R^2 is gradually increasing across models 1-5, but goes from 0.778 in specification 5 to 0.764 in Model 6, meaning that the models explain less of the variation in EPE when education is added. This is surprising since more variables often mean that the models can explain more of the variation in the dependent variable. One possible explanation for this could be that part of tertiary education is already captured in the other controls, as it does have low-moderate correlation with GDP (see Table 3), and that Model 6 is over-controlling. Visual inspection of the data also suggests that much of the variation in EPE has been explained by country fixed effects since within-country variation over time is generally low and across-country variation is larger.

Additionally, Table 4 shows that the number of observations differs across the models, which occurs since the regressions only include observations that have data across all variables – if data for one variable is missing, the entire row drops. Models 1-3 have all 534 EPE observations since the WiP and GovL both have 540 observations that cover all EPE observations. The 514 observations in models 4-5 is due to FossEP being included in model 4, which has 520 observations, but when matched with EPE, only 514 are shared. The final model includes Edu with 530 observations, for which only 504 are shared across the dataset. This implies

that 36 country-year observations are incomplete for one or more variables included in the final model.

Table 4. Regression table.

VARIABLES	(1) Environmental Protection Exp.	(2) Environmental Protection Exp.	(3) Environmental Protection Exp.	(4) Environmental Protection Exp.	(5) Environmental Protection Exp.	(6) Environmental Protection Exp.
Women in Parliament	0.00127 (0.00185)	0.00107 (0.00224)	0.00111 (0.00208)	0.000930 (0.00214)	0.000671 (0.00215)	0.00145 (0.00202)
Left-wing Cabinet			-4.36e-05 (0.000446)	-0.000116 (0.000449)	-8.26e-05 (0.000412)	-1.62e-05 (0.000401)
Fossil Electricity Prod.				-0.000201 (0.000962)	9.45e-06 (0.000858)	-4.77e-05 (0.000791)
GDP per Capita, int. \$					-4.30e-06** (1.79e-06)	-4.28e-06*** (1.51e-06)
Tertiary Education						0.00361 (0.00381)
Constant	0.183*** (0.0619)	0.155** (0.0690)	0.155** (0.0702)	0.175** (0.0727)	0.410*** (0.116)	0.317*** (0.100)
Observations	534	534	534	514	514	504
R-squared	0.758	0.768	0.768	0.773	0.778	0.764
Country FE	YES	YES	YES	YES	YES	YES
Year FE	NO	YES	YES	YES	YES	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

8. Discussion

In this chapter, the results from the previous chapter will be discussed in relation to the literature and contextualised. The first section interprets the results and discusses the findings and their implications, while the second section focuses on the conceptual framework and the hypothesised channel of effect. Before closing the chapter, the weaknesses of the study and ideas for future research are discussed.

8.1 Outcomes Versus Spending

Contrary to the hypothesis, the study found no statistically significant relationship between female parliamentary representation and environmental protection expenditure across all specifications. Numerous previous studies find that female representation can affect environmental outcomes; however, none of them focus on spending (Mavisakalyan & Tarverdi 2019; Salamon 2025; Koengkan et al. 2026). This is an important distinction, as this could mean that female political representation affects the political direction but not necessarily budget priorities. The studies by Mavisakalyan & Tarverdi (2019), Salamon (2025), and Koengkan et al. (2026) all focused on the effects of female parliamentary representation on environmental policy – specifically, more stringent environmental policies, access to clean energy, lower CO₂ emissions, and forest cover. This suggests that environmental improvements do not necessarily require increased spending, and that the formulation of policies might matter more for environmental outcomes than the allocated budget. Also, it is potentially easier for parliamentarians to vote according to their preferences for laws or regulations since these tend to offer more freedom in voting than budgets. We may see more of an effect in these areas since representatives have more freedom to vote freely rather than follow the party.

Environmental protection expenditure is also a small budget category compared to larger areas such as education, infrastructure, or, more recently, defence spending, for which gender affects the size of spending (Koch & Fulton 2011; Park 2017). As a result, even if female politicians have different policy preferences, these may not appear in smaller spending categories, such as environmental protection. Also, many EU members have relatively high national wealth and economic development levels, compared to globally. Such countries have likely already acted on the environmental degradation from increased industrialisation. Therefore, it is possible that many member states have already established varying

degrees of basic environmental protection systems, and do not feel the need to further expand these much.

8.2 From Preferences to Policy

Through the MVT framework, we would expect no significant effect of female representation on environmental protection expenditure. Analysing the results from this perspective raises the question of the preferences of the median voter. Assuming that the null findings are due to strategic vote-maximising behaviour, the actions of politicians would reflect those of the median voter – the mainstream values. This creates an interesting tension between the scientific consensus and the environmental concern discourse, and the actual public desire for change and budget compromises. The goal of vote-maximising politicians is to win elections, and when the position of the median voter moves from higher to lower preferences for environmental protection, politicians follow. The results generally show low levels of environmental protection expenditure, which, from this perspective, would mean that the median voter does not place much importance on this matter. Therefore, trends in political ideology and party affiliation can have real implications for climate goals. With the recent rise of radical right-wing parties in Europe, the median voter shifts to the right (Aktas 2024; The Brussels Times with Belga 2025), placing less importance on environmental issues. This may create tension between the preferences of the median voter and the urgent need for environmental action. It raises a democratic question of the role of politicians who, on one hand, are the people's representatives, and on the other, are the ones with governing power to enact the environmental policies.

When applying the CCM framework, we interpret the results differently, and higher female representation should mean an increase in pro-environment parliamentary politicians. A null-finding between female representation and environmental expenditure does not necessarily mean the theory is not applicable, but is rather an indication of either: 1) female representation affects policy design more than allocation, as argued in section 8.1, or 2) that the politicians' preferences get hindered or diluted as they transfer through the political system and therefore do not appear in spending. The collective decision-making process may dilute preferences through party coalitions where parties must compromise on their common preferences to gain a political majority or to settle on a policy. The preferences of female politicians could also be hindered by the gendered composition of the political bodies. This is supported by Ramstetter and Habersack (2020), who showed that female politicians were significantly more supportive of environmental legislation than men; however, given that women are

underrepresented in political power, policy outcomes may still predominantly reflect men's preferences.

8.2.1 Synthesis

Political systems are complex and multi-layered, meaning that parts of each theory may be useful to explain the findings. The goal of this study is not to provide evidence for either theory but to view the results from both perspectives and ultimately combine them since they both provide valuable insights to contextualise the results. In line with CCM, politicians are citizens who, most likely, are passionate about political issues and want to win to make a difference in society. MVT proposes that status and money are what motivate people to win elections, but pursuing those values can be done in many other fields apart from politics. If more female politicians are elected, we should then have more people who, on average, are more inclined to prioritise environmental politics, such as environmental protection.

Once elected, these female politicians are faced with party dynamics, policy and budget negotiations, the urge to win the next election, while also holding fewer seats than their male counterparts. For their preferences to transfer into spending, female politicians must be able to raise the priority of these issues within their parties, argue for why increased spending would be more beneficial than reshaping current policies, while also compromising with other parties. Here, both MVT and CCM provide explanations for why the study found no sufficient evidence that female representation increases environmental spending. In line with CCM, female politicians likely still prioritise environmental protection, but due to compromises, negotiations, or other hinder it might be hard to justify increasing spending rather than reshaping. Politics is also a competition where you must win, or have a political majority, to be able to implement your policies. Here, MVT and the insight that candidates want to win elections apply. Proposed policies or budgets might get watered down to appeal to a larger share of the public to increase the chances of winning and staying in office.

8.3 Weaknesses

Due to the timeframe of this project, simplicity was prioritised when constructing the model used. While this allowed for effective use of time, it also had implications for the results. Therefore, even if the results were statistically significant, they could not be deemed causal. Firstly, it is not certain that the OLS assumptions hold. The exogeneity assumption is likely violated since both reverse causality and simultaneity bias could be present, meaning that the error term is

correlated with values of WiP. Since female politicians are more pro-environmental, it is possible that environmental spending and female politicians mutually influence each other, which would cause simultaneity bias. Countries that spend more on environmental protection may also elect more women, or vice versa. It is also possible that the environmental protection expenditure drives increased female representation, implying potential reverse causality. Countries with higher environmental spending may also exhibit more progressive political preferences more broadly, which could be associated with higher levels of female political representation. To solve these biases, it would be beneficial to add an instrumental variable that is correlated with WiP and only affects EPE through WiP. This way, the variation in WiP is isolated by an external source that cannot be influenced by EPE. Finding a good instrument where the assumptions hold can be difficult, and an easier, but less effective, way to address these biases would be to add time lags to female representation. This would also be beneficial since policy decisions may take years to fully implement before the results appear in the environmental protection expenditure. There are also potential outliers present, especially in EPE, and the risk of OVB still remains since there could still be a correlation between the WiP and the error term, and controls such as corruption, as highlighted by Salamon (2025), and gender equality could be included.

To reduce the risk of bias from the wrong functional form, it would have been good to explore non-linear model specifications. It was difficult to assess linearity through visual inspection alone, and it would have been valuable to add squared WiP and check its significance. Visual inspection of EPE graphs and box plots also indicates potential outliers that could have been further investigated and potentially removed.

8.4 Outlook

For future research, it would be interesting to focus on regional or local levels of government. On this level, community and personal characteristics might matter more than in a national political setting. The public might be more familiar with the candidates since both the physical and perceived distance between the public and the politicians is closer. Being more familiar with candidates might affect voting behaviour, with people being more likely to vote for specific candidates rather than just a party. Additionally, national politicians may adopt a stricter role as a party representative than those in local settings. This reasoning is supported by the findings of Sundström and McCright (2014), who found that differences in expressed environmental concern could be explained by gender in municipal and county councils, but were largely explained by party orientation in the national parliament. A local setting would also be interesting since not all CEPA activities

are primarily handled by the central government. For example, many CEPA activities that fall under waste management – such as collecting and transporting waste, and sweeping streets and parks – are often handled by the local or regional levels of government.

9. Conclusion

This study aimed to analyse the effect of female representation on environmental spending by focusing on female parliamentary representation in the national government and environmental protection expenditure within the EU. The results showed no statistically significant association between female parliamentary representation and environmental protection expenditure. This suggests that the share of women in parliament does not influence how much a country spends on environmental protection and that the variation observed in environmental protection expenditure comes from factors other than gender and the preferences of the politicians. While the study finds no empirical support for the hypothesis, it contributes to the literature by shifting focus from environmental outcomes to environmental spending – an underexplored dimension in female representation studies. This distinction may help refine how the policy impact of gender representation is understood in future research.

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Appendix 1

Member States in Sample	Joined EU
Austria	1995
Belgium	1958
Bulgaria	2007
Croatia	2013
Cyprus	2004
Czechia	2004
Denmark	1973
Estonia	2004
Finland	1995
France	1958
Germany	1958
Greece	1981
Hungary	2004
Ireland	1973
Italy	1958
Latvia	2004
Lithuania	2004
Luxembourg	1958
Malta	2004
Netherlands	1958
Poland	2004
Portugal	1986
Romania	2007
Slovakia	2004
Slovenia	2004
Spain	1986
Sweden	1995

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